# Final Design Noise Study

SR 0422, Section M1B
Pottstown Bypass
Lower Pottsgrove Township
Montgomery County
MPMS No. 16738




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# 1.0 Executive Summary

The Pennsylvania Department of Transportation (PennDOT) and the Federal Highway Administration (FHWA) are finalizing traffic noise abatement options for proposed roadway improvements in SR 0422, Section M1B. This specific project, referred to as SR 0422 Section M1B, is one of six separate construction sections that altogether comprise the State Route (SR) 0422 Pottstown Bypass Express Reconstruction Project and involves the total reconstruction of 1.72 miles of SR 0422 from approximately 650 feet west of the Porter Road underpass to approximately 730 feet east of the Park Road overpass. SR 0422, Section M1B is entirely located in Lower Pottsgrove Township, Montgomery County.

While this Final Design Noise Study adheres to the overall parameters of the 2003 preliminary noise study, all conceptual data from the prior study are superseded by the latest available engineering designs and planning assumptions. Traffic noise levels for six noise study areas (NSA) in both the existing year 2015 and the future design year 2043—represented by the year 2043 No Build and Build alternatives—were predicted using the a FHWA Traffic Noise Model (TNM) validated by data collected from a noise monitoring program conducted in 2016. A total of 272 receptor locations in TNM representing 497 residences and a community playground were analyzed in this Final Design Noise Study in order to identify and abate traffic noise impacts.

Future traffic noise impacts are predicted to be prevalent throughout Section M1B. However, compared with the No Build alternative, traffic noise levels would be lower in the Build alternative due to the proposed roadway realignment in some areas and construction of a new highway traffic barrier along the length of the SR 0422 median, as well as project cost-saving measures resulting in the construction of four earthen berms throughout Section M1B. As these proposed actions would attenuate traffic noise, the Build alternative is predicted to confer a net benefit to the future ambient noise environment in Section M1B prior to consideration of noise abatement.

Under the Build alternative, traffic noise levels are predicted to approach or exceed the FHWA and PennDOT noise abatement criteria at 87 receptor locations representing 152 residences and a community playground, thus warranting noise abatement consideration. For these residences, noise barriers were determined to be the most effective noise mitigation measure per the project purpose and need. Of the five noise barriers evaluated in this Final Design Noise Study, three were determined to be both feasible and reasonable per the PennDOT three-phased approach to noise abatement determination and, as such, are recommended for implementation. At an overall 419 square feet of abatement per benefited residence, the three recommended barriers total 6,628 feet in length and 108,050 square feet in area, and would benefit a community playground area and 254 residences, including all ground-level residences predicted to be impacted by traffic noise, of which nearly all (95 percent) would also meet or exceed the desired noise reduction design goal of seven decibels.

Following approval of this Final Design Noise Study, public meetings will be held to determine the viewpoints of the communities impacted by traffic noise. All findings would be presented to the public and a vote would be conducted for each recommended noise barrier. Of the votes tallied, 50 percent or

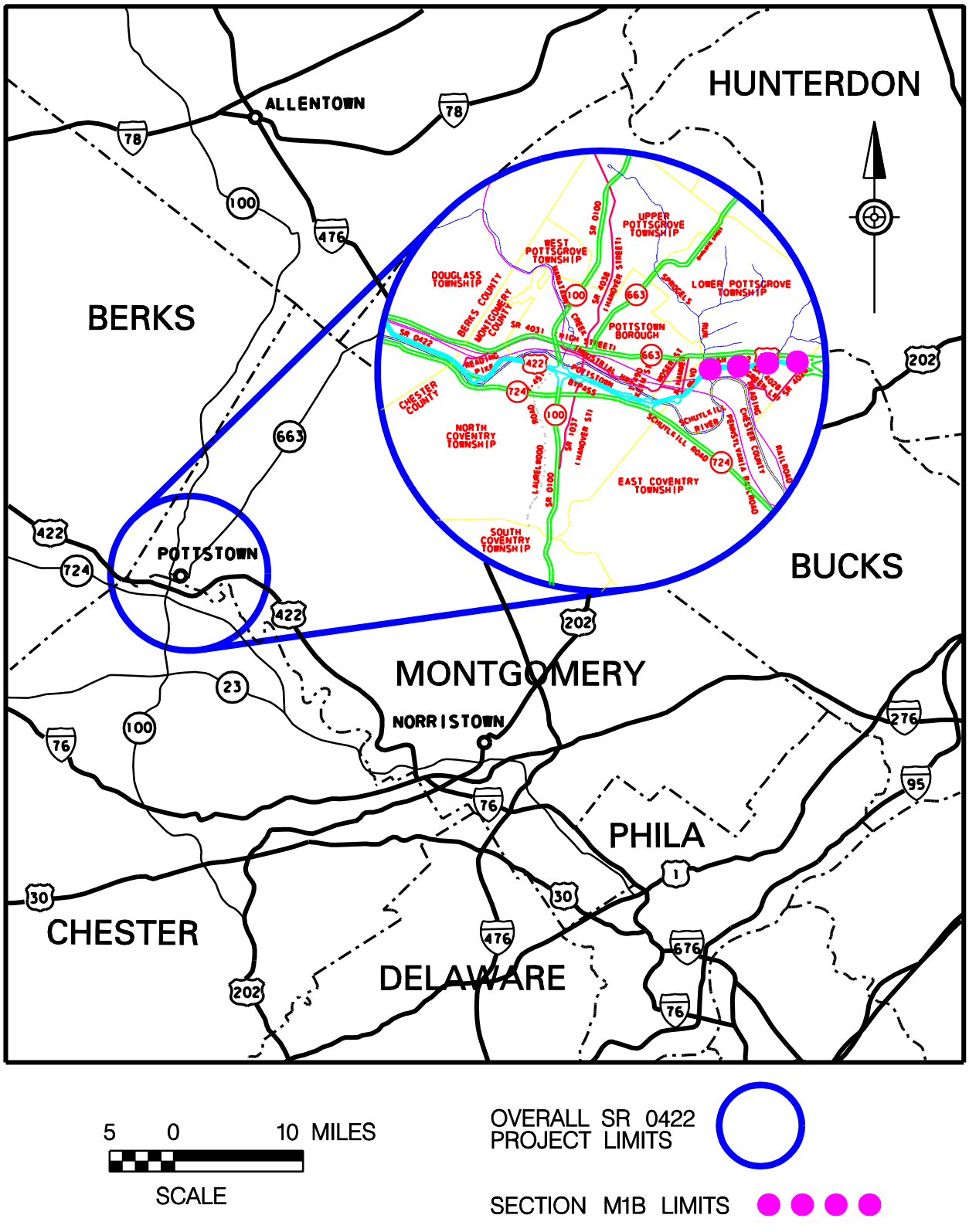
more must be in favor for a noise barrier to be further considered. The results of the final design noise abatement public meetings will be included in the final version of this Final Design Noise Study.

## 2.0 Introduction

The Federal Highway Administration (FHWA) and the Pennsylvania Department of Transportation (PennDOT) are evaluating options to reconstruct and improve a seven-mile section of SR 0422 between the Berks County line and the Sanatoga Interchange in Chester and Montgomery Counties. The purpose of this Final Design Noise Study is to identify potential traffic noise impacts stemming from the proposed improvements in SR 0422, Section M1B—one of six separate construction sections that comprise the SR 0422 Pottstown Bypass Express Reconstruction Project—and recommend noise abatement at impacted locations that would be warranted, feasible, and reasonable based upon FHWA and PennDOT criteria.

This Final Design Noise Study provides a comprehensive analysis which include a description of the project background, project purpose and need, the alternatives analyzed, characteristics of noise, methods used for conducting a traffic noise impact and abatement analysis, identification of noise sensitive receptors, summary of existing and future traffic noise impacts, traffic noise abatement considerations, construction noise, and public involvement.

**Figure 2-1: Project Location Map**



## 2.1 Project Background

The project, designated as SR 0422, Section M1B, involves the total reconstruction of 1.72 miles of SR 0422 from approximately 650 feet west of the Porter Road underpass to approximately 730 feet east of the Park Road overpass. This section of SR 0422 is located entirely in Lower Pottsgrove Township, Montgomery County but is closely bordered by Pottstown Borough as well as Limerick Township. To the north of SR 0422, Section M1B are densely populated residential communities while south of SR 0422, Section M1B predominately consists of a few single family residential homes and undeveloped areas.

A preliminary traffic noise study for SR 0422, Section M1B was performed previously by GTS Technologies (now American Engineers Group, LLC) in 2003. The preliminary study found that of the six noise study areas identified within the project area, five areas were found to warrant further analysis during Final Design to determine noise abatement meeting the feasibility and reasonableness criteria. As the 2003 preliminary study was based upon conceptual traffic and engineering data, all conclusions derived therein were considered preliminary in nature.

In contrast to the 2003 preliminary study, the findings in this Final Design Noise Study are based upon final engineering design and the most current available traffic planning information and assumptions. As a result, the findings in this study supersede those of the 2003 preliminary noise study. While this Final Design Noise Study adheres to the general parameters of the preliminary noise study, several minor revisions have been made to the noise study areas such as the labeling and delineation in order to provide a comprehensive and clear analysis.

## 2.2 Purpose and Need

The existing SR 0422 Pottstown Bypass Express corridor was constructed in the early 1960s. The existing concrete pavement is deteriorating along with the many bituminous overlays. Many geometric features of the existing facility including horizontal radii, superelevation, typical section, acceleration and deceleration lengths, sight distance, vertical clearance, etc. are deficient based on current PennDOT and FHWA design criteria therefore posing significant safety risks to the travelling public. In addition, many of the eighteen structures along the seven-mile corridor are considered Structurally Deficient. An above average crash history has also been identified along the corridor as a result of the deficiencies listed above. The purpose of the SR 0422 Pottstown Bypass Express Reconstruction Project is to eliminate the previously mentioned deficiencies by providing consistent roadway typical section to meet current design standards, modifying the horizontal geometry to meet minimum radii, sight distance and superelevation criteria, adjusting the vertical geometry to meet sight distance and minimum vertical clearance criteria for SR 0422 and crossing roadways, and reconstructing all structures along the corridor. Seven interchanges along the corridor will be reconstructed and/or reconfigured to provide the required acceleration and deceleration lane lengths in order to improve traffic operations and provide safer conditions for the travelling public.

This report documents the noise analysis and recommended improvements for the SR 0422, Section M1B construction section only.

## 2.3 Alternatives Analyzed

### 2.3.1 No Build Alternative

For the SR 0422, Section M1B design year of 2043, the No Build alternative would maintain the existing roadway design and geometry in SR 0422, Section M1B as well as allow for any planned maintenance and routine modifications. This alternative also assumes completion of any reasonably foreseeable transportation, development, and infrastructure projects that are already in progress; are programmed by PennDOT or FHWA; or are included in the fiscally constrained Regional Transportation Plan. Improvements from these projects are anticipated to be completed independently from any improvements proposed from the SR 0422, Section M1B project.

### 2.3.2 Build Alternative

For the SR 0422, Section M1B design year of 2043, the Build alternative would reconstruct the entirety of the four-lane limited access SR 0422 expressway in Section M1B and provide a new alignment with improvements that include increased horizontal radii, shoulder and median widths, and vertical clearances, as follows:

- The mainline horizontal alignment from Pleasantview Road to Park Road would be reconstructed on new and existing alignment with larger radii meeting current horizontal stopping sight distance (SSD) criteria for a 60 mile per hour (MPH) design speed. Existing radii would be increased from approximately 1433 feet to 2020 feet. To reduce the right-of-way impacts, the proposed radii were minimized by shifting the median barrier to the inside of each curve to provide the design SSD of 570 feet for both directions of travel.
- Mainline right shoulder widths would be increased from 10 feet to 12 feet to meet current design criteria for daily truck volumes greater than 250. A constant 20-foot wide median is proposed for the entire length of the project thus eliminating the existing “pinch-points” at either approach to the bridge carrying SR 0422 over Sanatoga Road and Creek.
- The mainline vertical alignment would provide a SSD and headlight sight distance of 570 feet for all proposed vertical crest and sag curves (570 feet required at 60 MPH). In addition, the reconstructed Pleasantview Road and Park Road bridges would provide the required 16’6” vertical clearance over SR 0422.

The Build alternative also includes reconstruction of the following four structures:

- Pleasantview Road Bridge over SR 0422
- Park Road Bridge over SR 0422
- SR 0422 Bridge over Sanatoga Creek and Sanatoga Road
- SR 0422 Bridge over Porter Road

In addition, Intelligent Transportation System (ITS) improvements would be provided along the corridor.

## 2.4 Characteristics of Noise

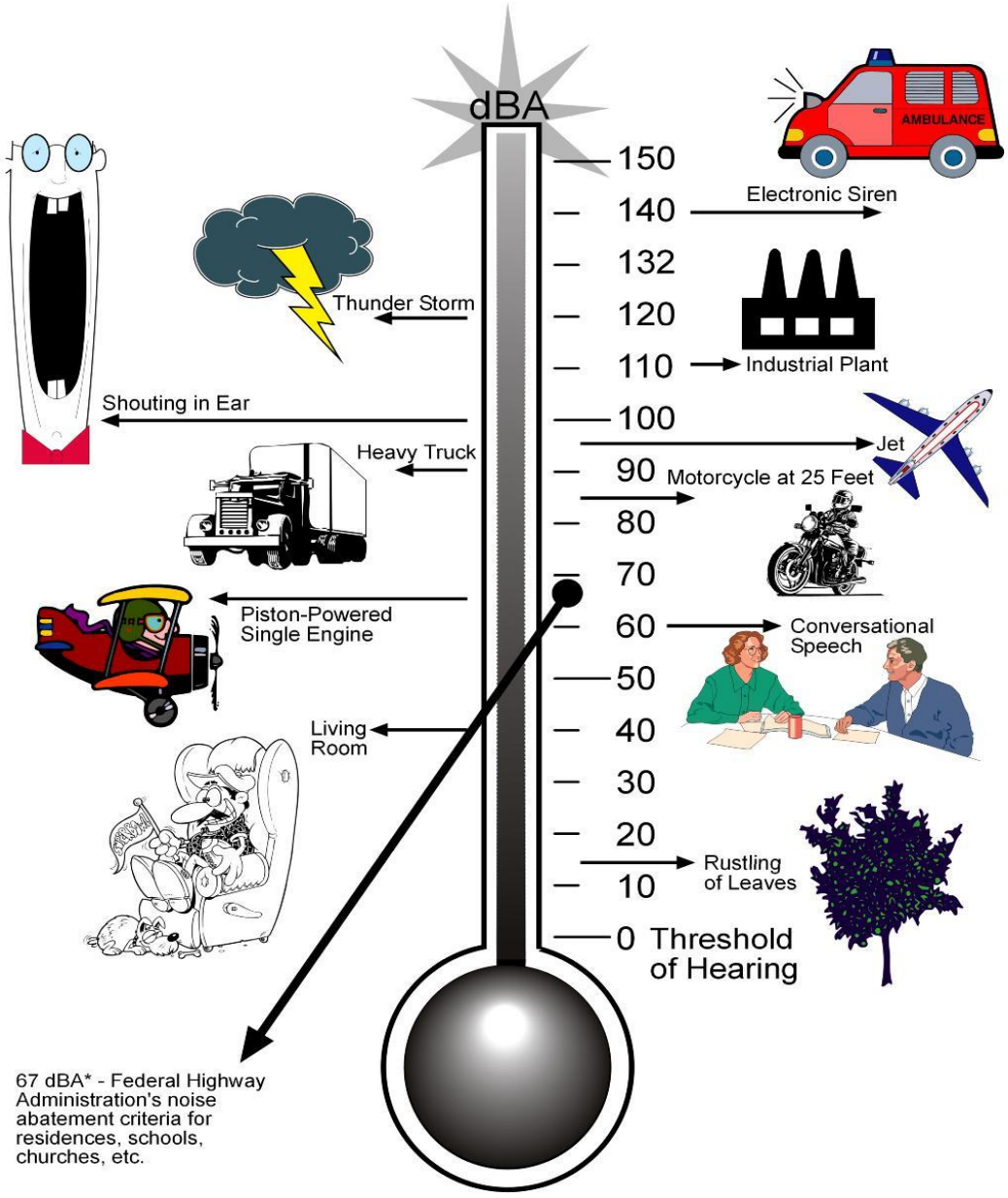
Sound is defined as a form or energy transmitted by vibrations in the air that are received by the ear through sense of hearing. Noise is generally referred to as unwanted sound. The terms noise and sound are used synonymously.

Sound is described as average sound pressure levels (SPL). The most common unit of measurement is decibel, (dB). To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies. For the purposes of environmental studies, the A-weighted scale on a common sound level instrument is used because this scale closely approximates the range of frequencies an average human ear can detect. The A-weighted noise levels are defined as dBA. Figure 2-2 shows typical A-weighted noise levels.

In typical noisy environments, changes in noise of 1 dB to 2 dB are generally not perceptible. However, it is widely accepted that people are able to begin to detect sound level increases of 3 dB in typically noisy environments. An increase of 3 dB requires a doubling of existing sound energy, such as doubling the volume of traffic on a highway, or halving of distance from a highway. Generally, a3 dB increase in noise levels is considered barely detectable while a 5 dB increase is perceived as a distinctly noticeable increase and a 10 dB increase is perceived as being twice as loud.

Noise consists of three interrelated elements: the source, the transmission path, and the receptor. All three elements must be present for there to be noise. Without a source to produce sound, there is no noise. Likewise, there is no noise if the sound is not received. Noise may be continuous or intermittent and of high frequency or low frequency. Traffic noise is typically measured over a one-hour time period, which is defined as the level equivalent (Leq(h)).

**Figure 2-2: Examples of Common Outdoor Noise and dBA Levels**




Sound Level Comparisons

* The Federal Highway Administration's noise abatement criteria are listed as dBA. dBA is a time weighted value for noise. dB represents an individual noise event. dBA for a noise source is generally less than dB.

Source: FHWA

# 3.0 Methodology

## 3.1 Federal and State Noise Policies

This Final Design Noise Study was completed in accordance with the FHWA *Highway Traffic Noise: Analysis and Abatement Guidelines* (FHWA-HEP-10-025, December 2011) and the PennDOT *Project Level Highway Traffic Noise Handbook*, Publication No. 24 (November 2015). The Project is defined as Type 1 by 23 Code of Federal Regulations (CFR) 772 as the improvements proposed in the overall SR 0422 Pottstown Bypass Expressway Reconstruction Project would affect both horizontal and vertical sightlines between the expressway and adjacent noise study areas, as well as modify several interchanges and auxiliary travel lanes. Therefore, a detailed traffic noise analysis is required based upon 23 CFR 772.

The PennDOT Publication No. 24 has adopted the Noise Abatement Criteria (NAC) that have been established by FHWA under 23 CFR 772 for determining traffic noise impacts for a variety of land uses. The NAC, listed in Table 3-1 for various activities, represent the upper limit of acceptable traffic noise conditions and apply them to land use areas which have regular human activity where lowered noise levels are desired. The NAC is given in terms of the hourly, A-weighted, equivalent sound level in decibels (dBA).

**Table 3-1: Hourly Weighted Sound Levels dB(A) For Various Land Use Activity Categories**

| Land Use Activity Category | Leq(h)[1] | Description of Land Use 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, B or C. |
| F | - | Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing. |
| G | - | Undeveloped lands that are not permitted. |

Source: Pennsylvania Department of Transportation, *Project Level Highway Traffic Noise Handbook, Publication No. 24* (November 2015).

[1] Impact thresholds should not be used as design standards for noise abatement purposes.

[2] Includes undeveloped lands permitted for this activity category.

## 3.2 Field Noise Monitoring and Modeling Methods

Traffic noise levels are modeled using the FHWA Traffic Noise Model (TNM) 2.5, the latest approved version. To calculate noise levels at receptor locations, TNM uses acoustical algorithms that take into account three-dimensional sound propagation variables such as atmospheric absorption and ground type, as well as intervening obstructions such as terrain, barriers, and building rows. Both existing and proposed roadway geometries are modeled in TNM along with noise sensitive receptor locations and traffic characteristics such as total volumes, vehicle classification, travel speeds, and flow control devices such as traffic signals and acceleration/deceleration lanes.

To verify the accuracy of TNM for use in predicting Project noise, an initial validation noise model was developed to match both traffic and acoustical environments observed during a noise monitoring program. These field data including roadway and terrain geometries were inputted into the TNM and the output modeled noise levels were compared with the monitored noise levels. This was done to ensure that changes between future and existing conditions were due solely to changes in conditions related to the project and did not erroneously reflect discrepancies in the modeling and monitoring techniques. Generally, the difference between the monitored and modeled traffic noise levels should be within 3 dBA.

With the validated noise model, existing year 2015 noise levels were then predicted using existing worst-case noise hour traffic volumes and composition. The model was then revised by replacing the current roadway design with the proposed SR 0422 roadway design along with any associated changes to adjacent terrain while the existing traffic data were replaced with future year 2043 traffic projections. These two models were then used to predict the future design year (2043) No Build alternative and Build alternative noise levels as well as any potential traffic noise impacts and abatement.

The noise abatement determination is based on PennDOT's three-phased approach. The first phase determines whether noise abatement is warranted by a traffic noise impact which occurs when the predicted traffic noise levels either approach or exceed the NAC or are substantially higher than the existing noise levels. The approach level has been defined by PennDOT as 1 dBA less than the NAC while a substantial noise increase is defined as an increase of 10 dBA or more in highway traffic noise levels from existing noise levels. Receptors that satisfy either the approach or substantial increase condition would be impacted by traffic noise and warrant consideration of traffic noise abatement measures as guided by phases two and three of the PennDOT three-phased approach.

## 3.3 Traffic and Model Data

Existing and future year traffic volumes were based upon data provided in the *Pottstown Bypass (US 422) Reconstruction Traffic Study, Supplement Number 1 – Chester and Montgomery Counties, Pennsylvania* (August 2011) which was developed for PennDOT by the Delaware Valley Regional Planning Commission (DVRPC) to analyze existing traffic conditions, and the effects of potential corridor improvements on future traffic volumes and patterns. The study provided current (2010) traffic counts along with 2015 and 2035 traffic forecasts for both the No Build and Build alternative configurations. The projected growth rates utilized in the report's 2015 and 2035 traffic projections were applied to this study in order to extrapolate traffic volumes for the design year (2043.) No new entrance or exit points were added to the SR 0422 corridor in the Build alternative. Although neither existing nor design year traffic volumes were

available for Pleasantview Road and Park Road traveling over SR 0422, traffic noise contribution from these low volume roadways would be marginal relative to SR 0422 traffic noise and would not meaningfully contribute to the ambient traffic noise environment. See Appendix A for a summary of traffic data used to model traffic noise in this Final Design Noise Study.

As future hourly traffic data were developed by DVRPC, long-term noise monitoring was not required to determine the loudest traffic noise hour. The evening peak traffic hour of 5 PM was used in this study as the loudest traffic noise hour which was determined by identifying the hour during which the highest future volume of traffic and number of heavy trucks may travel at the highest free-flow speeds within the designed future roadway capacity. A review of the DVRPC 24-hour traffic data concluded that the highest volume of hourly traffic would occur in the hours of 7 AM and 5 PM, and that both traffic hours would operate at the design speed within the designed roadway capacity at near free flow conditions, in the Build year 2043. In addition, to account for the effect of diurnal traffic patterns on traffic noise, TNM modeling of SR 0422 in the Build year for both morning and evening peak hours determined that while all receptors impacted by traffic noise in 7 AM would also be impacted at 5 PM, traffic noise levels at 5 PM would be on average 1.1 dBA higher and cause additional noise impacts to 36 residences at 16 noise sensitive receptor locations. As a result, the evening peak hour of 5 PM was selected as the loudest traffic noise hour in this Final Design Noise Study. See Appendix A for the supporting data.

Vehicle classifications were determined from PennDOT's *Internet Traffic Modeling System* and PennDOT's *Roadway Management System (RMS)*. As part of routine RMS updates, 24-hr vehicle volume and classification counts were performed for the SR 0422 corridor in 2015 which provided classification of the traffic volume data into automobiles, medium trucks, heavy trucks, and motorcycles in conjunction with guidance from the FHWA Office of Highway Policy's *Traffic Monitoring Guide* and the Towing and Recovery Association of America's *Vehicle Identification Guide*. In addition, per FHWA recommendations for multi-lane highway noise abatement projects in the final design stage, the Build traffic volumes and vehicle classifications were divided across each SR 0422 travel lane per a typical non-uniform distribution for four-lane urban highways developed for FHWA's *Recommended Best Practices for the Use of FHWA Traffic Noise model* (December 2015).

All existing and proposed roadway geometry were exported from the project topographic survey and roadway design model then digitally imported into the TNM at a horizontal and vertical accuracy of one foot. Likewise, terrain data used in the TNM were one-foot derivations of a digital terrain model developed from the project topographic survey and supplemented by 2005 DVRPC elevation contours for areas falling outside the project survey. Both roadways and shoulders were modeled in the TNM as single-lane centerlines. Although the existing and future posted SR 0422 speed limit is 55 miles per hour (MPH), both the existing and proposed roadway design speed is 60 MPH; therefore, the more conservative 60 MPH was used in this Final Design Noise Study. Dwelling unit counts for all noise sensitive receptors used in this study were confirmed using the online Montgomery County Property Records Search maintained by the Montgomery County Board of Assessment Appeals.

# 4.0 Existing Highway Traffic Noise Environment

## 4.1 Field Noise Monitoring and Model Validation

The modeling process began with the TNM validation per PennDOT requirements. This was achieved by comparing the monitored noise levels with the noise levels generated by a validation computer model matching the traffic volumes and speeds observed during the noise monitoring program. The traffic data obtained during each monitoring session was converted into one-hour traffic data for use in the validation noise model. Validation ensures that reported changes between existing and future alternatives are due to changes in traffic and not resulting from discrepancies between monitoring and modeling techniques. A difference of 3 dBA or less between the monitored and modeled levels is considered by PennDOT to be an acceptable level of accuracy as this is the limit of change detectable by the typical human ear.

Prior to noise monitoring, a land use review and a windshield survey were performed to identify noise sensitive land uses and any significant sources of acoustical shielding. Eight representative locations were chosen for short-term noise monitoring, as shown in Appendix B. Noise monitoring was performed for twenty minutes at each monitoring location with simultaneous traffic counts conducted for five vehicle types: automobiles, medium trucks, heavy trucks, buses, and motorcycles. All noise measurements were collected on October 12$^{th}$ and 13$^{th}$, 2016 between 9 AM and 6:30 PM under meteorologically acceptable conditions specifically dry pavement, calm or light winds, and free-flowing traffic. Measurements were collected using an ANSI Type 1 Bruel & Kjaer Type 2236 noise meter which was field calibrated before and after each measurement with a Bruel & Kjaer Type 4231 calibrator unit. Laboratory calibration certificates for noise meters are included in Appendix C.

Monitored noise levels in the project area ranged from 59 dBA to 78 dBA. A summary of the short-term monitoring results is presented in Table 4-1 below, while all field data sheets and noise meter output summaries are presented in Appendices D and E, respectively. The noise monitoring program confirmed that SR 0422 traffic noise is the dominant source of noise in the existing noise environment in the project area.

A summary of the model validation process is also shown in Table 4-1. For all eight monitoring sites, the difference between the modeled and monitored noise levels range from -2 dBA to +1 dBA, while the average difference was 0.7 dBA. As the validation process shows less than a 3 dBA difference between the monitored and modeled noise levels, the validation noise model was verified to be representative of existing conditions and was thereby used as the developmental template for all future year noise prediction models.

**Table 4-1: Short-Term Monitoring and Model Validation Results**

| NSA | Site | Address | Land Use/Activity Category | Noise Levels (dBA) | | |
|---|---|---|---|---|---|---|
| | | | | Monitored | Modeled | Difference between Monitored and Modeled |
| A | M1 | 1610 Medical Drive | Interior / D | 63 | 63 | 0 |
| B | M2 | 1621 Rosewood Court | Residential / B | 59 | 59 | 0 |
| B | M3 | 140 1st Avenue | Residential / B | 63 | 63 | 0 |
| D | M4 | 205 Pleasantview Road | Residential / B | 66 | 66 | 0 |
| C | M5 | 66 Commons Drive | Residential / B | 59 | 60 | 1 |
| C | M6 | 2558 Terraced Hill Court | Residential / B | 59 | 60 | 1 |
| E | M7 | 205 Park Road | Residential / B | 67 | 66 | -1 |
| F | M8 | 115 Evergreen Road | Residential / B | 78 | 76 | -2 |

## 4.2 Existing Conditions

The project area was divided into NSAs in order to delineate groups of noise sensitive receptors that are exposed to a common noise environment comprised of similar noise sources and levels such as traffic volumes, traffic mix, traffic speed, and topographic features. The six NSAs analyzed in this Final Design Noise Study are consistent with the six NSAs identified in the 2003 preliminary noise study, although several NSA's were slightly expanded. To determine traffic noise levels in the existing conditions, each NSA was modeled in the TNM using the 2015 worst-case noise hour traffic volumes and composition. Below are descriptions of each NSA with a summary of its existing traffic noise environment. See Appendix B for map graphics showing each NSA and Appendix F for modeled noise levels for each receptor.

### NSA A

NSA A, located at the western end of SR 0422, Section M1B, consists of a medical park plaza adjacent to westbound SR 0422. The plaza is located on Medical Drive and consists of six noise receptors (A-001 through A-006) that each represent an individual group of medical facilities. The noise monitoring site (M1) was located at 1610 Medical Drive adjacent to SR 0422 and Porter Road. As there are no exterior use areas in this medical park plaza, the indoor noise level for all six receptors were evaluated under Activity Category D. Existing 2015 condition exterior noise levels in NSA A are predicted to range from 59 dBA to 70 dBA, while the interior noise levels are predicted to decrease by 25 dBA under the assumption that windows are single-glazed and are kept closed on a near daily basis, per FHWA guidance. As a result, no traffic impacts are predicted to occur in NSA A as interior noise levels would range from 34 dBA to 45 dBA, which are below the Activity Category D interior NAC of 52 dBA.

In the 2003 preliminary noise study, NSA A was designated as NSA 9. The boundary of NSA 9 is consistent with NSA A and no changes were made to the extents of the NSA.

### NSA B

Located on the north side of westbound SR 0422, NSA B consists of a combination of condominiums, townhouses, single family homes, and a community playground. The Maple Ridge and Maple Glen Village

condominiums and townhouses are located mainly on South Sunnybrook Road and Maple Glen Circle while the single family homes are located mainly on First Avenue. In total, 123 noise receptors (B-001 through B-123) represent 219 dwelling units and a community playground in NSA B with two monitoring sites located at 1621 Rosewood Court (M2) and 140 1st Street (M3) adjacent to SR 0422. NSA B consists of 121 residential receptors evaluated under Activity Category B, and two receptors at the community playground area evaluated under Activity Category C. Existing 2015 condition exterior noise levels are predicted to range between 43 dBA and 75 dBA with 40 receptors representing 59 residences and a community playground that currently experience traffic noise impacts due to levels approaching or exceeding the NAC.

In the 2003 preliminary noise study, NSA B was designated as NSA 10. The spatial extent of NSA 10 has been slightly expanded in the Final Design Noise Study in order to include all residences adjacent to First Avenue and Bramblewood Court.

### NSA C

Located on the north side of westbound SR 0422 between Pleasantview Road and Sanatoga Road, NSA C consists of single-family residences accessed on East High Street via Princeton Avenue and Commons Drive, as well as townhouses on Shelly Drive and Terraced Hill Court. In total, 68 noise receptors (C-001 through C-068) represent 124 dwelling units in NSA C with two monitoring sites located at 66 Commons Drive (M5) and 2558 Terraced Hill Court (M6) adjacent to SR 0422. As NSA C consists only of residential land uses, the traffic noise for all 68 receptors were evaluated under Activity Category B. Existing 2015 condition exterior noise levels are predicted to range between 48 dBA and 71 dBA with 23 receptors representing 33 residences that are impacted currently experience traffic noise impacts due to levels approaching or exceeding the NAC.

In the 2003 preliminary noise study, NSA C was designated as NSA 11. The spatial extent of NSA 11 has been slightly expanded in this Final Design Noise Study in order to include all residences on to Blackberry Drive, Shelly Drive, and Allyson Lane.

### NSA D

Located on the south side of eastbound SR 0422 along Pleasantview Road, NSA D consists of nine single-family residences on Pleasantview Road as represented by nine noise receptors (D-001 through D-009) with one monitoring site located at 205 Pleasantview Road (M4) adjacent to SR 0422. As NSA D consists only of residential land uses, the traffic noise for all nine receptors were evaluated under Activity Category B. Existing 2015 condition exterior noise levels are predicted to range between 53 dBA and 75 dBA with one receptor representing one residence that is currently impacted by traffic noise due to levels approaching or exceeding the NAC.

In the 2003 preliminary noise study, NSA D was designated as NSA 12. The boundary of NSA 12 is consistent with NSA D and no changes were made to the extents of NSA.

### NSA E

Located on the south side and adjacent to eastbound SR 0422 along Park Road at the eastern end of SR 0422, Section M1B, NSA D consists of 23 single-family residences on Park Road represented by 19 noise

receptors (E-001 through E-019) with a monitoring site located at 205 Park Road (M7) adjacent to SR 0422. As NSA E consists only of residential land uses, the traffic noise for all 19 receptors were evaluated under Activity Category B. Existing 2015 condition exterior noise levels are predicted to range between 59 dBA and 72 dBA with seven receptors representing seven residences that are currently impacted by traffic noise due to levels approaching or exceeding the NAC.

In the 2003 preliminary noise study, NSA E was designated as NSA 14. The boundary of NSA 14 is consistent with NSA E and no changes were made to the extents of NSA.

#### NSA F

Located on the north side and adjacent to westbound SR 0422 between Park Road and Evergreen Road at the eastern end of SR 0422, Section M1B, NSA F consists of 115 single-family mobile residences accessed via East High Street represented by 48 noise receptors (F-001 through F-048) with a monitoring site located at 115 Evergreen Road (M8) adjacent to SR 0422. As NSA F consists only of residential land uses, the traffic noise for all 48 receptors were evaluated under Activity Category B. Existing 2015 condition exterior noise levels are predicted to range between 58 dBA and 77 dBA with 30 receptors representing 80 residences that are currently impacted by traffic noise due to levels approaching or exceeding the NAC.

In the 2003 preliminary noise study, NSA F was designated as NSA 13. The boundary of NSA 13 is consistent with NSA F and no changes were made to the extents of NSA.

# 5.0 Future Highway Traffic Noise Environment

## 5.1 Future Traffic Noise Model Input

To complete phase one of the PennDOT three-phased noise abatement approach, future traffic noise impacts in the Build alternative were identified at each receptor location with modeled traffic noise levels that either approach or exceed the NAC, or are substantially higher than the existing noise levels. To predict these noise levels, the existing noise model was revised to reflect conditions in the Build alternative as described in Section 3.3 above.

In addition to modeling year 2043 roadway design and traffic data projections, changes to the terrain within the SR 0422, Section M1B right-of-way were also recommended by a value engineering study prepared in April 2017, which recommended to minimize off-site material hauling costs by retaining on premise waste earthen material generated by the proposed roadway reconstruction activities. Of the candidate areas where waste material may be utilized as earthen berms, four sites were found to be spatially compatible with potential noise abatement locations. One berm would be located along NSA B, two berms along NSA C, and one berm along NSA F. Of the four berms sites, the two located along NSA C and NSA F would abate traffic noise by adding substantial sightline obstruction between residences and SR 0422 while the remaining two berms—located along NSA B and NSA C—would provide minor noise abatement by extending the existing terrain closer to the proposed roadway noise sources, thereby optimizing noise barrier placement such that noise diffraction would occur sooner than without the berms. The abatement effect of each berm is included in the noise levels predicted by the Build alternative

noise model as shown in Appendix F. Appendix B provides a graphical presentation of each berm, with additional top-of-berm height information shown for the two berms along NSA C and NSA F which would add substantial sightline obstruction between residences and SR 0422.

For future year 2043 traffic projections under the Build alternative, the 2011 DVRPC traffic study also accounted for a then-anticipated, toll-supported commuter rail line extension from Norristown to Reading along the SR 0422 corridor. The effect of this new transit service reduced future vehicle travel demand on the SR 0422 corridor, thereby lowering the projected traffic volumes in the Build alternative relative to the No Build alternative. Due to lack of local support for the rail line extension, however, the project is no longer being considered. As a result, all future noise impact and abatement analyses for the Build alternative in this Final Design Noise Study were performed based on DVRPC traffic projections for the No Build alternative, which are consistent with and representative of travel conditions in the Build alternative as the associated roadway improvements (i.e., without the previously anticipated rail service) would not affect future travel patterns or travel demand on the SR 0422 corridor. Furthermore, the use of No Build alternative traffic volumes, which are higher than the traffic volumes projected by DVRPC for the Build alternative (i.e. with the then-anticipated rail service) would result in a more conservative prediction of future traffic noise and determination of noise abatement in this Final Design Noise Study. See Appendix A for documentation of coordination between Jacobs, FHWA and PennDOT confirming the use of No Build volumes for design year traffic projections.

## 5.2 Future Noise Impact Assessment

Although future traffic noise impacts are predicted to be prevalent throughout SR 0422, Section M1B, implementation of the Build alternative is predicted to confer a net benefit to the ambient noise environment. Several factors in the Build alternative combine to reduce the total number of traffic noise impacts from 109 receptors representing 195 residences in the No Build alternative to 87 receptors representing 152 residences in the Build alternative. This improvement was due to the addition of earthen berms per value engineering recommendations as described in Section 5.1 above as well as the construction of a 52-inch concrete glare screen along the length of the SR 0422 median in Section M1B where none currently exists. Furthermore, the proposed roadway alignment would be shifted up to approximately 30 feet away from NSA C residences located at Terrace Hill Court, Shelly Lane, and the east end of Commons Drive. The anticipated effect of these factors on the Build alternative would be a decrease in the average noise levels by 3 dBA (from 67 dBA to 64 dBA) thereby resulting in the mitigation of traffic noise impacts at 46 residences. As a result, the Build alternative is anticipated to confer a net benefit to future traffic noise levels and the ambient noise environment relative to the No Build alternative in SR 0422, Section M1B prior to consideration of noise abatement.

All noise impacts in the Build alternative would also be present in the No Build alternative, with the sole exception of receptor C-004 as the proposed roadway curve radius would bring the SR 0422 alignment approximately 12 feet closer to residences in that area. All traffic noise impacts were due to modeled noise levels approaching or exceeding the NAC for Activity Category B (i.e., residential,) and none were due to a substantial increase (i.e., 10 dBA) over existing noise levels. All NSA's are predicted to be impacted by traffic noise with the exception of NSA A where only interior noise was evaluated under Activity

Category D. See Appendix B for graphics showing the location of each noise impact, and Appendix F for tables showing the future noise levels predicted at each modeled receptor.

Per PennDOT guidance, highway traffic noise analyses will be performed for developed lands as well as undeveloped lands if they are considered "permitted." Undeveloped lands are deemed to be permitted when there is a definite commitment to develop land with an approved specific design of land use activities as evidenced by the issuance of at least one building permit. In accordance with PennDOT policy, an undeveloped lot is considered to be planned, designed, and programmed if a building permit has been issued by the local authorities prior to the Date of Public Knowledge for the relevant project. PennDOT considers the "Date of Public Knowledge" as the date that the final NEPA approval is made, and thereafter would have no obligation to provide noise mitigation for any undeveloped land that is permitted or constructed. Coordination with the Lower Pottsgrove Township Manger in February 2017 determined that no undeveloped and permitted land uses would be present within or adjacent to SR 0422, Section M1B. For undeveloped lands with no development permitted, PennDOT policy requires the prediction of future noise levels for use by local planning officials. See Appendix B for graphics showing contours showing the distances at which the NAC for each land use activity category would be approached.

# 6.0 Highway Traffic Noise Consideration and Abatement Alternatives

## 6.1 Abatement Alternatives

FHWA and PennDOT noise abatement guidelines recommend a variety of abatement measures that should be considered in response to transportation-related noise impacts. While noise barriers and/or earth berms are generally the most effective form of noise mitigation, additional mitigation measures exist which have the potential to provide considerable noise reductions. Mitigation measures considered for this project include traffic control measures; alteration of horizontal and vertical alignments; acoustical Insulation of public-use and non-profit (i.e. Activity Category D) facilities; acquisition of buffer land; and the construction of earthen berms and/or noise barriers.

Due to the purpose and need of the proposed highway project, traffic control and alignment alteration measures were not deemed to be feasible abatement options. The acquisition of buffer land was also deemed to be not feasible as this option would result in significant residential displacements due to high density of development in the project area. In addition, acoustical insulation was not considered as no Activity Category D noise impacts were identified. As a result, the construction of earthen berms and noise barriers were selected as the noise abatement alternatives evaluated for all NSA's where traffic noise impacts were identified in this Final Design Noise Study.

## 6.2 Feasibility and Reasonableness Criteria

Noise abatement determination is based on PennDOT's three phased approach: warranted, feasibility, and reasonableness. The first phase determines whether noise abatement is warranted, the results of which are summarized in Section 5.2 above. In the Build alternative, traffic noise impacts are predicted to occur at 87 receptors representing 152 residences under Activity Category B across NSA B, NSA C, NSA D,

NSA E, and NSA F and, as such, the consideration of noise abatement is warranted for each NSA mentioned.

The second phase evaluates noise abatement alternatives and determines whether any meet the feasibility criteria. The chosen noise abatement alternative is considered feasible if it provides a noise reduction of at least 5 dBA for a majority (i.e. 50 percent or greater) of the impacted receptors. In addition, a feasible noise abatement measure would not cause unsafe roadway conditions or other engineering constraints such as restricting access to vehicular or pedestrian travel, interfering with maintenance activities, utilities and/or drainage, and incurring extraordinary costs associated with structural reinforcement or right-of-way purchase.

The third phase of noise abatement determination evaluates whether the proposed abatement options meet the reasonableness criteria, as described below. Noise abatement must be both feasible and reasonable to be recommended for implementation.

### Cost Reasonableness Value

The reasonable cost value for noise barriers is 2,000 as based upon a maximum square footage of abatement per benefited receptor (MaxSF/BR.) The square footage of the barrier is determined based on its length and height from the finished ground elevation at the base of the barrier to its top elevation. The total number of benefited receptors includes all receptors that would receive a 5 dBA or greater insertion loss from the noise barrier.

### Noise Reduction Design Criteria and Goals

Per 23 CFR 772, a noise reduction design goal is required for highway traffic noise abatement evaluation. Noise reduction is measured by comparing Build alternative pre- and post-barrier noise levels. This difference between unabated and abated noise levels is known as insertion loss. PennDOT has defined the noise reduction design goal as achieving at least 7 dBA of insertion loss for at least one benefited receptor while insertion losses of 7 dBA or above are desired for additional impacted receptors as justifiable by the point of diminishing acoustical return on increasing barrier height.

In this Final Design Noise Study, the point of diminishing acoustical return on barrier height was established by adopting the analysis methodology promulgated by the Noise Barrier Optimization Tool (NBOT) per FHWA's *Recommended Best Practices for the Use of FHWA Traffic Noise model* (December 2015.) The basis of this tool centers on comparing the Effectiveness per Cost (E/C) ratio across a number of uniform barrier height scenarios. For each barrier abatement scenario, the "Effectiveness" or E value is calculated by dividing the total number of benefited receptors (including non-impacted receptors) by the total number of impacted receptors, then multiplying the resulting value with the percentage of impacted receptors that meet or exceed the desired 7 dBA insertion loss design goal; the "Cost" or C value is the total surface area of the barrier in square feet. With the E/C ratio calculated for each height scenario, the point of diminishing acoustical return on barrier height is ascertained by identifying the uniform wall height scenario yielding the highest E/C ratio. This scenario establishes the initial baseline height for optimizing the final design of a noise barrier, which is the process that seeks the most efficient use of

materials (e.g., barrier panel, earth fill) to achieve noise reduction design goals at as many receptors as possible within the allowable MaxSF/BR constraint.

In addition to the above criteria and design goals, it is desirable to reduce future exterior noise levels back to existing exterior noise levels as well as reduce future exterior noise levels to the low 60 dBA range (i.e., 60 dBA to 63 dBA) for Activity Category B and Activity Category C receptors, and the upper 60 dBA range (i.e., 65 dBA to 68 dBA) for Activity Category E receptors.

### Consideration of Viewpoints

As related to the viewpoints of property owners and residences, the viewpoints of all benefited receptors shall be solicited in order to obtain enough responses to document a decision on either desiring or not desiring a noise abatement measure. Although the public may express opinions regarding the desire for or against particular noise abatement measures at any point in the development of a project, the solicitation of viewpoints does not formally occur until information contained within the draft version of this Final Design Noise Study has been approved for circulation to the public by PennDOT and FHWA. This process assures the public has access to the results of noise analyses prior to making any decision related to the desire for or available choices associated with noise abatement measures.

## 6.3 Noise Abatement Evaluation

Of the five noise barriers evaluated in NSA's impacted by traffic noise in the Build alternative, three barriers located in NSA B, NSA C, and NSA F were found to be both feasible and reasonable per the PennDOT three-phased approach to noise abatement determination and, as such, are recommended for implementation. At an overall 419 square feet of abatement per benefited receptor, the three recommended barriers total 108,050 square feet in area and would benefit 256 residences overall. Nearly all impacted residences (93 percent) would also receive the desired noise reduction design goal of 7 dBA insertion loss. The feasibility and reasonableness assessment of each barrier is summarized in Table 6-1.

**Table 6-1: Noise Abatement Feasibility and Reasonableness Assessment**

| Barrier | Insertion Loss (dBA) | Average Insertion Loss (dBA) | Average Height (feet) | Total Length (feet) | Total Area (square feet) | Benefited | Area per Benefited Receptor | Feasible | Reasonable |
|---|---|---|---|---|---|---|---|---|---|
| B | 1 - 13 | 5 | 17.4 | 2,784 | 48,264 | 105 | 460 | Yes | Yes |
| C | 0 - 10 | 5 | 11.9 | 2,586 | 31,050 | 71 | 437 | Yes | Yes |
| D | 0 - 9 | 2 | 11.3 | 454 | 5,085 | 2 | 2,543 | Yes | No |
| E | 1 - 8 | 3 | 16.2 | 936 | 15,184 | 7 | 2,169 | Yes | No |
| F | 0 - 15 | 7 | 22.9 | 1,258 | 28,736 | 80 | 359 | Yes | Yes |

Each evaluated noise barrier was modeled in the TNM with a wall panel length of 16 feet and shorter lengths as warranted by the one-foot horizontal and vertical accuracy requirement of the modeling environment. The optimization of barrier lengths and heights was performed on a per-panel basis to meet and be consistent with noise reduction targets as defined by the uniform height scenario with the highest E/C ratio per NBOT methodology, which may be reviewed in Appendix G. For each recommended barrier,

acoustical profiles were developed as based on optimized barrier lengths and panel heights and are available for final engineering design as well as for review in TNM. As developed for and presented in this Final Design Noise Study, the dimensions and locations of all recommended barriers were confirmed to be free of conflict with all constructability aspects of the feasibility criteria such as vehicle and pedestrian safety, utilities and drainage, and access for maintenance purposes as well as to adjacent properties. Furthermore, a line-of-sight analysis was performed in TNM as well as third-party modeling software to confirm that all recommended noise barriers as designed in this Final Design Noise Study would have sufficient height to obstruct all visual sightlines between residences and roadway noise sources. Each barrier will be described below in turn and presented graphically in Appendix B which also show minimum heights comprising the acoustical profile of the proposed noise barriers. Per PennDOT and FHWA guidelines, warranted, feasible, and reasonable worksheets are required to be completed for all impacted noise sensitive receptors within the study area and are included in Appendix H.

### Barrier B

Barrier B was evaluated as a system of two overlapping walls (designed to avoid conflict with the Sprogels Run 100-Year Floodplain) along westbound SR 0422 to provide noise abatement for 63 residences and a community playground area predicted to be impacted by traffic noise between Rosewood Court and Oaktree Court in NSA B. At an average height of 17.4 feet and a length of 2,784 feet, Barrier B is predicted to average 5 dBA of insertion loss and benefit 103 residences and a community playground in the Build alternative, including 60 residences and the community playground area that are impacted by traffic noise. With an optimized surface area of 48,264 square feet, Barrier B would achieve a cost reasonableness value of 460 square feet of abatement per benefited receptor as well as achieve the noise reduction design goal of 7 dBA insertion loss for 60 impacted residences which is 95 percent of the 63 impacted residences in NSA B. Although the three remaining impacted residences—second-story receptors B-067 and B-068 at the west end of Rosewood Court—would not be benefited by a 5 dBA insertion loss within the allowable noise barrier construction height limit of 30 feet, the noise barrier system as proposed would provide sufficient insertion loss to mitigate the traffic noise impacts predicted at B-067 and B-068. In addition, all future noise levels are predicted to be reduced to the low 60 dBA range as well as back to existing noise levels, including second-story receptors B-067 and B-068. As such, Barrier B would be feasible and reasonable per PennDOT noise abatement determination policy and is therefore recommended for construction.

In addition to Barrier B, an earthen berm is also proposed to be constructed near the edge of the westbound SR 0422 shoulder between NSA B and SR 0422 per value engineering recommendations. This berm would begin on the western end of NSA B with Barrier B then terminate at the western end of Pine Tree Court. Although this berm would not provide additional sightline obstruction between SR 0422 and residences, it would cause the diffraction of roadway noise to occur sooner as the berm would increase the slope of the roadway cut, thereby shifting the top of the cut slope closer to the roadway. As such, it is anticipated to provide minor noise abatement in support of Barrier B, which would be constructed upon the highest elevation of the berm.

### Barrier C

Barrier C was evaluated as a system of two overlapping walls (designed to accommodate drainage needs) along westbound SR 0422 to provide noise abatement for 21 residences predicted to be impacted by traffic noise between Pleasantview Road and Terraced Hill Court in NSA C. At an average height of 11.9 feet and a length of 2,586 feet, Barrier C is predicted to average 5 dBA of insertion loss and benefit 71 residences in the Build alternative including all 21 residences impacted by traffic noise. With the exception of receptor C-001, all future noise levels are predicted to be reduced to the low 60 dBA range as well as back to existing noise levels. Noise abatement consideration was not warranted for receptor C-001 as no traffic noise impact was predicted at this location which is elevated approximately 20 feet above the roadway as well as shielded by the Pleasantview Road overhead bridge structure. With an optimized surface area of 31,050 square feet, Barrier C would achieve a cost reasonableness value of 437 square feet of abatement per benefited receptor as well as achieve the noise reduction design goal of 7 dBA insertion loss for 17 residences which is 81 percent of impacted residences in NSA C. As such, Barrier C would be feasible and reasonable per PennDOT noise abatement determination policy and is therefore recommended for construction.

In addition to Barrier C, two earthen berms are also proposed to be constructed near the edge of the westbound SR 0422 shoulder between NSA C and SR 0422 per value engineering recommendations. One berm would be constructed on the western side of NSA C adjacent to residences on Princeton Avenue and Commons Drive while the second berm would be constructed on the eastern side of NSA C adjacent to residences on Blackberry Drive, Shelly Drive, and Terraced Hill Court. For residences on Shelly Lane and the eastern end of Commons Drive, the eastern berm would provide up to 13 feet of additional obstruction to lines-of-sight with SR 0422 and, as such, is predicted to provide substantial noise abatement in support of Barrier C to be constructed upon the highest elevation of the eastern berm. See Appendix B for a graphical representation showing approximate total heights of the noise abatement combination proposed in this area.

Although the remaining section of the eastern berm adjacent to Terraced Hill Court as well as the entire western berm would not provide additional sightline obstruction between SR 0422 and residences, both berms would cause the diffraction of roadway noise to occur sooner as each berm would increase the slope of the roadway cut thereby shifting the top of the cut slope closer to the roadway. As such, these berms are predicted to provide minor noise abatement in support of Barrier C which would be constructed on the highest elevation of the berm.

### Barrier D

Located along eastbound SR 0422 between NSA D and SR 0422, Barrier D was evaluated as a system of two, non-overlapping walls, one on each side of the Pleasantview Road overhead bridge structure. This barrier system would be gapped to accommodate Pleasantview Road. Additionally, as a result of the grade separation between SR 0422 and the residences, noise abatement is required to be developed at the same grade as Pleasantview Road which is approximately 25 feet above SR 0422. At an average height of 11.3 feet and a total length of 454 feet for an optimized surface area of 5,085 square feet, Barrier D is predicted to benefit a total of two residences, including the one residence impacted by traffic noise in the Build alternative.

Although Barrier D would meet the design goal of 7 dBA insertion loss at one residence, Barrier D would have a cost reasonableness value of 2,543 square feet of abatement per benefited receptor which exceeds the 2,000 MaxSF/BR cost reasonableness criteria. Due to the setback and wide spacing between residences in this NSA, attempts to increase the number of benefited receptors were unsuccessful without also significantly increasing the surface area of Barrier D and its corresponding cost reasonableness value. In addition, further attempts at redesigning Barrier D to minimize the gap in the barrier system were not feasible due to safety concerns with sight distance at residential driveways as well as the limited right-of-away availability on either side of Pleasantview Road. As such, Barrier D would be feasible but not reasonable per PennDOT noise abatement determination policy and is therefore not recommended for construction.

### Barrier E

Located along eastbound SR 0422 between NSA E and SR 0422, Barrier E was evaluated as a system of four walls comprised of two overlapping walls (designed to accommodate drainage needs) on either side of the Park Road overhead bridge structure. For analysis purposes, to facilitate a best-case noise abatement scenario, this barrier system was assumed to not be gapped as both sets of walls would be physically integrated into a 16.5 feet high bridge wing wall to form a single contiguous wall construct along the SR 0422 roadway shoulder. At an average height of 16.2 feet and a total length of 936 feet and an optimized surface area of 15,184 square feet, Barrier E is predicted to average 3 dBA of insertion loss and benefit all four residences impacted by traffic noise in the Build alternative.

Although Barrier E would benefit a total of seven residences as well as meet the design goal of 7 dBA insertion loss at two residences, Barrier E would have a cost reasonableness value of 2,169 square feet of abatement per benefited receptor, which exceeds the 2,000 MaxSF/BR cost reasonableness criteria. Due to the setback of and wide spacing between residences in this NSA, attempts to increase the number of benefited receptors were unsuccessful without also significantly increasing the cost reasonableness value. Furthermore, additional construction cost may be incurred in order to physically integrate the barrier system into the Park Road bridge wing walls, thereby increasing the cost reasonableness value further above the 2,000 MaxSF/BR criteria. As such, Barrier E would be feasible but not reasonable per PennDOT noise abatement determination policy and is therefore not recommended for construction.

### Barrier F

Barrier F was evaluated as a single continuous wall along westbound SR 0422 to provide noise abatement for 63 residences predicted to be impacted by traffic noise between Park Road and Evergreen Road in NSA F. At an average height of 22.9 feet and a length of 1,258 feet, Barrier F is predicted to average 7 dBA of insertion loss and benefit 80 residences in the Build alternative, including all 63 residences impacted by traffic noise. All future noise levels are predicted to be reduced to the low 60 dBA range as well as back to existing noise levels. Due to the future noise level of 78 dBA predicted for receptor F-001, the average noise barrier height was raised 2.9 feet above the point of diminishing returns as identified by NBOT (20 feet) in order to provide receptor F-001 with sufficient insertion loss (15 dBA) in order to reduce the future noise level to the low 60 dBA range. With an optimized surface area of 28,736 square feet, Barrier F would achieve a cost reasonableness value of 359 square feet of abatement per benefited receptor as well as achieve the noise reduction design goal of 7 dBA insertion loss for 60 impacted residences which is 95

percent of the 63 impacted residences in NSA F. As such, Barrier F would be feasible and reasonable per PennDOT noise abatement determination policy and is therefore recommended for construction.

In addition to Barrier F, an earthen berm is also proposed to be constructed between the eastern half of NSA F and the edge of shoulder of the westbound SR 0422 on-ramp per value engineering recommendations. The berm would provide up to 17 feet to 21 feet of obstruction to lines-of-sight with SR 0422 and, as such, is predicted to provide substantial noise abatement in NSA F for nearby residences.

## 7.0 Construction Noise Consideration and Abatement Opportunities

It is anticipated that construction of this project will result in increased noise levels, though temporary, throughout the project area. The increase in noise within the adjacent communities are generated from construction activities which include but are not limited to the clearing of land, the construction of roadways and related features, and the moving of construction equipment such as diesel-powered earth-moving equipment (i.e. dump trucks and bulldozers), compressors, and pile drivers.

Noise levels from diesel-powered equipment range between 80 to 95 dBA at a distance of 50 feet according to the FHWA Construction Noise Handbook (FHWA, August 2006.) Impact equipment, such as pile drivers, can potentially generate louder noise levels. However, noise levels during construction are difficult to predict since the type of construction activity and the equipment used varies during each stage of work. Additionally, construction activities are not usually located at one location for very long or are consistently generating noise for a specific duration.

While that may be the case, it is necessary to provide reasonable abatement measures for construction noise to minimize any potential impacts for the adjacent communities despite their temporary nature. The contractor shall use equipment adapted to operate with the least possible noise and shall conduct his work so that any annoyance to occupants of nearby property and the general public will be minimized during construction.

## 8.0 Public Involvement Process

As part of the noise mitigation process and the PennDOT noise policy, consideration of the public's needs and preference must be taken into account when determining the reasonableness of noise mitigation within the project area. In order to do so, outreach to the local community through a public meeting is necessary to allow for public input. The noise analysis and proposed mitigation information will be presented to the public at a scheduled public meeting following the approval of this report. Coordination with local officials is necessary to ensure participation from both residents and property owners within the adjacent communities who may be potentially affected by this project have the opportunity to provide their input.

The purpose of the public meeting is also to determine the desires of benefitted receptors. Whether or not noise barriers that satisfy all feasible and reasonable criteria of the PennDOT noise policy will be constructed as well as the barrier's location, color, and texture will be determined by the community through a voting process. Of all the votes tallied, a 50% or great margin must be in favor of the proposed

noise barrier in order for the noise barrier to be considered reasonable per PennDOT noise policy. Voting results will be assessed by the project team as well as the Engineering District for votes not in favor of the proposed noise wall on an individual proposed noise barrier basis in order to provide a comprehensive assessment of the overall proposed noise mitigation. Once a determination is made on the recommended noise barriers, the results will be documented and included as a supplement to this report.

# Appendix A

## Noise Model Traffic Inputs and Loudest Hour Selection

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Fax 1.215.569.5963

**Date** **December 7th, 2017**

**To** File

**From** Jacobs

**Subject** SR 0422 Section M1B Final Design Noise Study Traffic Projections

The intent of this memorandum is to document the coordination efforts between the Federal Highway Administration (FHWA), Pennsylvania Department of Transportation (PennDOT), Delaware Valley Regional Planning Commission (DVRPC) and Jacobs Engineering Group Inc. (Jacobs) to clarify the most appropriate future traffic volumes for use in development of the Final Design Noise Study for the SR 0422, Section M1B project in Lower Pottsgrove Township, Montgomery County.

The Final Design Noise Study utilizes the latest available traffic analysis from the Pottstown Bypass (US 422) Reconstruction Traffic Study Supplement Number 1 – Chester and Montgomery Counties, Pennsylvania prepared by DVRPC in August 2011 to analyze current traffic conditions versus future projections along the SR 0422 Pottstown Bypass corridor, which includes the limits of Section M1B. Typically, a 'Build' scenario model would attract higher volumes, particularly if the roadway improvements include additional travel movement(s) and/or lane(s). For the SR 0422 improvements, all current movements are maintained (no new/additional on or off-ramp movements), and the number of traffic lanes in each direction is maintained (two lanes in each direction). As such, 'Build' volumes and 'No-Build' volumes are expected to be similar if not identical.

The 'Build' scenario traffic volumes in the DVRPC study were unexpectedly lower than those in the 'No-Build' scenario, leading Jacobs to coordinate with DVRPC the possible reasons driving this outcome. The reason contributing to the lower 'Build' volumes is the inclusion of a SR 0422 toll supported extension of train service from Norristown to Reading (Schuylkill River Metro, which parallels the SR 0422 corridor), as that project was anticipated when the traffic study for the SR 0422 corridor was being prepared. The Schuylkill River Metro project is now off the table due to cost and lack of local support.

Jacobs coordinated with DVRPC to investigate the possibility of updating the projected traffic volumes for the 'Build' scenario, knowing that the Schuylkill River Metro project is no longer anticipated. The following is a summary of Jacobs' coordination with DVRPC:

- To update the traffic projections, DVRPC will need to perform the entire efforts of the initial study, i.e. traffic data collection, modeling, analysis, report, etc.
- DVRPC anticipates 9-12 months to accomplish this task after work order Notice To Proceed (NTP), which will negatively impact the project schedule.
- Since the traffic study was prepared, DVRPC has updated its Long Range Plan twice, and developed an entirely new travel demand model. The population and employment projections used for the 2035 Long Range Plan were developed before the 2010 census data were released, and were based on the 2000 census employment estimates and the 2005 census mid-course population estimates. This makes it very difficult to compare the 'No-Build' volumes in the traffic study with 'Build' volumes from a new traffic model and Long Range Plan.
- The travel model used by DVRPC for the 2011 traffic study was validated in 2005, and calibrated in the US 422 corridor using 2008-2010 traffic counts. At that time, traffic volumes were growing by approximately 1.0% per year and that growth rate was reflected in the travel model. Since that time, highway traffic volumes along the corridor and throughout southeast PA have been declining and are just now beginning to increase. DVRPC's current model is validated with 2015 traffic counts and forecasts highway traffic volume growth in the 0.3% to 0.5% per year range. An updated 'Build' model would be starting with a lower base year volume, the volumes would be increasing at a slower rate, and that rate would be applied over fewer years (2010 to 2035 in the 2011 traffic study versus 2015 to 2035 now).

Based on the information above, Jacobs recommended using the projected 'No-Build' scenario traffic volumes from the 2011 DVRPC study to develop the Final Design Noise Study for the SR 0422 Section, M1B project. This recommendation was sent to PennDOT and FHWA for concurrence on June 26, 2017 via email from Dilip Radadia, PE (Jacobs Project Manager).

On July 21, 2017, via email correspondence, Jennifer Elsken (FHWA Environmental Protection Specialist, PennDOT Division) confirmed that use of the DVRPC 2011 traffic study 'No-Build' scenario traffic volumes for the Final Design Noise Study of Section M1B is most appropriate, provided that sufficient documentation and logical explanation of methodology to determine the conservatism of the approach is included in the final document.

**TRAVEL MONITORING**
Montgomery County
S.R. 0422 - Section M1B

| HOUR BEGINNING | WEDNESDAY 08/26/09 - WB | WEDNESDAY 08/26/09 - EB | WEDNESDAY 08/26/09 - TOTAL | THURSDAY 08/27/09 - WB | THURSDAY 08/27/09 - EB | THURSDAY 08/27/09 - TOTAL | FRIDAY 08/28/09 - WB | FRIDAY 08/28/09 - EB | FRIDAY 08/28/09 - TOTAL | HOUR BEGINNING |
|---|---|---|---|---|---|---|---|---|---|---|
| 12:00 AM | | | | 285 | 158 | 443 | | 228 | | 12:00 AM |
| 1:00 AM | | | | 144 | 130 | 274 | | 135 | | 1:00 AM |
| 2:00 AM | | | | 152 | 128 | 280 | | 127 | | 2:00 AM |
| 3:00 AM | | | | 142 | 162 | 304 | | 181 | | 3:00 AM |
| 4:00 AM | | | | 184 | 544 | 728 | | 483 | | 4:00 AM |
| 5:00 AM | | | | 386 | 1,512 | 1,898 | | 1,342 | | 5:00 AM |
| 6:00 AM | | | | 799 | 2,727 | 3,526 | | 2,382 | | 6:00 AM |
| 7:00 AM | | | | 1,351 | 2,726 | 4,077 | | 2,456 | | 7:00 AM |
| 8:00 AM | | | | 1,297 | 2,179 | 3,476 | | 2,064 | | 8:00 AM |
| 9:00 AM | | | | 1,286 | 1,735 | 3,021 | | 1,647 | | 9:00 AM |
| 10:00 AM | | | | 1,278 | 1,438 | 2,716 | | 1,477 | | 10:00 AM |
| 11:00 AM | | | | 1,338 | 1,347 | 2,685 | | 1,356 | | 11:00 AM |
| 12:00 PM | 1,362 | 1,352 | 2,714 | 1,341 | 1,371 | 2,712 | | | | 12:00 PM |
| 1:00 PM | 1,488 | 1,297 | 2,785 | 1,488 | 1,303 | 2,791 | | | | 1:00 PM |
| 2:00 PM | 1,838 | 1,411 | 3,249 | 1,987 | 1,483 | 3,470 | | | | 2:00 PM |
| 3:00 PM | 2,578 | 1,376 | 3,954 | 2,533 | 1,542 | 4,075 | | | | 3:00 PM |
| 4:00 PM | 2,915 | 1,469 | 4,384 | 2,976 | 1,672 | 4,648 | | | | 4:00 PM |
| 5:00 PM | 3,052 | 1,447 | 4,499 | 3,047 | 1,636 | 4,683 | | | | 5:00 PM |
| 6:00 PM | 2,138 | 1,265 | 3,403 | 2,119 | 1,229 | 3,348 | | | | 6:00 PM |
| 7:00 PM | 1,332 | 913 | 2,245 | 1,344 | 944 | 2,288 | | | | 7:00 PM |
| 8:00 PM | 1,127 | 862 | 1,989 | 1,147 | 837 | 1,984 | | | | 8:00 PM |
| 9:00 PM | 1,002 | 688 | 1,690 | 1,016 | 630 | 1,646 | | | | 9:00 PM |
| 10:00 PM | 672 | 596 | 1,268 | 694 | 563 | 1,257 | | | | 10:00 PM |
| 11:00 PM | 498 | 260 | 758 | 740 | 336 | 1,076 | | | | 11:00 PM |
| **TOTAL** | | | | 29,074 | 28,332 | 57,406 | 0 | | | **TOTAL** |
| | 5:00 PM | 4:00 PM | 5:00 PM | 5:00 PM | 6:00 AM | 5:00 PM | | 7:00 AM | | |

Source: *Pottstown Bypass (US 422) Reconstruction Traffic Study, Supplement Number 1 – Chester and Montgomery Counties, Pennsylvania* (August 2011)

**Comparative TNM Analysis**

| **Peak Hours** | **7:00 AM** | **5:00 PM** |
|---|---|---|
| Number of Impacted Receptors | 73 | 89 |
| Number of Impacted Dwelling Units | 127 | 163 |
| Average traffic noise level (dBA) | 60.4 | 61.5 |

## Traffic Volumes

### Mainline

- Existing (2015)
  - EB AM Peak – 2,867
  - WB AM Peak – 1,702
  - EB PM Peak – 1,732
  - WB PM Peak – 3,073
- No Build (Design Year 2043)
  - EB AM Peak – 3,647
  - WB AM Peak – 2,174
  - EB PM Peak – 2,177
  - WB PM Peak – 3,798
- Build (Design Year 2043)
  - EB AM Peak – 3,579
  - WB AM Peak – 2,109
  - EB PM Peak – 2,136
  - WB PM Peak – 3,574

### Ramp A

- Existing (Current build year 2023)
  - AM Peak – 316
  - PM Peak – 518
- No Build (Design Year 2043)
  - AM Peak – 371
  - PM Peak – 606
- Build (Design Year 2043)
  - AM Peak – 413
  - PM Peak – 677

## Vehicle Classifications

### Mainline

- Automobile
  - EB – 79%
  - WB – 41%
- Medium Trucks
  - EB – 13%
  - WB – 46%
- Heavy Trucks
  - EB – 7%
  - WB – 12%
- Motorcycles
  - EB – 0.9%
  - WB – 0.8%

### Ramp A

- Automobile – 74%
- Medium Trucks – 16%
- Heavy Trucks – 7%
- Motorcycles – 2.6%

Source: *Pottstown Bypass (US 422) Reconstruction Traffic Study,*
Supplement Number 1 – Chester and Montgomery Counties, Pennsylvania (August 2011)

Table I-4 shows the non-uniform traffic distributions used in the scenarios for the 4- and 8-lane highways, while

Table I-5 shows the traffic distributions for the 12-lane highway. These distributions were based on an analysis of the traffic data that were collected by the Volpe Center for the Phase 1 TNM Validation Study.

**Table I-4. Non-uniform Traffic Distributions for 4- and 8-lane Facilities**

| **With a Typical Truck Percentage in the Traffic Flow** | | | | | | |
|---|---|---|---|---|---|---|
| **Facility:** | **4-lane** | | **8-lane** | | | |
| **Lane:** | **1** | **2** | **1** | **2** | **3** | **4** |
| Lane % MT+Bus | 81.8 | 18.2 | 38.1 | 40.5 | 17.3 | 4.1 |
| Lane % HT | 76.9 | 23.1 | 49.4 | 35.8 | 11.8 | 3.1 |
| Lane % Trucks | 77.7 | 22.3 | 44.2 | 38.5 | 13.7 | 3.6 |
| Lane % Car | 53.0 | 47.0 | 30.4 | 26.5 | 29.1 | 14.0 |
| % Total Traffic | 55.3 | 44.7 | 31.5 | 27.6 | 27.8 | 13.1 |
| **With a High Truck Percentage in the Traffic Flow** | | | | | | |
| **Facility:** | **4-lane** | | **8-lane** | | | |
| **Lane:** | **1** | **2** | **1** | **2** | **3** | **4** |
| Lane % MT+Bus | 82.8 | 17.2 | 49.0 | 32.3 | 14.9 | 3.8 |
| Lane % HT | 74.7 | 25.3 | 38.1 | 52.7 | 9.0 | 0.2 |
| Lane % Trucks | 76.0 | 24.0 | 41.6 | 45.8 | 11.2 | 1.4 |
| Lane % Car | 55.3 | 44.7 | 32.4 | 26.5 | 27.4 | 13.7 |
| % Total Traffic | 60.6 | 39.4 | 33.7 | 29.6 | 25.0 | 11.7 |

**Table I-5. Non-uniform Traffic Distributions for 12-lane Facilities**

| **With a Typical Truck Percentage in the Traffic Flow** | | | | | | |
|---|---|---|---|---|---|---|
| **Lane:** | **1** | **2** | **3** | **4** | **5** | **6** |
| Lane % MT+Bus | 17.8 | 18.1 | 34.9 | 25.7 | 1.9 | 1.7 |
| Lane % HT | 8.3 | 17.1 | 37.1 | 34.1 | 1.9 | 1.6 |
| Lane % Trucks | 10.8 | 17.5 | 36.8 | 31.3 | 1.9 | 1.7 |
| Lane % Car | 12.1 | 16.0 | 22.4 | 21.6 | 15.1 | 12.9 |
| % Total Traffic | 12.0 | 16.1 | 23.7 | 22.3 | 13.9 | 11.9 |

JACOBS

Subject SR 0422/MIB TRAFFIC | Project YIW02502

Sheet No. 1 of 8

Authored by TC Date 2/27/17 | Checked by SM Date 8/8/17

$P = B(1+GR)^N$

THIS SHEET
TRAFFIC PROJECTION TO DESIGN YEAR (2043). GROWTH FACTOR CALCULATED FROM DVRPC PROJECTIONS. NO BUILD ALTERNATIVE

CURRENT VS. 2035 (NO BUILD)

WB

$32,900 = 27,100(1+GR)^{25}$

$GR = .0078$

FROM FIGURE 10 OF DVRPC REPORT

EB

$35,500 = 28,600(1+GR)^{25}$

$GR = .0087$

CURRENT VS. 2015 (NO BUILD)

WB

$28,300 = 27,100(1+GR)^{5}$

$GR = .0087$

FROM FIGURE 12 OF DVRPC REPORT

EB

$29,900 = 28,600(1+GR)^{5}$

$GR = .0089$

JACOBS

Subject SR 422/M18 TRAFFIC | Project 41W02502

Sheet No. 2 of 8

Authored by TC Date 2/27/17 | Checked by SM Date 8/8/17

## NO BUILD PROJECTIONS

EXTRAPOLATED NUMBERS FROM CURRENT YEAR IN DVRPC REPORT (2010). ROUNDED TO NEAREST HUNDRED.

### 2023 (OPENING YEAR)

WB

$$x = 27{,}100\,(1+.0078)^{13}$$

$$x = 30{,}100$$

EB

$$x = 28{,}600\,(1+.0087)^{13}$$

$$x = 32{,}000$$

### 2043 (DESIGN YEAR)

WB

$$x = 27{,}100\,(1+.0087)^{33}$$

$$x = 36{,}100$$

EB

$$x = 28{,}600\,(1+.0089)^{33}$$

$$x = 38{,}300$$

JACOBS

Subject SR 0422/MIB TRAFFIC | Project 41W12502

Sheet No. 3 of 8

Authored by TC Date 2/27/17 | Checked by SM Date 8/8/17

## NO BUILD AM/PM PEAK HOUR PROJECTIONS (2035 VS. 2043)

WB

AM: $\frac{1951}{32,900} = \frac{x}{36,100}$ $x = 2174$

PM: $\frac{3461}{32,900} = \frac{x}{36,100}$ $x = 3798$

EB

AM: $\frac{3380}{35,500} = \frac{x}{38,300}$ $x = 3647$

WB: $\frac{2018}{35,500} = \frac{x}{38,300}$ $x = 2177$

SEE FIGURES 10 AND 14 IN DVRPC REPORT

JACOBS

Subject SR 0422 / MIB TRAFFIC | Project 41WD2502

Sheet No. 4 of 8

Authored by JC Date | Checked by SM Date 8/8/17

## NO BUILD AM/PM PEAK HOUR PROJECTIONS (2010 VS. 2023)

WB

AM: $\frac{1651}{27,100} = \frac{x}{30,000}$ $x = 1828$

PM: $\frac{2976}{27,100} = \frac{x}{30,000}$ $x = 3294$

EB

AM: $\frac{2726}{28,600} = \frac{x}{32,000}$ $x = 3050$

PM: $\frac{1672}{28,600} = \frac{x}{32,000}$ $x = 1871$

SEE FIGURE 3 IN DVRPC REPORT

## RAMP A TRAFFIC PROJECTIONS

- DETERMINE GROWTH RATE FROM RAMP D DATA IN DVRPC REPORT. RAMP A IS OUTSIDE OF DVRPC STUDY LIMITS.

NO BUILD – CURRENT VS. 2035 – FIGURE 10

$$P = B(1+GR)^N$$

$$6100 = 5000(1+GR)^{25}$$

$$GR = .008$$

- CALCULATE PEAK HOUR VS. ADT PERCENTAGE FOR RAMP D

CURRENT

AM: 141/1700 = .083
PM: 132/1700 = .078

2035 NO BUILD

AM: 210/2900 = .072
PM: 210/2900 = .072

- APPLY CALCULATED GROWTH RATE FROM RAMP D CALCS TO PROJECT VOLUMES FOR RAMP A FROM RMS DATA (BASE YEAR 2016). PROJECT TO 2024 TO COMPARE WITH TPD STUDY.

NO BUILD (2024 - TPD STUDY YEAR)

$P = 5747 (1+.008)^8$

$P = 6125$

NO BUILD (2043 - DESIGN YEAR)

$P = 5747 (1+.008)^{27}$

$P = 7,126$

FOR 2023 (NO BUILD)

$P = 5747 (1+.008)^7$

$P = 6077$

PEAK HOUR 2023 (NO BUILD)

NO BUILD AM = (.052)(6077) = 316

NO BUILD PM = (.085)(6077) = 517

JACOBS

Subject SR 0422/MIB TRAFFIC | Project 71W02502

Sheet No. 1 of 8

Authored by TC Date 2/27/17 | Checked by SM Date 8/8/17

- CALCULATE PEAK HOUR VOLUMES FOR RAMP A USING TPD PEAK HOUR PROJECTIONS AND 2024 RAMP A VOLUME PROJECTED FROM RMS DATA.

  NO BUILD AM = (317+151) / 6125 = .076
  NO BUILD PM = (522+428) / 6125 = .155

- USING CALCULATED PERCENTAGES, PROJECT DESIGN YEAR PEAK HOUR VOLUMES

  NO BUILD AM = (.076)(7126) = 542
  NO BUILD PM = (.155)(7126) = 105

---

THE NUMBERS ABOVE ASSUME THE LOOP RAMP FROM NB EVERGREEN TO WB SR 0422 IS NOT CONSTRUCTED.

JACOBS

Subject SR 0422 / MIB Project 4IW02502
TRAFFIC Sheet No. 8 of 8
Authored by TC Date 2/27/17 Checked by SM Date 8/8/17

- CALCULATE PEAK HOUR VOLUMES FOR RAMP A USING TPD PEAK HOUR PROJECTIONS AND 2024 RAMP A PROJECTED FROM RMS DATA.

NO BUILD AM = 317/6125 = .052
NO BUILD PM = 522/6125 = .085

- USING CALCULATED PERCENTAGES, PROJECT DESIGN YEAR PEAK HOUR VOLUMES

NO BUILD AM = (.052)(7126) = 371
NO BUILD PM = (.085)(7126) = 606

---

THE NUMBERS ABOVE ASSUME THE LOOP RAMP FROM NB EVERGREEN TO WB SR 0422 IS CONSTRUCTED.

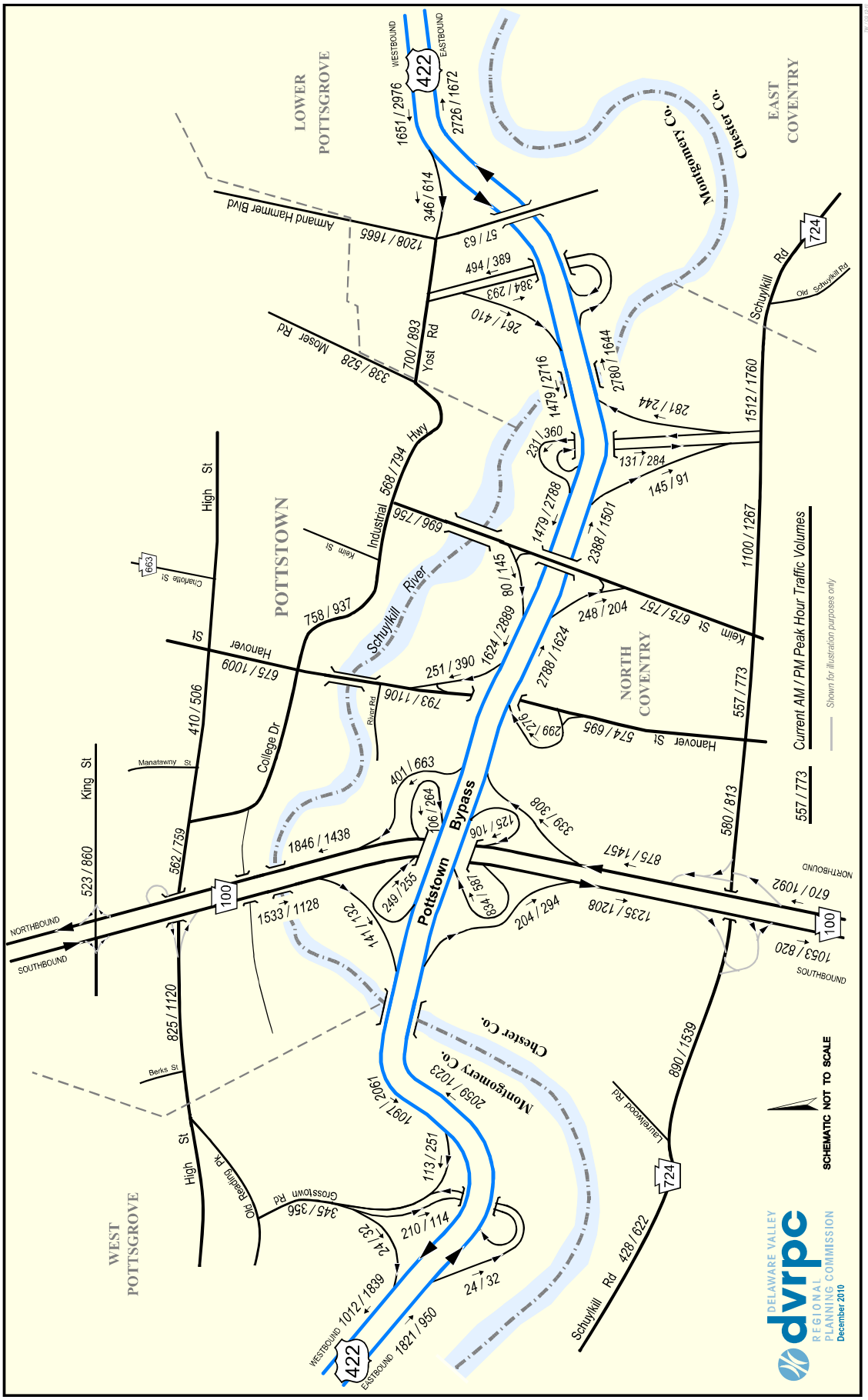



**Figure 3. Current AM/PM Peak Hour Traffic Volumes**

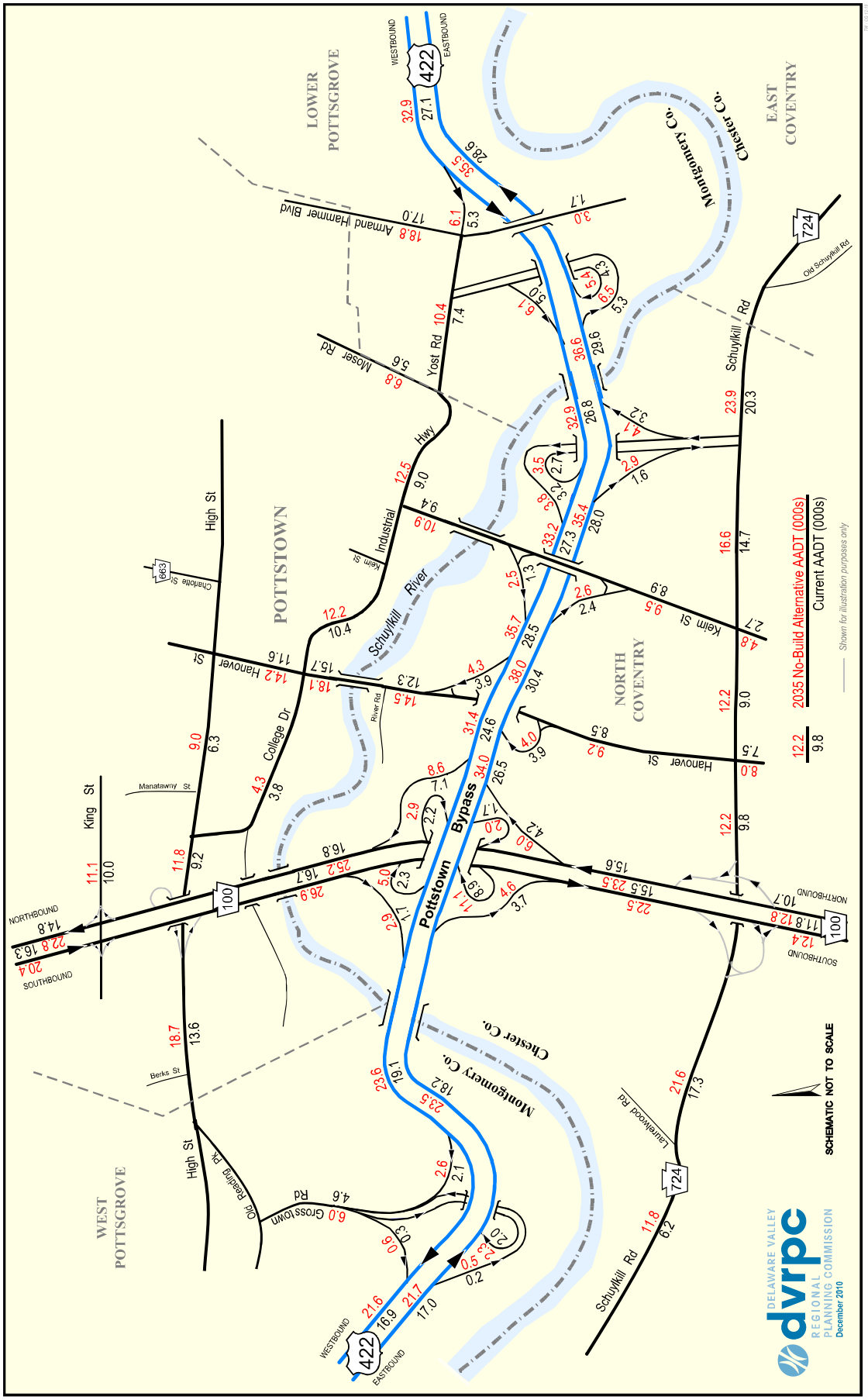



**Figure 10. Current and 2035 No-Build Alternative Average Daily Traffic Volumes**

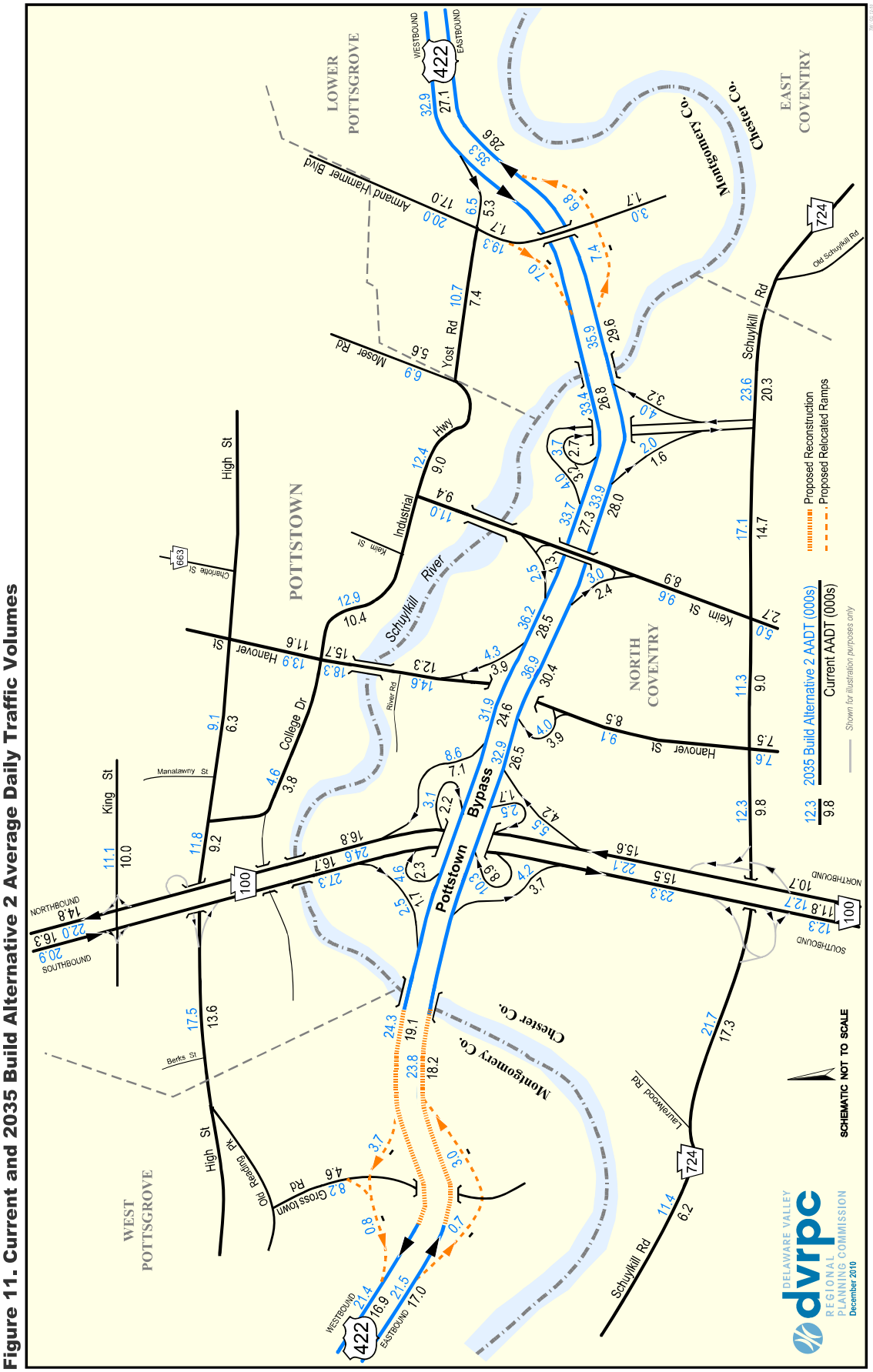



**Figure 11. Current and 2035 Build Alternative 2 Average Daily Traffic Volumes**

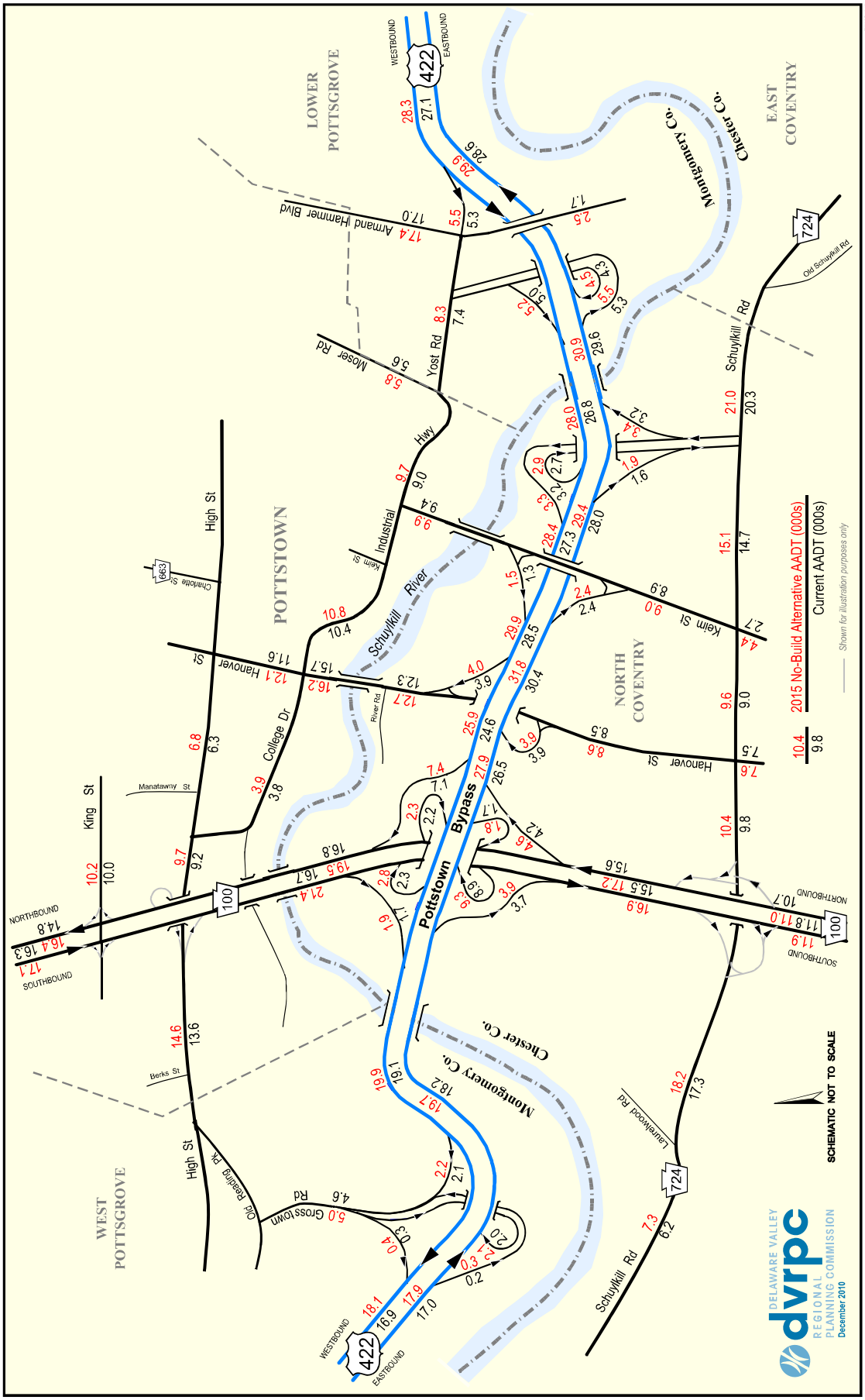



**Figure 12. Current and 2015 No-Build Alternative Average Daily Traffic Volumes**

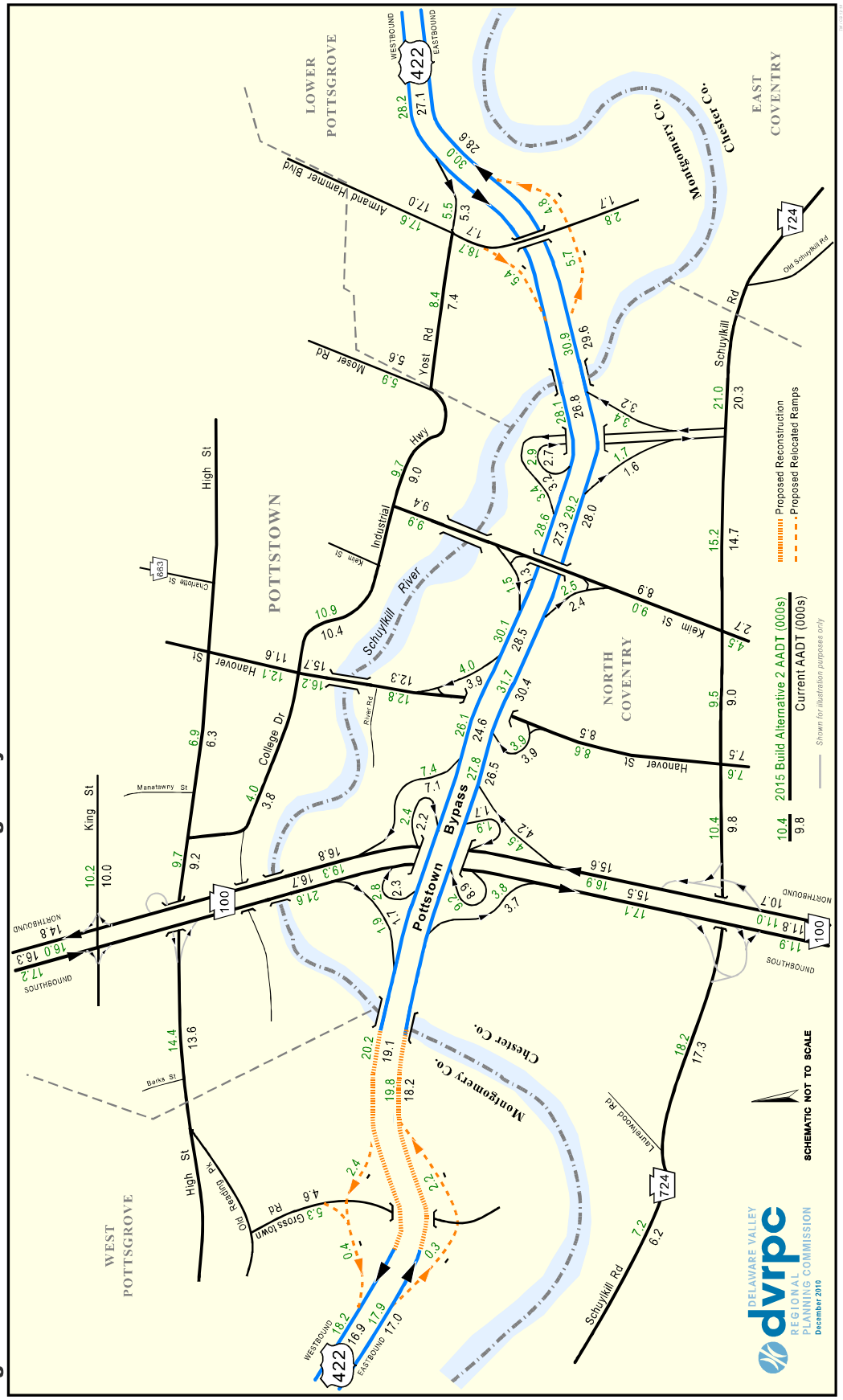
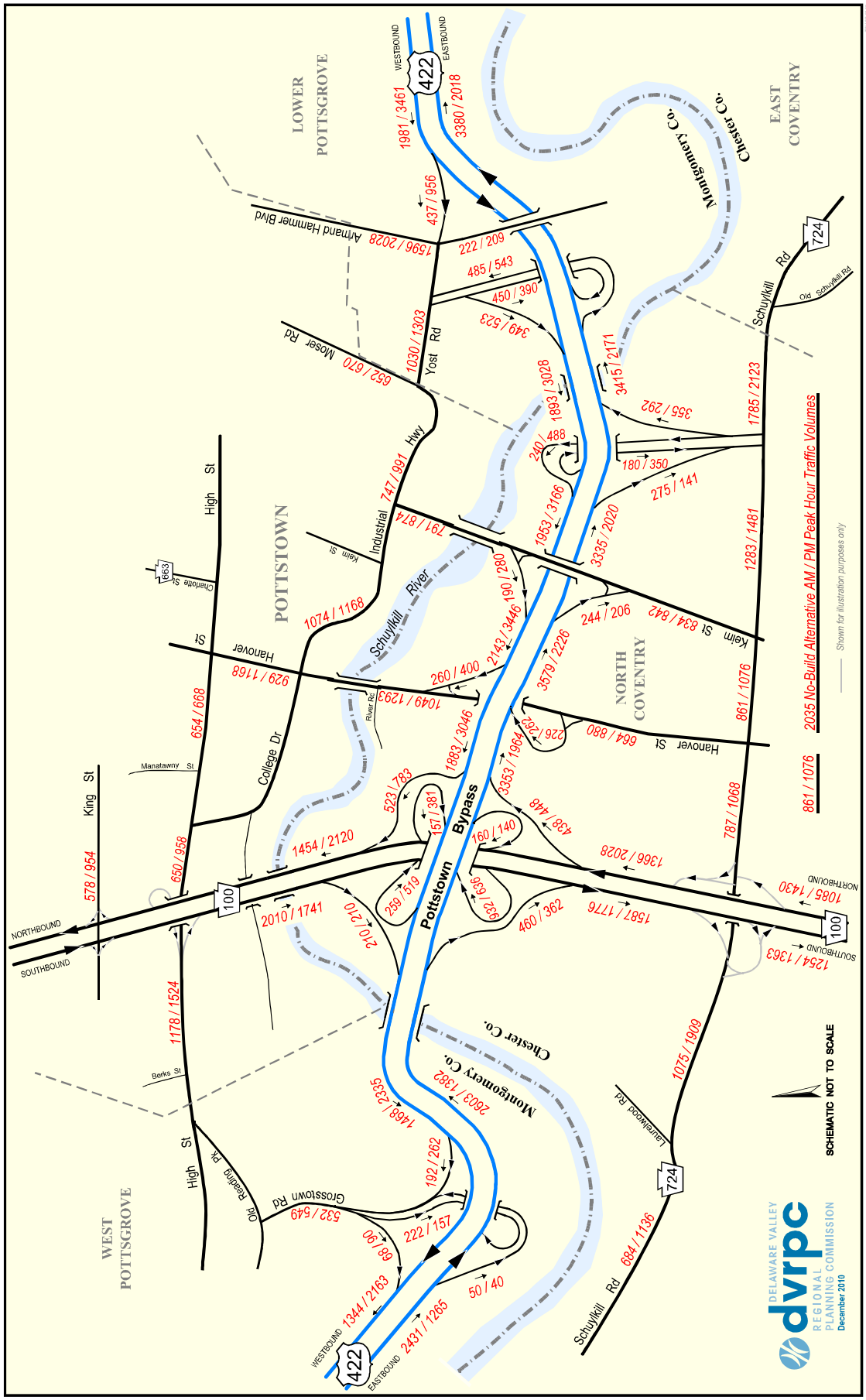
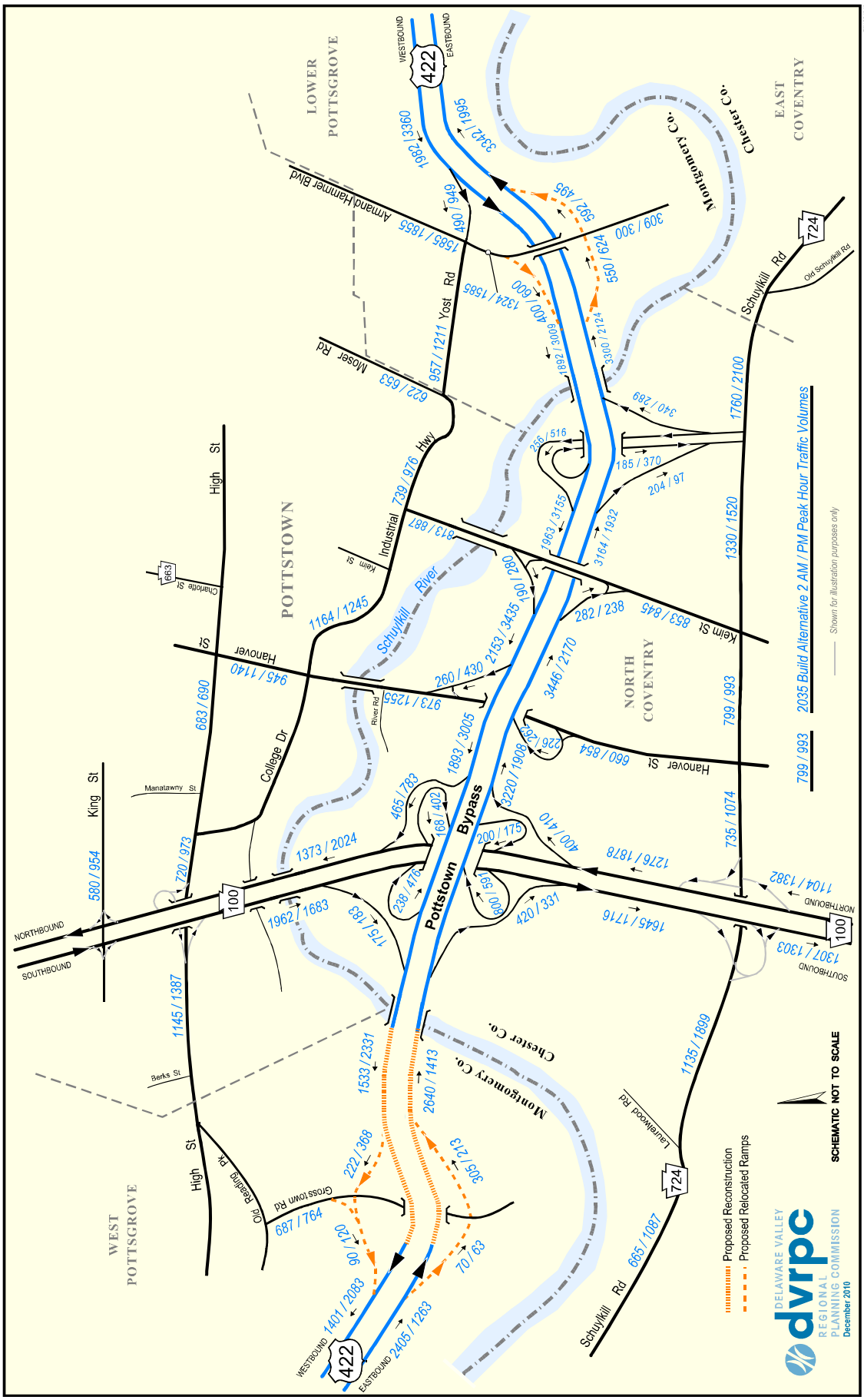



**Figure 13. Current and 2015 Build Alternative 2 Average Daily Traffic Volumes**


Figure 14. 2035 No-Build Alternative AM/PM Peak Hour Traffic Volumes
LOWER POTTSGROVE
EAST COVENTRY
POTTSTOWN
NORTH COVENTRY
WEST POTTSGROVE
Montgomery Co.
Chester Co.
Schuylkill River
Pottstown Bypass
WESTBOUND
EASTBOUND
NORTHBOUND
SOUTHBOUND
Armand Hammer Blvd
Yost Rd
Moser Rd
Industrial Hwy
High St
King St
College Dr
Manatawny St
Hanover St
Keim St
Schuylkill Rd
Old Schuylkill Rd
Laurelwood Rd
Grosstown Rd
Old Reading Pk
Berks St
River Rd
Chantolle St
1981 / 3461
3380 / 2018
437 / 956
1596 / 2028
222 / 209
485 / 543
450 / 390
349 / 523
1030 / 1303
652 / 670
1893 / 3028
3415 / 2171
355 / 292
1785 / 2123
240 / 488
180 / 350
275 / 141
1953 / 3166
3335 / 2020
1283 / 1481
747 / 991
791 / 874
1074 / 1168
190 / 280
2143 / 3446
244 / 206
834 / 842
861 / 1076
929 / 1168
260 / 400
1049 / 1293
3579 / 2226
654 / 668
1883 / 3046
226 / 282
664 / 880
861 / 1076
2035 No-Build Alternative AM / PM Peak Hour Traffic Volumes
Shown for illustration purposes only
3353 / 1964
523 / 783
157 / 381
438 / 448
160 / 140
1366 / 2028
787 / 1068
1085 / 1430
650 / 958
1454 / 2120
578 / 954
2010 / 1741
210 / 210
259 / 519
632 / 636
460 / 362
1587 / 1776
1254 / 1363
1178 / 1524
1075 / 1909
SCHEMATIC NOT TO SCALE
1468 / 2536
2603 / 1382
192 / 262
532 / 649
68 / 90
222 / 157
1344 / 2163
2431 / 1265
50 / 40
684 / 1136
DELAWARE VALLEY
dvrpc
REGIONAL
PLANNING COMMISSION
December 2010


Figure 15. 2035 Build Alternative2 AM/PM Peak Hour Traffic Volumes
POTTSTOWN
LOWER POTTSGROVE
WEST POTTSGROVE
NORTH COVENTRY
EAST COVENTRY
Montgomery Co.
Chester Co.
Schuylkill River
Pottstown Bypass
WESTBOUND
EASTBOUND
NORTHBOUND
SOUTHBOUND
422
100
724
663
Armand Hammer Blvd
Yost Rd
Moser Rd
Industrial Hwy
High St
King St
Hanover St
College Dr
Manatawny St
Keim St
Keim St
Schuylkill Rd
Old Schuylkill Rd
Laurelwood Rd
Old Reading Pk
Grosstown Rd
Berks St
River Rd
Charlotte St
2035 Build Alternative 2 AM / PM Peak Hour Traffic Volumes
Shown for illustration purposes only
Proposed Reconstruction
Proposed Relocated Ramps
SCHEMATIC NOT TO SCALE
DELAWARE VALLEY
dvrpc
REGIONAL PLANNING COMMISSION
December 2010

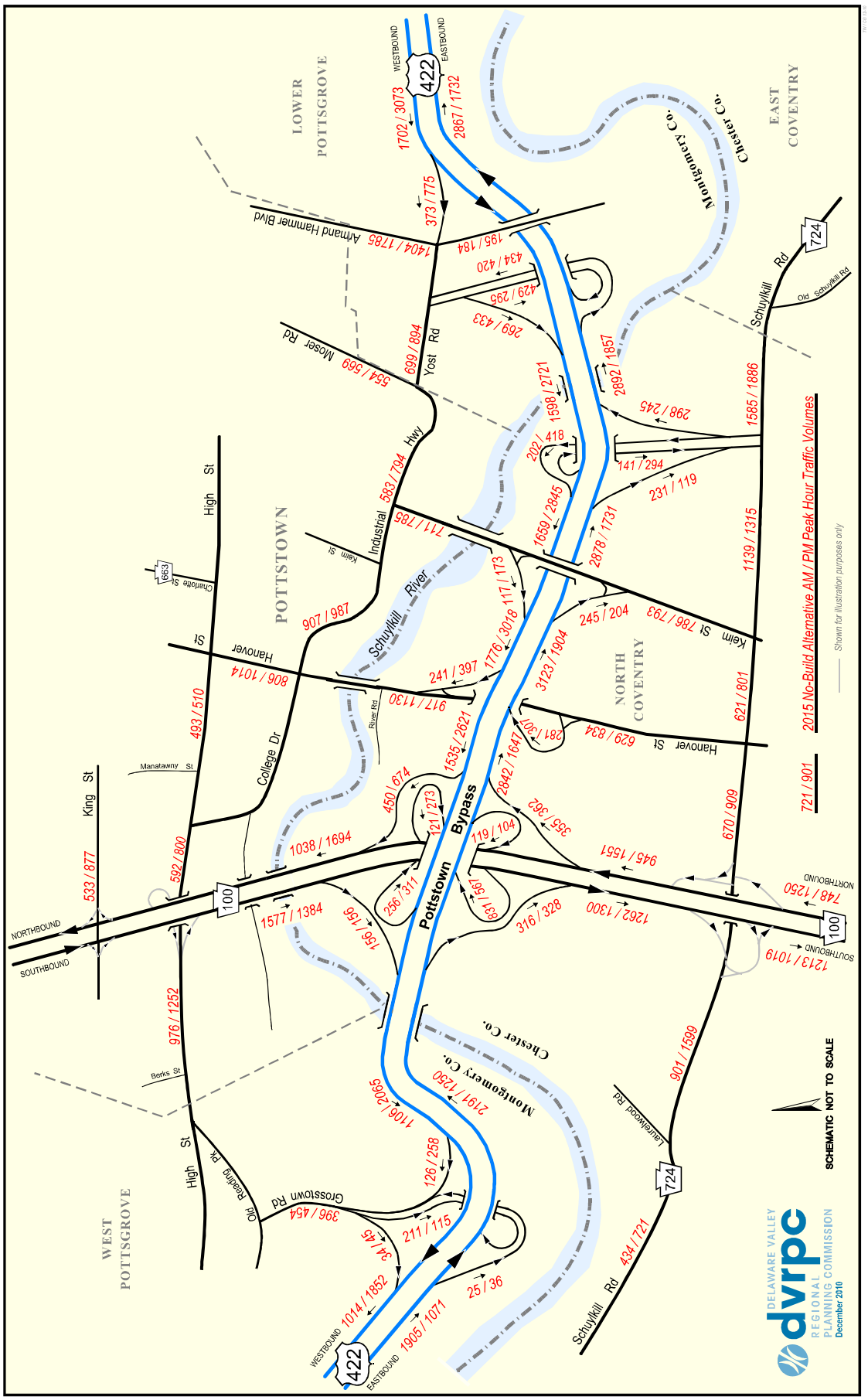



**Figure 16. 2015 No-Build Alternative AM/PM Peak Hour Traffic Volumes**

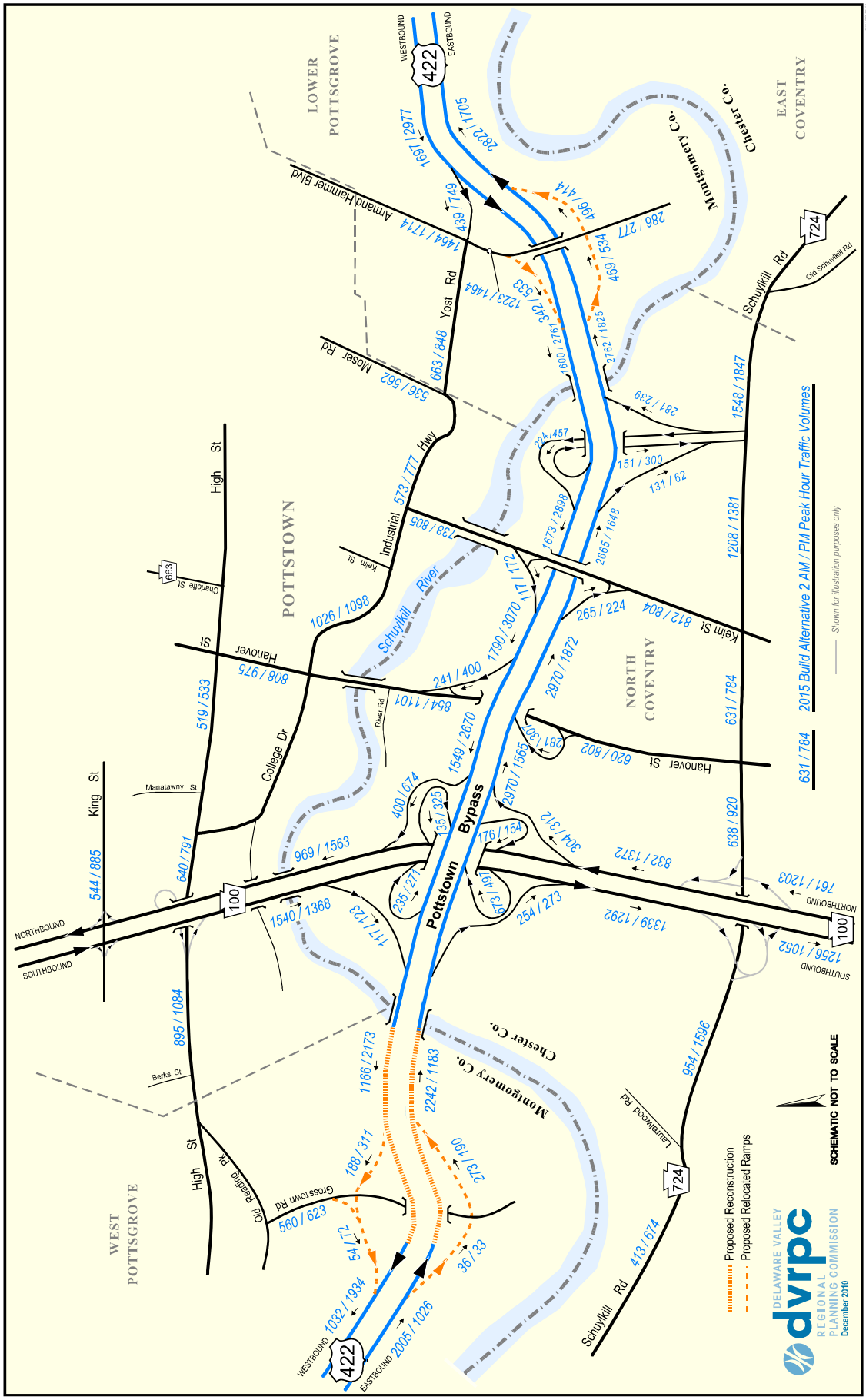



**Figure 17. 2015 Build Alternative 2 AM/PM Peak Hour Traffic Volumes**

RMSRM466 ROADWAY MANAGEMENT INFORMATION SYSTEM 03/01/2017 13:26:22

LTERM: MWILECZ CURRENT TRAFFIC COUNT DATA (DIRECTIONAL)

COUNTY...: 46 MONTGOMERY | | COUNT - KEY.: 46/0422/0061/0000

STATE ROUTE: 0422 | BASE YR: 2015 | - DATE.....: 09/15/2015

SEGMENT....: 0081 |_____| - TYPE.....: AXLE VOL

OFFSET.....: 0000 | - REF. NO...: 2015269

FT: 2602 MI: 0.493

| | BASE YEAR | CURRENT ESTIMATE | % OF TOTAL |
|---|---|---|---|
| TOTAL VEHICLES (ADT): | 24139 | 24168 | ------ |
| TOTAL TRUCKS (ADTT).: | 2897 | 2900 | ------ |
| 3 AXLE W/TRL.....: | 145 | 145 | 5.0 |
| 3 AXLE-MULTI AXLTRL: | 261 | 261 | 9.0 |
| 6 AXLE-SINGLE TRL..: | 9 | 9 | 0.3 |
| 5 AXLE-MULTI TRL...: | 0 | 0 | 0.0 |
| 6 AXLE-MULTI TRL...: | 0 | 0 | 0.0 |
| 7 AXLE-MULTI TRL...: | 0 | 0 | 0.0 |
| WEEKDAY TRUCKS.....: | 3708 | 3712 | |
| 18K ESAL - RIGID....: | 1804 | 1805 | |
| - FLEXIBLE.: | 1365 | 1366 | |

DIRECTION.....: WEST

DURATION (HOURS)..: 24

PERCENT TRUCKS....: 12

TRAF PATTERN GROUP: 03

DAILY - TOTAL VMT.: 11914

- TRUCK VMT.: 1429

----DESIGN HR VOL FACTORS-----

K: 8 D: 64 T: 5

-----TRAFFIC COUNT LIMITS-----

| | CO | -SR- | SEG. | OFF. |
|---|---|---|---|---|
| FROM: | 46 | 0422 | 0041 | 0000 |
| TO..: | 46 | 0422 | 0081 | 2602 |

--------PARALLEL LIMITS-------

| | | | | |
|---|---|---|---|---|
| FROM: | 46 | 0422 | 0040 | 0000 |
| TO..: | 46 | 0422 | 0090 | 0245 |

ACTION: I (A B E F G H I J L Q R S V W X Y)

MESSAGES: PRESS PF10 TO DISPLAY PREVIOUS CLASSES

RMSRM466 ROADWAY MANAGEMENT INFORMATION SYSTEM 03/01/2017 13:24:34

LTERM: MWILECZ CURRENT TRAFFIC COUNT DATA (DIRECTIONAL)

COUNTY...: 46 MONTGOMERY | | COUNT - KEY.: 46/0422/0060/0000

STATE ROUTE: 0422 | BASE YR: 2015 | - DATE.....: 09/15/2015

SEGMENT....: 0080 |_____| - TYPE.....: AXLE VOL

OFFSET.....: 0000 | - REF. NO...: 2015269

FT: 3046 MI: 0.577

| | BASE YEAR | CURRENT ESTIMATE | % OF TOTAL |
|---|---|---|---|
| TOTAL VEHICLES (ADT): | 22689 | 22716 | ------ |
| TOTAL TRUCKS (ADTT).: | 1588 | 1590 | ------ |
| MOTORCYCLE.....: | 204 | 204 | 0.9 |
| CAR.....: | 17947 | 17968 | 79.0 |
| PICKUP/VAN.....: | 2950 | 2954 | 13.0 |
| BUS.....: | 143 | 143 | 9.0 |
| 2 AXLE-SIX TIRE....: | 538 | 539 | 35.0 |
| 3 AXLE-SINGLE UNIT.: | 111 | 111 | 7.0 |
| 4 AXLE-SINGLE-UNIT.: | 222 | 222 | 14.0 |
| WEEKDAY TRUCKS.....: | 2033 | 2035 | |
| 18K ESAL - RIGID....: | 2634 | 2636 | |
| - FLEXIBLE.: | 1760 | 1761 | |

DIRECTION.....: EAST

DURATION (HOURS)..: 24

PERCENT TRUCKS....: 07

TRAF PATTERN GROUP: 03

DAILY - TOTAL VMT.: 13107

- TRUCK VMT.: 917

----DESIGN HR VOL FACTORS-----

K: 8 D: 64 T: 5

-----TRAFFIC COUNT LIMITS-----

| | CO | -SR- | SEG. | OFF. |
|---|---|---|---|---|
| FROM: | 46 | 0422 | 0040 | 0000 |
| TO..: | 46 | 0422 | 0090 | 0245 |

--------PARALLEL LIMITS-------

| | | | | |
|---|---|---|---|---|
| FROM: | 46 | 0422 | 0041 | 0000 |
| TO..: | 46 | 0422 | 0081 | 2602 |

ACTION: I (A B E F G H I J L Q R S V W X Y)

MESSAGES: PRESS PF11 TO DISPLAY MORE TRUCK CLASSES

RMSRM466 ROADWAY MANAGEMENT INFORMATION SYSTEM 03/01/2017 13:24:36

LTERM: MWILECZ CURRENT TRAFFIC COUNT DATA (DIRECTIONAL)

COUNTY...: 46 MONTGOMERY | | COUNT - KEY.: 46/0422/0060/0000

STATE ROUTE: 0422 | BASE YR: 2015 | - DATE.....: 09/15/2015

SEGMENT....: 0080 |_____| - TYPE.....: AXLE VOL

OFFSET.....: 0000 | - REF. NO...: 2015269

FT: 3046 MI: 0.577

| | BASE YEAR | CURRENT ESTIMATE | % OF TOTAL |
|---|---|---|---|
| TOTAL VEHICLES (ADT): | 22689 | 22716 | ------ |
| TOTAL TRUCKS (ADTT).: | 1588 | 1590 | ------ |
| 3 AXLE W/TRL.....: | 127 | 127 | 8.0 |
| 3 AXLE-MULTI AXLTRL: | 429 | 430 | 27.0 |
| 6 AXLE-SINGLE TRL..: | 13 | 13 | 0.8 |
| 5 AXLE-MULTI TRL...: | 5 | 5 | 0.3 |
| 6 AXLE-MULTI TRL...: | 0 | 0 | 0.0 |
| 7 AXLE-MULTI TRL...: | 0 | 0 | 0.0 |
| WEEKDAY TRUCKS.....: | 2033 | 2035 | |
| 18K ESAL - RIGID....: | 2634 | 2636 | |
| - FLEXIBLE.: | 1760 | 1761 | |

DIRECTION.....: EAST

DURATION (HOURS)..: 24

PERCENT TRUCKS....: 07

TRAF PATTERN GROUP: 03

DAILY - TOTAL VMT.: 13107

- TRUCK VMT.: 917

----DESIGN HR VOL FACTORS-----

K: 8 D: 64 T: 5

-----TRAFFIC COUNT LIMITS-----

| | CO | -SR- | SEG. | OFF. |
|---|---|---|---|---|
| FROM: | 46 | 0422 | 0040 | 0000 |
| TO..: | 46 | 0422 | 0090 | 0245 |

--------PARALLEL LIMITS-------

| | | | | |
|---|---|---|---|---|
| FROM: | 46 | 0422 | 0041 | 0000 |
| TO..: | 46 | 0422 | 0081 | 2602 |

ACTION: I (A B E F G H I J L Q R S V W X Y)

MESSAGES: PRESS PF10 TO DISPLAY PREVIOUS CLASSES

| SITE NO: 13813 | |
|---|---|
| County | MONTGOMERY (46) |
| Route | 0422 |
| Segment | 0061 |
| Dir | W |
| Current Avg Daily Traffic | 24139 |
| Current Avg Daily Truck Volume | 2897 |
| K Factor | 8 |
| D Factor | 64 |
| T Factor | 5 |
| Truck Percent | 12 |
| Base Traffic Year | 2015 |
| Traffic Pattern Group | URBAN - OTHER PRINCIPAL ARTERIALS |



| SITE NO: 13813 | |
|---|---|
| County | MONTGOMERY (46) |
| Route | 0422 |
| Segment | 0060 |
| Dir | E |
| Current Avg Daily Traffic | 22689 |
| Current Avg Daily Truck Volume | 1588 |
| K Factor | 8 |
| D Factor | 64 |
| T Factor | 5 |
| Truck Percent | 7 |
| Base Traffic Year | 2015 |
| Traffic Pattern Group | URBAN - OTHER PRINCIPAL ARTERIALS |



RMSRM466 ROADWAY MANAGEMENT INFORMATION SYSTEM 03/01/2017 14:08:15

LTERM: MWILECZ CURRENT TRAFFIC COUNT DATA (DIRECTIONAL)

COUNTY...: 46 MONTGOMERY | | COUNT - KEY.: 46/8013/0250/0444

STATE ROUTE: 8013 | BASE YR: 2016 | - DATE.....: 08/09/2016

SEGMENT....: 0250 |_____| - TYPE.....: AXLE VOL

OFFSET.....: 0000 - REF. NO...: 2016235

FT: 906 MI: 0.172

| | BASE YEAR | CURRENT ESTIMATE | % OF TOTAL |
|---|---|---|---|
| TOTAL VEHICLES (ADT): | 5747 | 5747 | ------ |
| TOTAL TRUCKS (ADTT).: | 402 | 402 | ------ |
| MOTORCYCLE.....: | 149 | 149 | 2.6 |
| CAR.....: | 4276 | 4276 | 74.0 |
| PICKUP/VAN.....: | 920 | 920 | 16.0 |
| BUS.....: | 20 | 20 | 5.0 |
| 2 AXLE-SIX TIRE....: | 154 | 154 | 38.0 |
| 3 AXLE-SINGLE UNIT.: | 72 | 72 | 18.0 |
| 4 AXLE-SINGLE-UNIT.: | 20 | 20 | 5.0 |
| WEEKDAY TRUCKS.....: | 515 | 515 | EST TRK |
| 18K ESAL - RIGID....: | 423 | 423 | VOL |
| - FLEXIBLE.: | 302 | 302 | |

DIRECTION.....: WEST

DURATION (HOURS)..: 24

PERCENT TRUCKS....: 07

TRAF PATTERN GROUP: 03

DAILY - TOTAL VMT.: 988

- TRUCK VMT.: 69

----DESIGN HR VOL FACTORS-----

K: 10 D: 55 T: 4

-----TRAFFIC COUNT LIMITS-----

| | CO | -SR- | SEG. | OFF. |
|---|---|---|---|---|
| FROM: | 46 | 8013 | 0250 | 0000 |
| TO..: | 46 | 8013 | 0500 | 0000 |

ACTION: I (A B E F G H I J L Q R S V W X Y)

MESSAGES: PRESS PF11 TO DISPLAY MORE TRUCK CLASSES

RMSRM466 ROADWAY MANAGEMENT INFORMATION SYSTEM 03/01/2017 14:08:21
LTERM: MWILECZ CURRENT TRAFFIC COUNT DATA (DIRECTIONAL)

COUNTY...: 46 MONTGOMERY | | COUNT - KEY.: 46/8013/0250/0444
STATE ROUTE: 8013 | BASE YR: 2016 | - DATE.....: 08/09/2016
SEGMENT....: 0250 |_____| - TYPE.....: AXLE VOL
OFFSET.....: 0000 | - REF. NO...: 2016235
FT: 906 MI: 0.172

| | BASE YEAR | CURRENT ESTIMATE | % OF TOTAL |
|---|---|---|---|
| TOTAL VEHICLES (ADT): | 5747 | 5747 | ------ |
| TOTAL TRUCKS (ADTT).: | 402 | 402 | ------ |
| 3 AXLE W/TRL.....: | 64 | 64 | 16.0 |
| 3 AXLE-MULTI AXLTRL: | 56 | 56 | 14.0 |
| 6 AXLE-SINGLE TRL..: | 4 | 4 | 1.0 |
| 5 AXLE-MULTI TRL...: | 8 | 8 | 2.0 |
| 6 AXLE-MULTI TRL...: | 4 | 4 | 1.0 |
| 7 AXLE-MULTI TRL...: | 0 | 0 | 0.0 |
| WEEKDAY TRUCKS.....: | 515 | 515 | EST TRK |
| 18K ESAL - RIGID....: | 423 | 423 | VOL |
| - FLEXIBLE.: | 302 | 302 | |

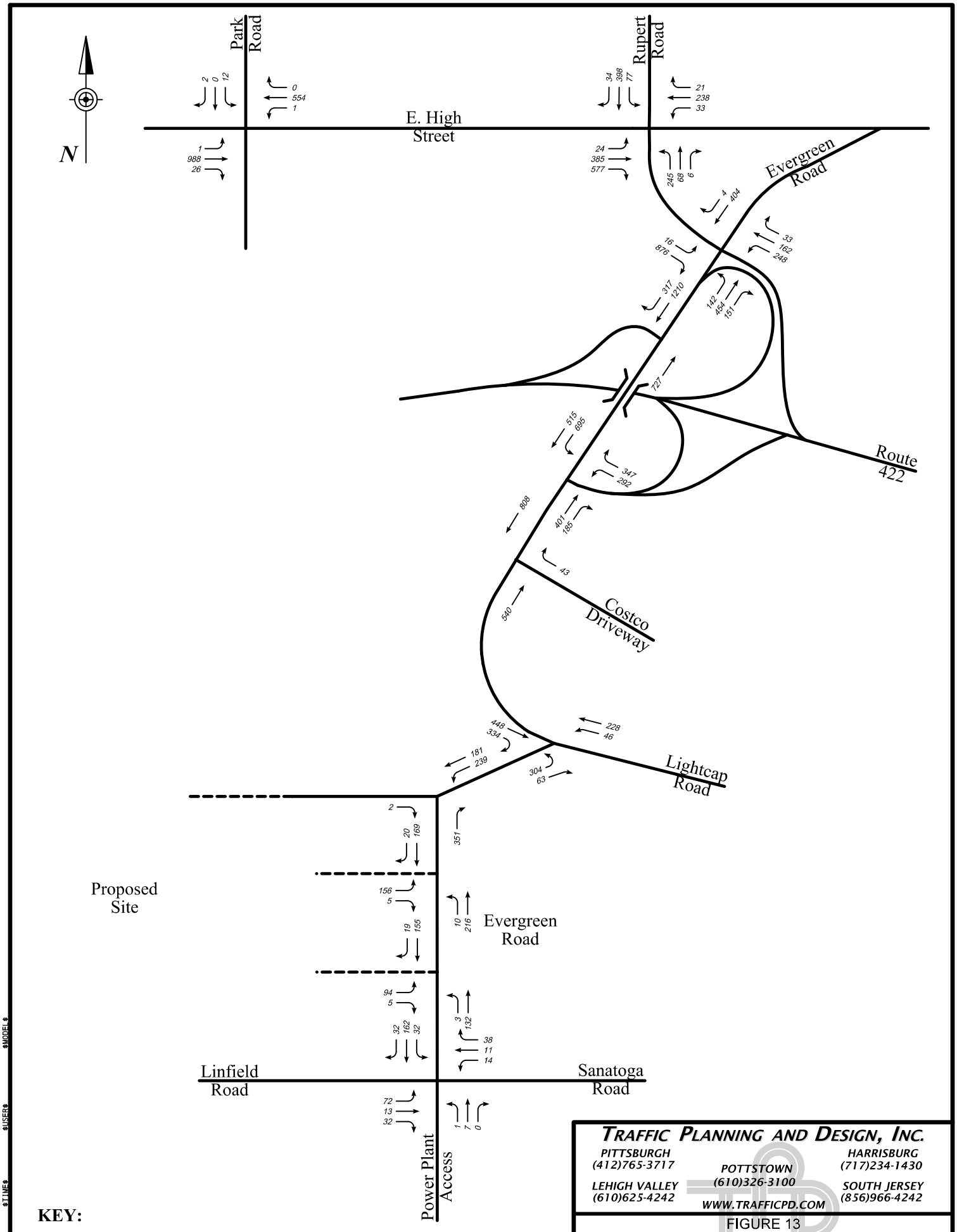
DIRECTION.....: WEST
DURATION (HOURS)..: 24
PERCENT TRUCKS....: 07
TRAF PATTERN GROUP: 03
DAILY - TOTAL VMT.: 988
- TRUCK VMT.: 69

----DESIGN HR VOL FACTORS-----
K: 10 D: 55 T: 4

-----TRAFFIC COUNT LIMITS-----

| | CO | -SR- | SEG. | OFF. |
|---|---|---|---|---|
| FROM: | 46 | 8013 | 0250 | 0000 |
| TO..: | 46 | 8013 | 0500 | 0000 |

ACTION: I (A B E F G H I J L Q R S V W X Y)
MESSAGES: PRESS PF10 TO DISPLAY PREVIOUS CLASSES




**KEY:**

**- - - - - - PROPOSED DRIVEWAY**

**SCHEMATIC DRAWING:NOT TO SCALE**

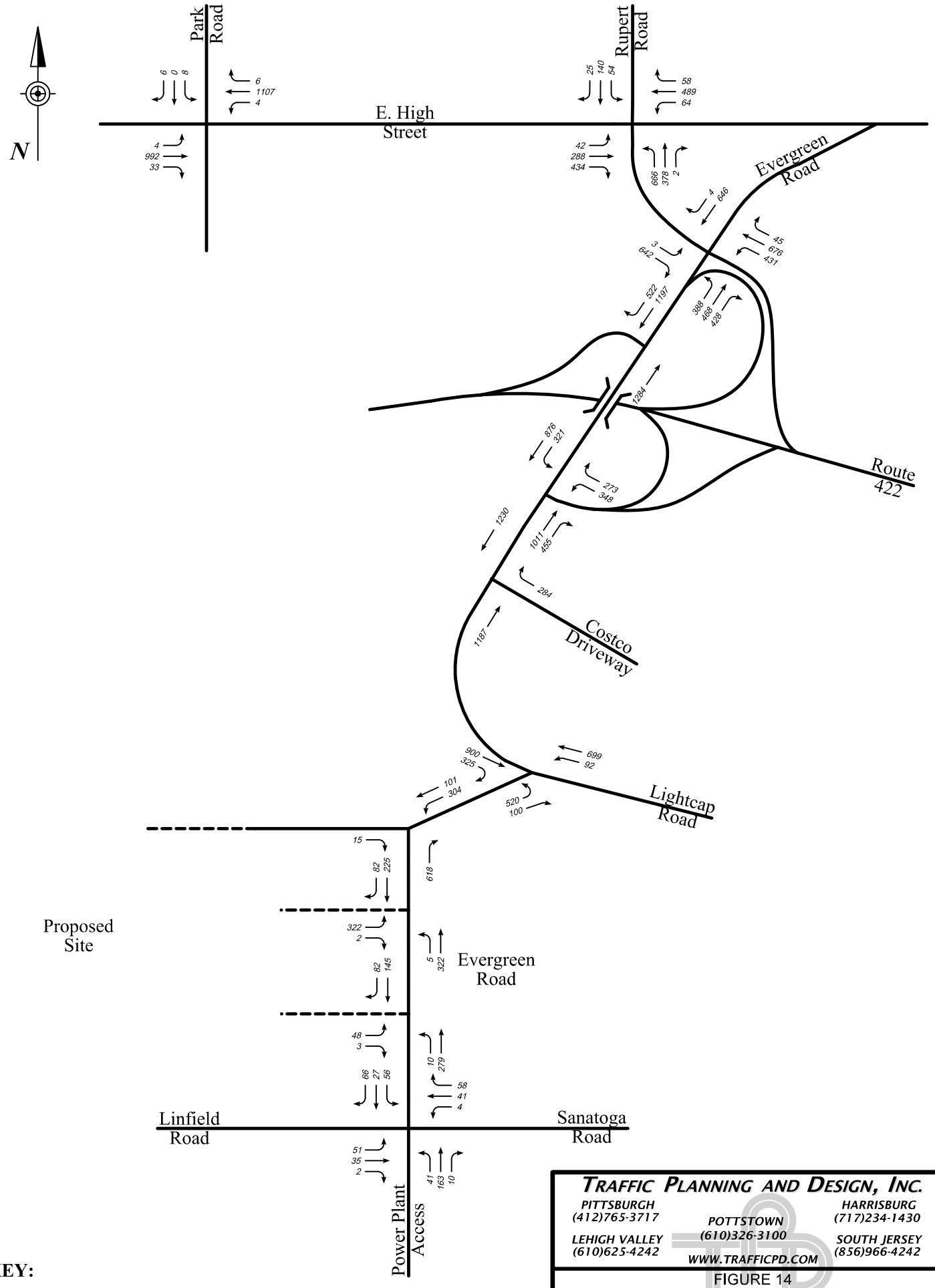

**TRAFFIC PLANNING AND DESIGN, INC.**

PITTSBURGH (412)765-3717
POTTSTOWN (610)326-3100
HARRISBURG (717)234-1430
LEHIGH VALLEY (610)625-4242
SOUTH JERSEY (856)966-4242
WWW.TRAFFICPD.COM


FIGURE 13

2024 PROJECTED CONDITIONS
WEEKDAY AM PEAK HOUR
TRAFFIC VOLUMES

$FILE$ $DATE$ $TIME$ $USER$ $MODEL$




**KEY:**

**- - - - - - PROPOSED DRIVEWAY**

**SCHEMATIC DRAWING:NOT TO SCALE**


**TRAFFIC PLANNING AND DESIGN, INC.**

PITTSBURGH (412)765-3717
POTTSTOWN (610)326-3100
HARRISBURG (717)234-1430
LEHIGH VALLEY (610)625-4242
SOUTH JERSEY (856)966-4242
WWW.TRAFFICPD.COM

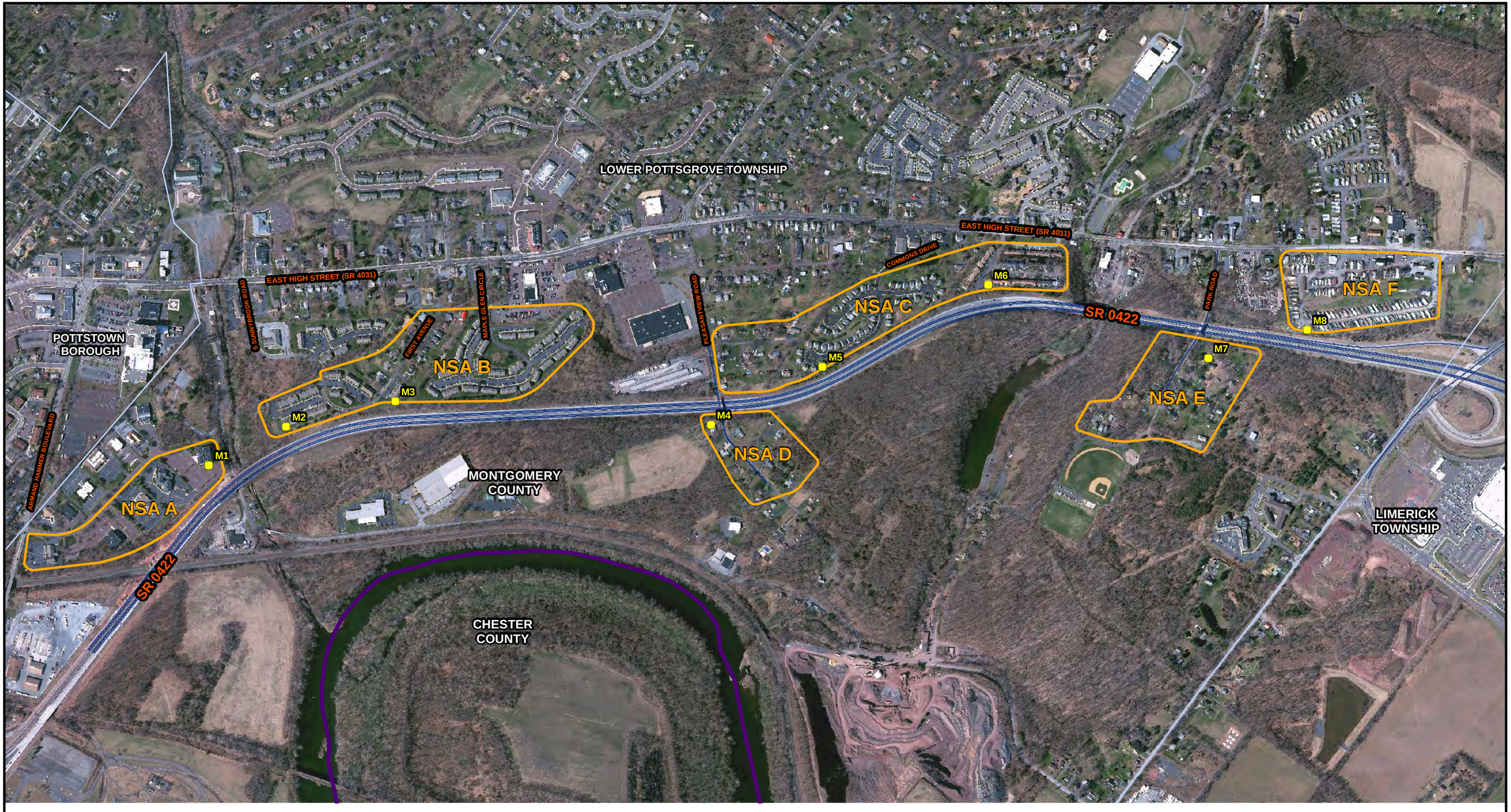

FIGURE 14

2024 PROJECTED CONDITIONS
WEEKDAY PM PEAK HOUR
TRAFFIC VOLUMES

$FILE$ $DATE$ $TIME$ $USER$ $MODEL$

# Appendix B

## Noise Study Areas and Abatement Locations




# NOISE STUDY AREA OVERVIEW

**SR 0422, SECTION M1B**
**SR 0422 POTTSTOWN BYPASS EXPRESS RECONSTRUCTION PROJECT**
**LOWER POTTSGROVE TOWNSHIP, MONTGOMERY COUNTY**

1,000 500 0 1,000 Feet

**Legend:**

- Noise Study Area (NSA)
- Noise Monitoring Site
- Proposed Roadway Alignment
- County Border
- Municipality Border

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# FIGURE 1 - NOISE STUDY AREA A

**SR 0422, SECTION M1B**
**SR 0422 POTTSTOWN BYPASS EXPRESS RECONSTRUCTION PROJECT**
**LOWER POTTSGROVE TOWNSHIP, MONTGOMERY COUNTY**

250 125 0 250 Feet

N

**Legend:**

- Proposed Roadway Alignment
- County Border
- Municipality Border
- Noise Monitoring Site
- Noise Study Area (NSA)
- Proposed Berm
- Top of Berm
- Berm Elevation (Feet)

**NOISE BARRIER STUDIED**

- Feasible & Not Reasonable
- Feasible & Reasonable
- Change in Noise Barrier Height
- Noise Barrier Height (Feet)

**NOISE IMPACT CONTOUR**

- Activity Categories B & C - 66 dBA
- Activity Category E - 71 dBA

**NOISE RECEPTORS**

- Impacted & Benefited
- Impacted & Not Benefited
- Not Impacted & Benefited
- Not Impacted & Not Benefited

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# FIGURE 2 - NOISE STUDY AREA B

**SR 0422, SECTION M1B**
**SR 0422 POTTSTOWN BYPASS EXPRESS RECONSTRUCTION PROJECT**
**LOWER POTTSGROVE TOWNSHIP, MONTGOMERY COUNTY**

325 162.5 0 325 Feet

N

**Legend:**

- Proposed Roadway Alignment
- County Border
- Municipality Border
- Noise Monitoring Site
- Noise Study Area (NSA)
- Proposed Berm
- Top of Berm
- Berm Elevation (Feet)

**NOISE BARRIER STUDIED**

- Feasible & Not Reasonable
- Feasible & Reasonable
- Change in Noise Barrier Height
- Noise Barrier Height (Feet)

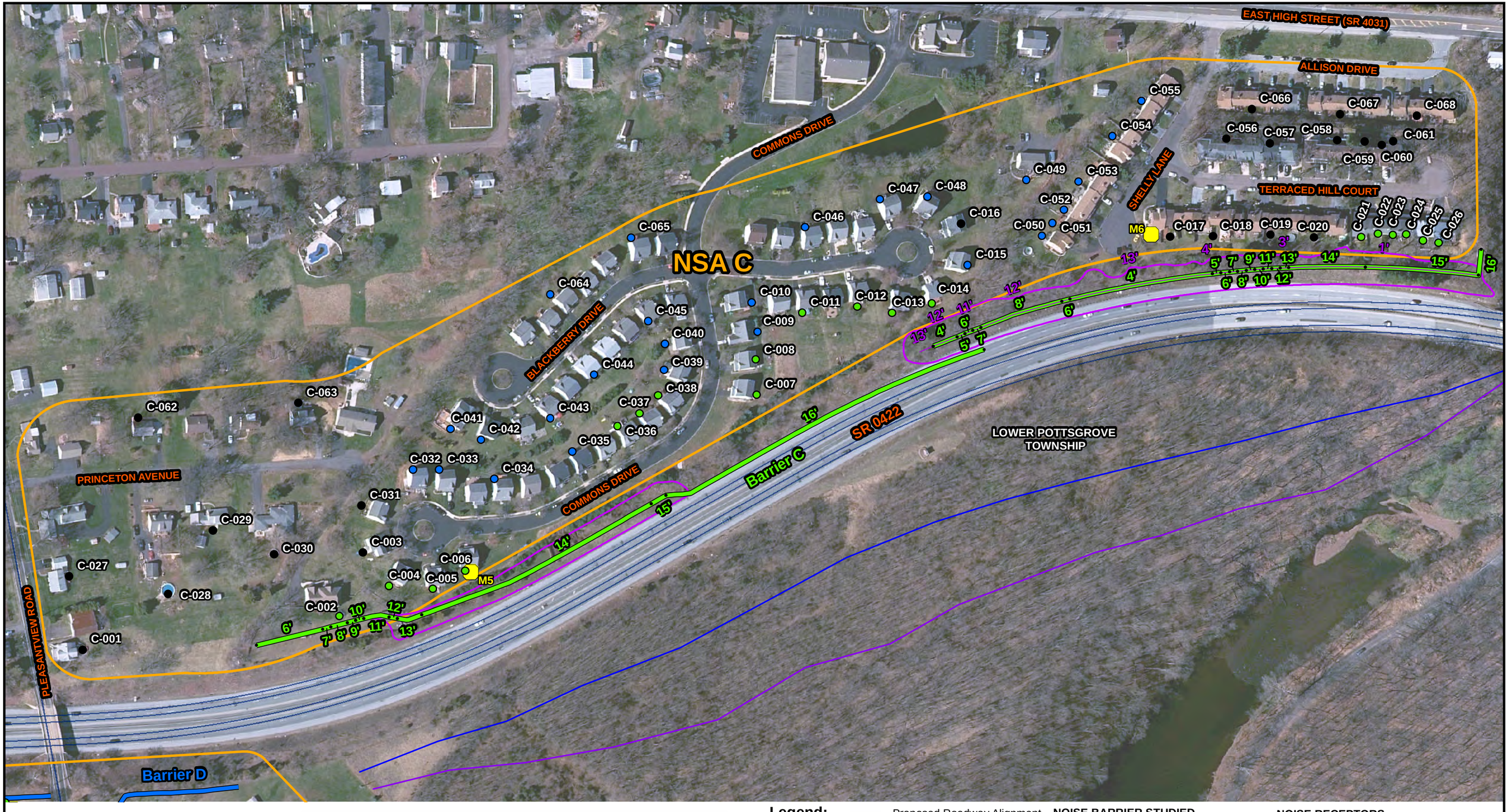
**NOISE IMPACT CONTOUR**

- Activity Categories B & C - 66 dBA
- Activity Category E - 71 dBA

**NOISE RECEPTORS**

- Impacted & Benefited
- Impacted & Not Benefited
- Not Impacted & Benefited
- Not Impacted & Not Benefited

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# FIGURE 3 - NOISE STUDY AREA C

**SR 0422, SECTION M1B**
**SR 0422 POTTSTOWN BYPASS EXPRESS RECONSTRUCTION PROJECT**
**LOWER POTTSGROVE TOWNSHIP, MONTGOMERY COUNTY**

250 125 0 250 Feet

N

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**Legend:**

- Proposed Roadway Alignment
- County Border
- Municipality Border
- Noise Monitoring Site
- Noise Study Area (NSA)
- Proposed Berm
- Top of Berm
- Berm Elevation (Feet)

**NOISE BARRIER STUDIED**

- Feasible & Not Reasonable
- Feasible & Reasonable
- Change in Noise Barrier Height
- Noise Barrier Height (Feet)

**NOISE IMPACT CONTOUR**

- Activity Categories B & C - 66 dBA
- Activity Category E - 71 dBA

**NOISE RECEPTORS**

- Impacted & Benefited
- Impacted & Not Benefited
- Not Impacted & Benefited
- Not Impacted & Not Benefited

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# FIGURE 4 - NOISE STUDY AREA D

**SR 0422, SECTION M1B**
**SR 0422 POTTSTOWN BYPASS EXPRESS RECONSTRUCTION PROJECT**
**LOWER POTTSGROVE TOWNSHIP, MONTGOMERY COUNTY**

250 125 0 250 Feet

N

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**Legend:**

- Proposed Roadway Alignment
- County Border
- Municipality Border
- Noise Monitoring Site
- Noise Study Area (NSA)
- Proposed Berm
- Top of Berm
- Berm Elevation (Feet)

**NOISE BARRIER STUDIED**

- Feasible & Not Reasonable
- Feasible & Reasonable
- Change in Noise Barrier Height
- Noise Barrier Height (Feet)

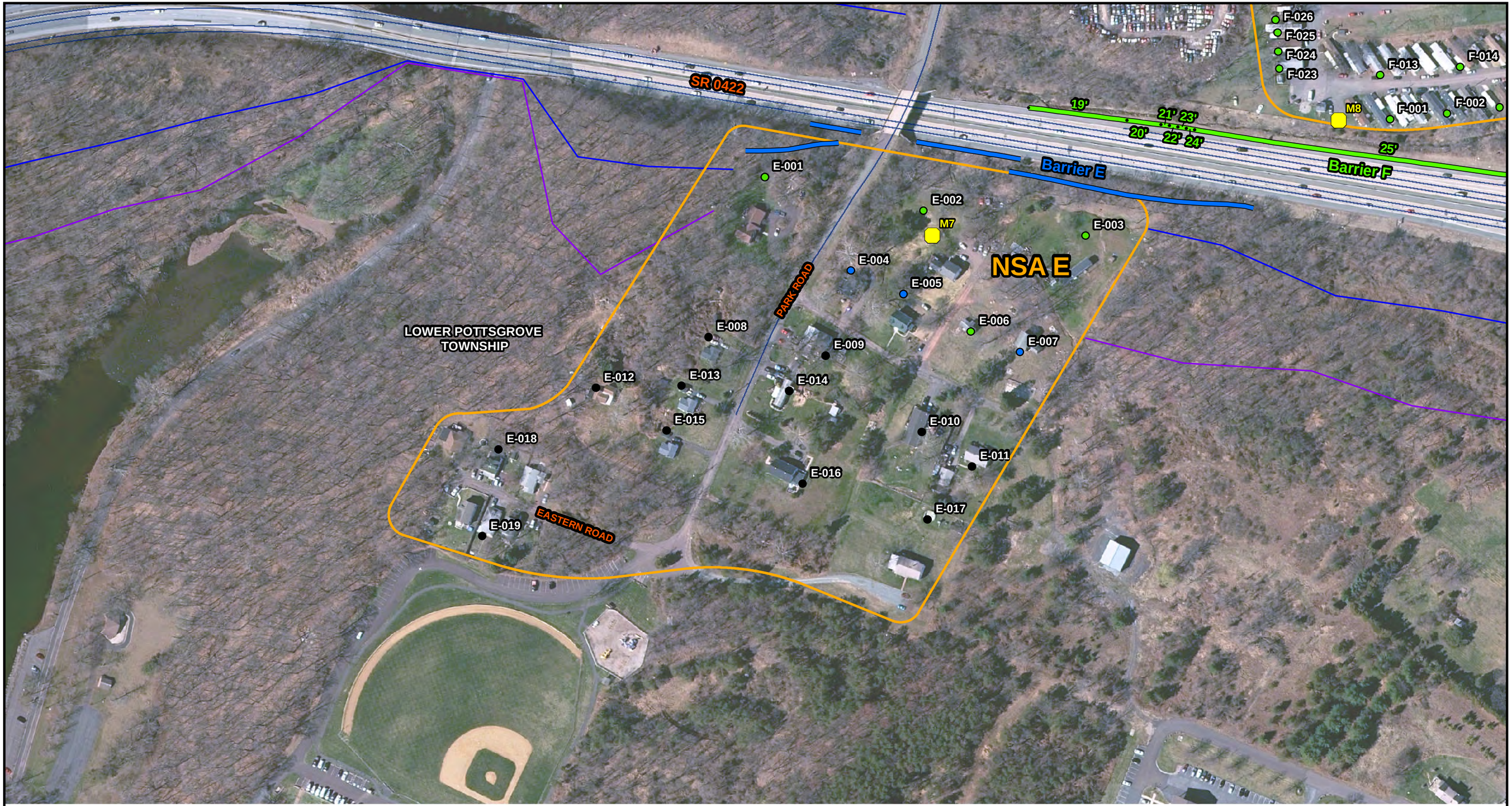
**NOISE IMPACT CONTOUR**

- Activity Categories B & C - 66 dBA
- Activity Category E - 71 dBA

**NOISE RECEPTORS**

- Impacted & Benefited
- Impacted & Not Benefited
- Not Impacted & Benefited
- Not Impacted & Not Benefited

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# FIGURE 5 - NOISE STUDY AREA E

**SR 0422, SECTION M1B**
**SR 0422 POTTSTOWN BYPASS EXPRESS RECONSTRUCTION PROJECT**
**LOWER POTTSGROVE TOWNSHIP, MONTGOMERY COUNTY**

250 125 0 250 Feet

N

**Legend:**

- Proposed Roadway Alignment
- County Border
- Municipality Border
- Noise Monitoring Site
- Noise Study Area (NSA)
- Proposed Berm
- Top of Berm
- Berm Elevation (Feet)

**NOISE BARRIER STUDIED**

- Feasible & Not Reasonable
- Feasible & Reasonable
- Change in Noise Barrier Height
- Noise Barrier Height (Feet)

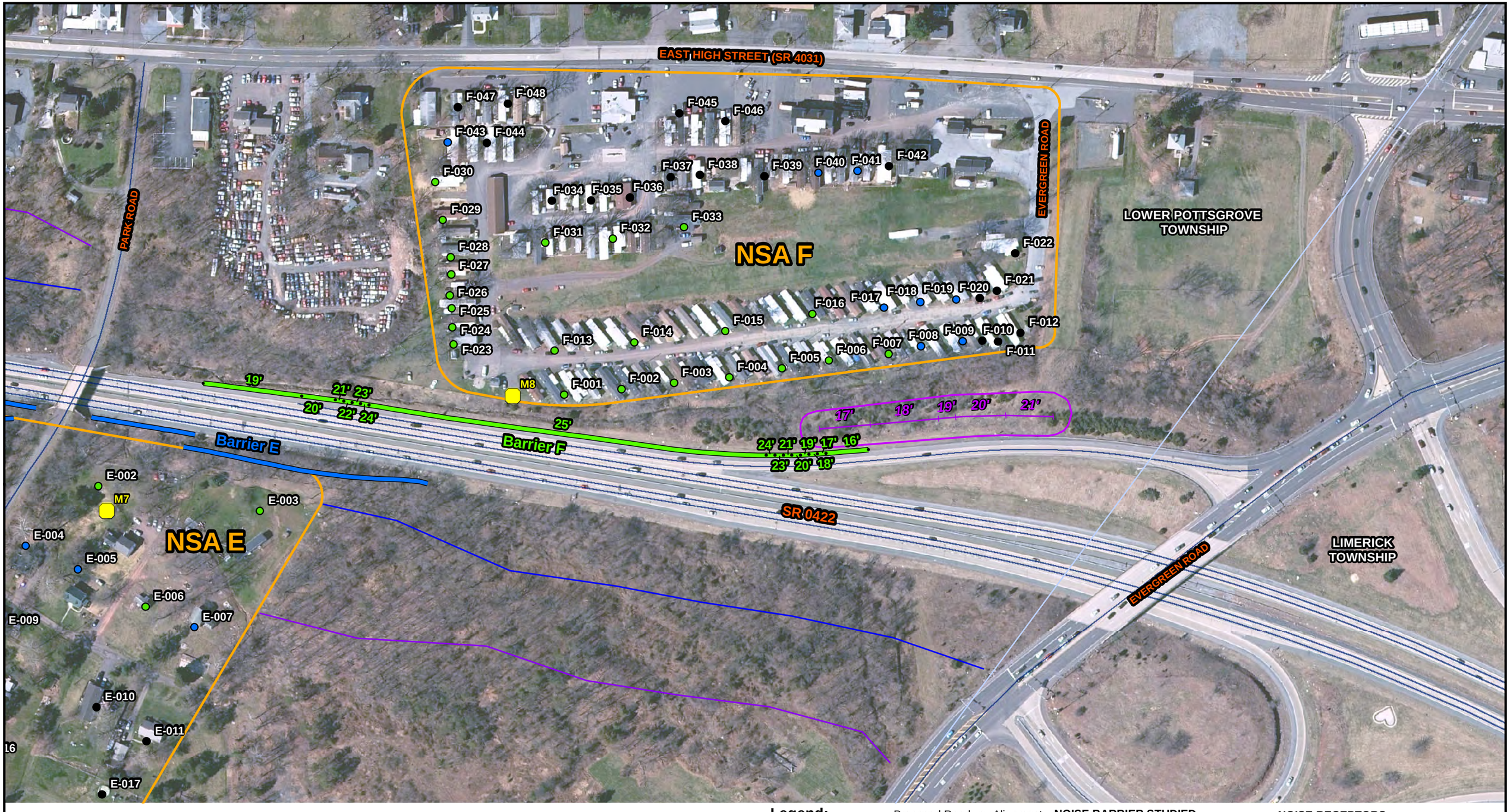
**NOISE IMPACT CONTOUR**

- Activity Categories B & C - 66 dBA
- Activity Category E - 71 dBA

**NOISE RECEPTORS**

- Impacted & Benefited
- Impacted & Not Benefited
- Not Impacted & Benefited
- Not Impacted & Not Benefited

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# FIGURE 6 - NOISE STUDY AREA F

**SR 0422, SECTION M1B**
**SR 0422 POTTSTOWN BYPASS EXPRESS RECONSTRUCTION PROJECT**
**LOWER POTTSGROVE TOWNSHIP, MONTGOMERY COUNTY**

250 125 0 250 Feet

N

**Legend:**

- Proposed Roadway Alignment
- County Border
- Municipality Border
- Noise Monitoring Site
- Noise Study Area (NSA)
- Proposed Berm
- Top of Berm
- Berm Elevation (Feet)

**NOISE BARRIER STUDIED**

- Feasible & Not Reasonable
- Feasible & Reasonable
- Change in Noise Barrier Height
- Noise Barrier Height (Feet)

**NOISE IMPACT CONTOUR**

- Activity Categories B & C - 66 dBA
- Activity Category E - 71 dBA

**NOISE RECEPTORS**

- Impacted & Benefited
- Impacted & Not Benefited
- Not Impacted & Benefited
- Not Impacted & Not Benefited

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# Appendix C

## Laboratory Calibration Certificates of Noise Meters

**Scantek, Inc.**
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP Lab Code: 200625-0

# Calibration Certificate No.35925

| | | | |
|---|---|---|---|
| *Instrument:* | **Acoustical Calibrator** | *Date Calibrated:* **3/28/2016** | *Cal Due:* **03/28/2017** |
| *Model:* | **4231** | *Status:* | **Received** / **Sent** |
| *Manufacturer:* | **Brüel and Kjær** | *In tolerance:* | X / X |
| *Serial number:* | **2085219** | *Out of tolerance:* | |
| *Class (IEC 60942):* | **1** | *See comments:* | |
| *Barometer type:* | | *Contains non-accredited tests:* | __Yes _X_ No |
| *Barometer s/n:* | | | |

| | | | |
|---|---|---|---|
| *Customer:* | **Jacobs Engineering** | *Address:* | **299 Madison Ave.,** |
| *Tel/Fax:* | **973-267-0555 x7176 / -3555** | | **Morristown, NJ 07960** |

**Tested in accordance with the following procedures and standards:**
Calibration of Acoustical Calibrators, Scantek Inc., Rev. 1/16/2015

**Instrumentation used for calibration:** Nor-1504 Norsonic Test System:

| Instrument - Manufacturer | Description | S/N | Cal. Date | Traceability evidence Cal. Lab / Accreditation | Cal. Due |
|---|---|---|---|---|---|
| 483B-Norsonic | SME Cal Unit | 31061 | Jul 20, 2015 | Scantek, Inc./ NVLAP | Jul 20, 2016 |
| DS-360-SRS | Function Generator | 88077 | Sep 9, 2014 | ACR Env./ A2LA | Sep 9, 2016 |
| 34401A-Agilent Technologies | Digital Voltmeter | MY47011118 | Sep 24, 2015 | ACR Env./ A2LA | Sep 24, 2016 |
| HM30-Thommen | Meteo Station | 1040170/39633 | Oct 23, 2015 | ACR Env./ A2LA | Oct 23, 2016 |
| 140-Norsonic | Real Time Analyzer | 1403978 | Mar 17, 2016 | Scantek, Inc. / NVLAP | Mar 17, 2017 |
| PC Program 1018 Norsonic | Calibration software | v.6.1T | Validated Nov 2014 | Scantek, Inc. | - |
| 4192-Brüel&Kjær | Microphone | 2854675 | Nov 11, 2015 | Scantek, Inc. / NVLAP | Nov 11, 2016 |
| 1203-Norsonic | Preamplifier | 92268 | Oct 14, 2015 | Scantek, Inc./ NVLAP | Oct 14, 2016 |

**Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)**

| **Calibrated by:** | Jeremy Gotwalt | **Authorized signatory:** | Valentin Ruzduga |
|---|---|---|---|
| Signature | | Signature | |
| Date | 3/29/16 | Date | 3/30/2016 |

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory.
This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.

**Results summary:** Device was tested and complies with following clauses of mentioned specifications:

| CLAUSES[1] FROM STANDARDS REFERENCED IN PROCEDURES: | MET[2] | NOT MET | COMMENTS |
|---|---|---|---|
| ***Manufacturer specifications*** | | | |
| Manufacturer specifications: Sound pressure level | X | | |
| Manufacturer specifications: Frequency | X | | |
| Manufacturer specifications: Total harmonic distortion | X | | |
| ***Current standards*** | | | |
| ANSI S1.40:2006 B.3 / IEC 60942: 2003 B.2 - Preliminary inspection | X | | |
| ANSI S1.40:2006 B.4.4 / IEC 60942: 2003 B.3.4 - Sound pressure level | X | | |
| ANSI S1.40:2006 A.5.4 / IEC 60942: 2003 A.4.4 - Sound pressure level stability | X | | |
| ANSI S1.40:2006 B.4.5 / IEC 60942: 2003 B.3.5 - Frequency | X | | |
| ANSI S1.40:2006 B.4.6 / IEC 60942: 2003 B.3.6 - Total harmonic distortion | X | | |

[1] The results of this calibration apply only to the instrument type with serial number identified in this report.

[2] The tests marked with (*) are not covered by the current NVLAP accreditation.

**Main measured parameters [3]:**

| Measured[4]/Acceptable[5] Tone frequency (Hz): | Measured[4]/Acceptable[5] Total Harmonic Distortion (%): | Measured [4]/Acceptable Level[5] (dB): |
|---|---|---|
| 999.81 ± 1.0/1000.0 ± 10.0 | 0.22 ± 0.10/ < 3 | 93.95 ± 0.12/94.0 ± 0.4 |
| 999.81 ± 1.0/1000.0 ± 10.0 | 0.28 ± 0.13/ < 3 | 113.98 ± 0.12/114.0 ± 0.4 |

[3] The stated level is valid at reference conditions.

[4] The above expanded uncertainties for frequency and distortion are calculated with a coverage factor k=2; for level k=2.00

[5] Acceptable parameters values are from the current standards

**Environmental conditions:**

| Temperature (°C) | Barometric pressure (kPa) | Relative Humidity (%) |
|---|---|---|
| 24.0 ± 1.0 | 98.90 ± 0.001 | 36.7 ± 2.0 |

**Tests made with following attachments to instrument:**

| |
|---|
| Calibrator ½" Adaptor Type: B&K UC2010 |
| Other: none |

**Adjustments:** Unit was not adjusted.
**Comments:** The instrument was tested and met all specifications found in the referenced procedures.

*Note:* The instrument was tested for the parameters listed in the table above, using the test methods described in the listed standards. All tests were performed around the reference conditions. The test results were compared with the manufacturer's or with the standard's specifications, whichever are larger.
Compliance with any standard cannot be claimed based solely on the periodic tests.

**Measured Data:** in Acoustical Calibrator Test Report # 35925 of two pages.

**Place of Calibration: Scantek, Inc.**
6430 Dobbin Road, Suite C
Columbia, MD 21045 USA
Ph/Fax: 410-290-7726/ -9167
callab@scantekinc.com

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**Scantek, Inc.**
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

# Calibration Certificate No.35926

*Instrument:* **Microphone**
*Model:* **4188**
*Manufacturer:* **Brüel & Kjær**
*Serial number:* **2057666**
*Composed of:*

*Date Calibrated:* **03/29/2016** *Cal Due:* **03/29/2017**

| *Status:* | Received | Sent |
|---|---|---|
| *In tolerance:* | X | X |
| *Out of tolerance:* | | |
| *See comments:* | | |

*Contains non-accredited tests:* __Yes _X_ No

*Customer:* **Jacobs Engineering**
*Tel/Fax:* **973-267-0555 x7176/ -3555**
*Address:* **299 Madison Ave., Morristown, NJ 07960**

**Tested in accordance with the following procedures and standards:**
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

**Instrumentation used for calibration:** N-1504 Norsonic Test System:

| Instrument - Manufacturer | Description | S/N | Cal. Date | Traceability evidence Cal. Lab / Accreditation | Cal. Due |
|---|---|---|---|---|---|
| 4838-Norsonic | SME Cal Unit | 31061 | Jul 20, 2015 | Scantek, Inc./ NVLAP | Jul 20, 2016 |
| DS-360-SRS | Function Generator | 88077 | Sep 9, 2014 | ACR Env./ A2LA | Sep 9, 2016 |
| 34401A-Agilent Technologies | Digital Voltmeter | MY47011118 | Sep 24, 2015 | ACR Env./ A2LA | Sep 24, 2016 |
| HM30-Thommen | Meteo Station | 1040170/39633 | Oct 23, 2015 | ACR Env./ A2LA | Oct 23, 2016 |
| PC Program 1017 Norsonic | Calibration software | v.6.1T | Validated Nov 2014 | Scantek, Inc. | - |
| 1253-Norsonic | Calibrator | 28326 | Nov 10, 2015 | Scantek, Inc./ NVLAP | Nov 10, 2016 |
| 1203-Norsonic | Preamplifier | 92268 | Oct 14, 2015 | Scantek, Inc./ NVLAP | |
| 4180-Brüel&Kjær | Microphone | 2246115 | Oct 26, 2015 | NPL-UK / UKAS | Oct 26, 2017 |

**Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)**

| Calibrated by: | Jeremy Gotwalt | Authorized signatory: | Valentin Buzduga |
|---|---|---|---|
| Signature | | Signature | |
| Date | 3/29/16 | Date | 3/30/2016 |

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory.
This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.
Document stored as: Z:\Calibration Lab\Mic 2016\B&K4188_2057666_M1.doc

**Results summary:** Device was tested and complies with following clauses of mentioned specifications:

| CLAUSES / METHODS[1] FROM PROCEDURES | | MET[2,3] | NOT MET | NOT TESTED | MEASUREMENT EXPANDED UNCERTAINTY (coverage factor 2) |
|---|---|---|---|---|---|
| Open circuit sensitivity (insert voltage method, 250 Hz) | | X | | | See below |
| Frequency response | Actuator response | X | | | 63 – 200Hz: 0.3 dB<br>200 – 8000 Hz: 0.2 dB<br>8 – 10 kHz: 0.5 dB<br>10 – 20 kHz: 0.7 dB<br>20 – 50 kHz: 0.9 dB<br>50 – 100 kHz: 1.2 dB |
| | FF/Diffuse field responses | X | | | 63 – 200Hz: 0.3 dB<br>200 – 4000 Hz: 0.2 dB<br>4 – 10 kHz: 0.6 dB<br>10 – 20 kHz: 0.9 dB<br>20 – 50 kHz: 2.2 dB<br>50 – 100 kHz: 4.4 dB |
| | Scantek, Inc. acoustical method | | | X | 31.5 – 125 Hz: 0.16 dB<br>250, 1000 Hz: 0.12 dB<br>2 – 8 kHz: 0.8 dB<br>12.5 – 16 kHz: 2.4 dB |

[1] The results of this calibration apply only to the instrument type with serial number identified in this report.

[2] Results are normalized to the reference conditions.

[3] The tests marked with (*) are not covered by the current NVLAP accreditation.

*Note:* The free field/diffuse field characteristics were calculated based on the measured actuator response and adjustment coefficients as provided by the manufacturer. The uncertainties reported for these characteristics may include assumed uncertainty components for the adjustment coefficients.

| **Comments:** | The instrument was tested and met all specifications found in the referenced procedures. |
|---|---|

**Environmental conditions:**

| Temperature (°C) | Barometric pressure (kPa) | Relative Humidity (%) |
|---|---|---|
| 23.5 ± 1.0 | 100.30 ± 0.001 | 33.7 ± 2.0 |

**Main measured parameters:**

| Tone frequency (Hz) | Measured[4] /Acceptable Open circuit sensitivity (dB re 1V/Pa) | Sensitivity (mV/Pa) |
|---|---|---|
| 250 | -30.06 ± 0.12/ -30.00 ±2.00 | 31.42 |

[4] The reported expanded uncertainty is calculated with a coverage factor k=2.00

**Tests made with following attachments to instrument and auxiliary devices:**

| |
|---|
| Protection grid mounted for sensitivity measurements |
| Actuator type: G.R.A.S. RA0014 |

**Measured Data:** Found on Microphone Test Report # 35926 of one page.

**Place of Calibration: Scantek, Inc.**
6430 Dobbin Road, Suite C
Columbia, MD 21045 USA
Ph/Fax: 410-290-7726/ -9167
callab@scantekinc.com

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**Scantek, Inc.**
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP Lab Code: 200625-0

# Calibration Certificate No.35927

## LIMITED USE

*Instrument:* **Sound Level Meter**
*Model:* **2236**
*Manufacturer:* **Brüel and Kjær**
*Serial number:* **2100601**
*Tested with:* **Microphone 4188 s/n 2057666**
**Preamplifier ZC0027**
*Type (class):* **1**
*Customer:* **Jacobs Engineering**
*Tel/Fax:* **973-267-0555 x7176 / -3555**

*Date Calibrated:* **3/29/2016** *Cal Due:* **03/29/2017**

| *Status:* | Received | Sent |
|---|---|---|
| *In tolerance:* | X | X |
| *Out of tolerance:* | | |
| *See comments:* | X | X |

*Contains non-accredited tests:* __Yes _X_ No
*Calibration service:* __ Basic _X_ Standard
*Address:* **299 Madison Ave.**
**Morristown NJ 07960**

**Tested in accordance with the following procedures and standards:**
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

**Instrumentation used for calibration:** Nor-1504 Norsonic Test System:

| Instrument - Manufacturer | Description | S/N | Cal. Date | Traceability evidence Cal. Lab / Accreditation | Cal. Due |
|---|---|---|---|---|---|
| 483B-Norsonic | SME Cal Unit | 31061 | Jul 20, 2015 | Scantek, Inc./ NVLAP | Jul 20, 2016 |
| DS-360-SRS | Function Generator | 88077 | Sep 9, 2014 | ACR Env./ A2LA | Sep 9, 2016 |
| 34401A-Agilent Technologies | Digital Voltmeter | MY47011118 | Sep 24, 2015 | ACR Env./ A2LA | Sep 24, 2016 |
| HM30-Thommen | Meteo Station | 1040170/39633 | Oct 23, 2015 | ACR Env./ A2LA | Oct 23, 2016 |
| PC Program 1019 Norsonic | Calibration software | v.6.1T | Validated Nov 2014 | Scantek, Inc. | - |
| 1251-Norsonic | Calibrator | 30878 | Nov 10, 2015 | Scantek, Inc./ NVLAP | Nov 10, 2016 |

**Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).**

**Environmental conditions:**

| Temperature (°C) | Barometric pressure (kPa) | Relative Humidity (%) |
|---|---|---|
| 23.1 | 101.26 | 38.1 |

| Calibrated by: | Jeremy Gotwalt | Authorized signatory: | Valentin Buzduga |
|---|---|---|---|
| Signature | | Signature | |
| Date | 3/29/16 | Date | 3/30/2016 |

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory.
This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.

**Results summary:** Device complies with following clauses of mentioned specifications:

| CLAUSES [1] FROM IEC/ANSI STANDARDS REFERENCED IN PROCEDURES: | RESULT[2,3] | EXPANDED UNCERTAINTY (coverage factor 2) [dB] |
|---|---|---|
| INDICATION AT THE CALIBRATION CHECK FREQUENCY – ANSI S1.4 CLAUSE 3.2 | Passed | 0.15 |
| INPUT AMPLIFIER TEST: GAIN TEST / ATTENUATOR SETTING - ANSI S1.4-1983 CLAUSE 5.3 | Passed | 0.25 |
| LEVEL LINEARITY TEST - ANSI S1.4-1983, CLAUSE 6.9 & 6.10 | Passed | 0.25 |
| WEIGHTING NETWORK TEST: A NETWORK - ANSI S1.4-1983 CLAUSE 8.2.1 | Passed | 0.25 |
| WEIGHTING NETWORK TEST: C NETWORK - ANSI S1.4-1983 CLAUSE 8.2.1 | Passed | 0.25 |
| WEIGHTING NETWORK TEST: LINEAR NETWORK - ANSI S1.4-1983 CLAUSE 8.2.1 | Passed | 0.25 |
| OVERLOAD DETECTOR TEST: A-NETWORK - ANSI S1.4-1983 CLAUSE 8.3.1 | Passed | 0.25 |
| F/S/I/PEAK TEST: STEADY STATE RESPONSE - ANSI S1.4 1983 CLAUSE 6.4 | Passed | 0.25 |
| FAST-SLOW TEST: OVERSHOOT TEST - ANSI S1.4 1983 CLAUSE 8.4.1 | Passed | 0.25 |
| SINGLE SINE WAVE BURST - ANSI S1.4 1983 CLAUSE 8.4.1 & 8.4.3 | Passed | 0.25 |
| IMPULSE TEST: CONTINUOUS SINE WAVE BURST - ANSI S1.4 1983 CLAUSE 8.4.3 | Passed | 0.25 |
| IMPULSE TEST: SINGLE SINE WAVE BURST - ANSI S1.4 1983 CLAUSE 8.4.1 & 8.4.3 | Passed | 0.25 |
| PEAK DETECTOR TEST, SINGLE SQUARE WAVE BURST - ANSI S1.4 1983 CLAUSE 8.4.4 | Failed | 0.25 |
| RMS DETECTOR TEST: CREST FACTOR TEST - ANSI S1.4-1983 CLAUSE 8.4.2 | Passed | 0.25 |
| RMS DETECTOR TEST: CONTINUOUS SINE WAVE BURST - ANSI S1.4-1983 CLAUSE 8.4.2 | Passed | 0.25 |
| TIME AVERAGING TEST: AVERAGING FUNCTIONS - ANSI S1.43 CLAUSE 9.3.2 | Passed | 0.25 |
| LINEARITY TEST - ANSI S1.43 CLAUSE 9.3.3 | Passed | 0.25 |
| FILTER TEST 1/1OCTAVE: RELATIVE ATTENUATION - IEC 61260, CLAUSE 4.4 & #5.3 | Passed | 0.25 |
| SUMMATION OF ACOUSTIC TESTS - ANSI S1.4 CLAUSE 5 USING ACTUATOR | Passed | 0.2-0.5 |

[1] The results of this calibration apply only to the instrument type with serial number identified in this report.

[2] Parameters are certified at actual environmental conditions.

[3] The tests marked with (*) are not covered by the current NVLAP accreditation.

**Comments:** The instrument fails the peak detector test and cannot be used for measuring the peak of burst signals as defined in ANSI S1.4 clause #8.4.4 (IEC 60651 clause 9.4.4). The unit can be normally used for the other SLM functions tested through calibration.

***Note:*** The instrument was tested for the parameters listed in the table above, using the test methods described in the listed standards. All tests were performed around the reference conditions. The test results were compared with the manufacturer's or with the standard's specifications, whichever are larger.
Compliance with any standard cannot be claimed based solely on the periodic tests.

**Tests made with the following attachments to the instrument:**

| |
|---|
| Microphone: Brüel & Kjær 4188 s/n 2057666 for acoustical test |
| Preamplifier: Brüel & Kjær ZC0027 for all tests |
| Other: line adaptor ADP005 (18pF) for electrical tests and 1448 (18pF) for noise test |
| Accompanying acoustical calibrator: Brüel and Kjær 4231 s/n 2085219 |

**Measured Data:** in Test Report # 35927 of 12 pages.

**Place of Calibration: Scantek, Inc.**
6430 Dobbin Road, Suite C
Columbia, MD 21045 USA
Ph/Fax: 410-290-7726/ -9167
callab@scantekinc.com

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory.
This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.

# Appendix D

## Noise Monitoring Data Sheets

# Section M1B - SR 0422 Pottstown Bypass Express Reconstruction Project

| | |
|---|---|
| **Site #** | **M1** |
| **Done By:** | **MC** |
| **Meter:** | **BK** |

**Description : 1610 Medical Drive**



| | Start | End |
|---|---|---|
| **Date** | 10/11/2016 | 10/11/2016 |
| **Time** | 3:53 PM | 4:13 PM |

| **Traffic** | **NB/EB** | **SB/WB** |
|---|---|---|
| **Cars** | 407 | 798 |
| **MT** | 11 | 61 |
| **HT** | 11 | 17 |
| **Buses** | 2 | 1 |
| **Motorcycles** | 2 | 5 |
| **Total** | **433** | **882** |

**Notes:**

**Both directions barely visiable at receptor.**

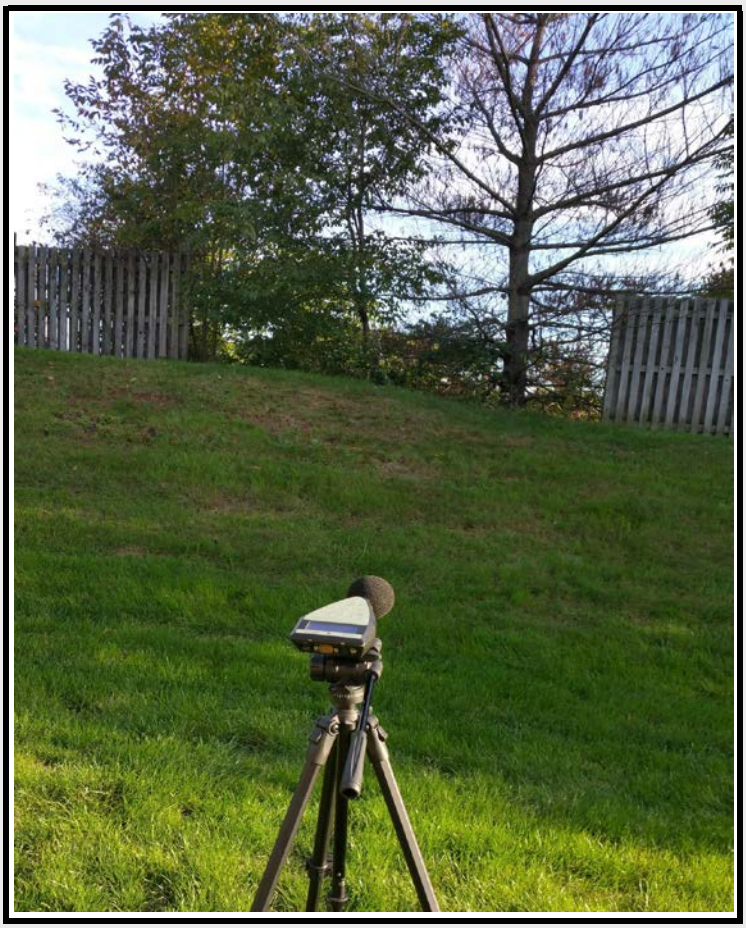
**Median walls, can only see tops of cars.**



# Section M1B - SR 0422 Pottstown Bypass Express Reconstruction Project

**Site #** M2
**Done By:** MC
**Meter:**

**Description : 1621 Rosewood Court**



| | Start | End |
|---|---|---|
| **Date** | 10/11/2016 | 10/11/2016 |
| **Time** | 4:40 PM | 5:00 PM |

| **Traffic** | **NB/EB** | **SB/WB** |
|---|---|---|
| **Cars** | | |
| **MT** | | |
| **HT** | | |
| **Buses** | | |
| **Motorcycles** | | |
| **Total** | **0** | **0** |

**Notes:** **No line of sight to roadway.**

**Berm steps up to past.**

**Noise is barely higher at other end because road remains relatively flat.**

**Grade separated 10 to 15' between berm and wood fence.**




**Jacobs Engineering Group, Inc.**

# Section M1B - SR 0422 Pottstown Bypass Express Reconstruction Project

**Site #** M3
**Done By:** MC
**Meter:**

**Description : 140 1st Ave**



| | Start | End |
|---|---|---|
| **Date** | 10/11/2016 | 10/11/2016 |
| **Time** | 5:37 PM | 5:58 PM |

| **Traffic** | **NB/EB** | **SB/WB** |
|---|---|---|
| **Cars** | 450 | 782 |
| **MT** | 4 | 30 |
| **HT** | 2 | 11 |
| **Buses** | 2 | 5 |
| **Motorcycles** | 2 | 1 |
| **Total** | **460** | **829** |

**Notes:**

**No line of sight to roadway.**

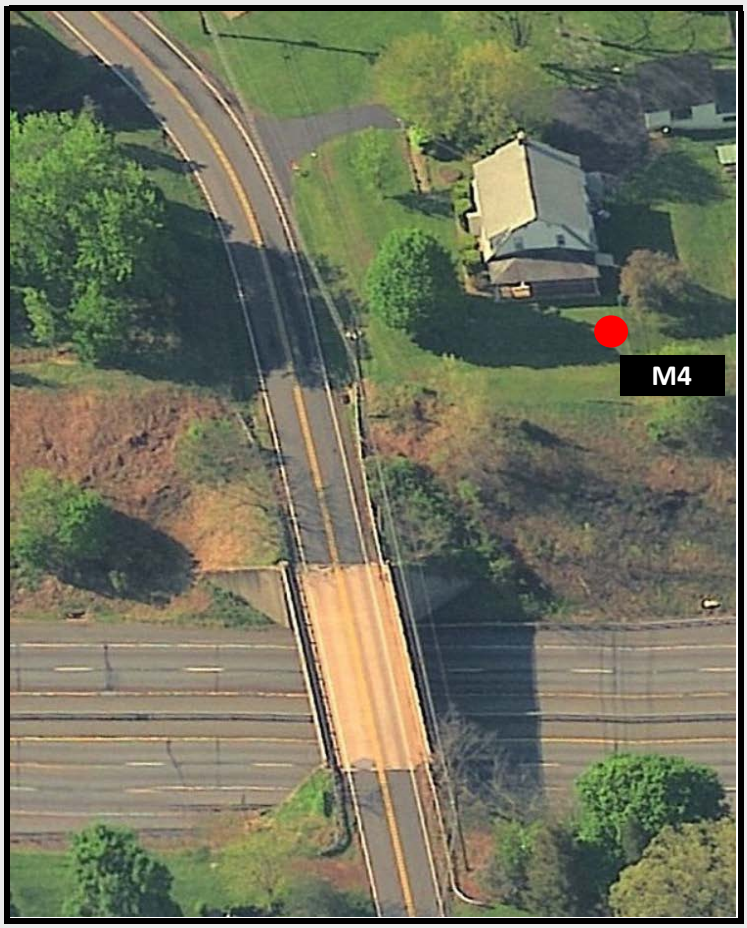



**Jacobs Engineering Group, Inc.**

# Section M1B - SR 0422 Pottstown Bypass Express Reconstruction Project

**Site #** M4
**Done By:** MC
**Meter:**

**Description : 205 S Pleasantview Rd**




| | Start | End |
|---|---|---|
| **Date** | 10/11/2016 | 10/11/2016 |
| **Time** | 6:25 PM | 6:46 PM |

| **Traffic** | **NB/EB** | **SB/WB** |
|---|---|---|
| **Cars** | 333 | 675 |
| **MT** | 2 | 36 |
| **HT** | 9 | 5 |
| **Buses** | 0 | 2 |
| **Motorcycles** | 0 | 1 |
| **Total** | **344** | **719** |

**Notes:**

**No line of sight to roadway.**




**Jacobs Engineering Group, Inc.**

# Section M1B - SR 0422 Pottstown Bypass Express Reconstruction Project

**Site #** M5
**Done By:** MC
**Meter:** BK

**Description : 66 Commons Drive**



| | Start | End |
|---|---|---|
| **Date** | 10/12/2016 | 10/12/2016 |
| **Time** | 10:30 AM | 10:52 AM |

| **Traffic** | **NB/EB** | **SB/WB** |
|---|---|---|
| **Cars** | 421 | 340 |
| **MT** | 11 | 39 |
| **HT** | 24 | 40 |
| **Buses** | 0 | 3 |
| **Motorcycles** | 1 | 1 |
| **Total** | **457** | **423** |

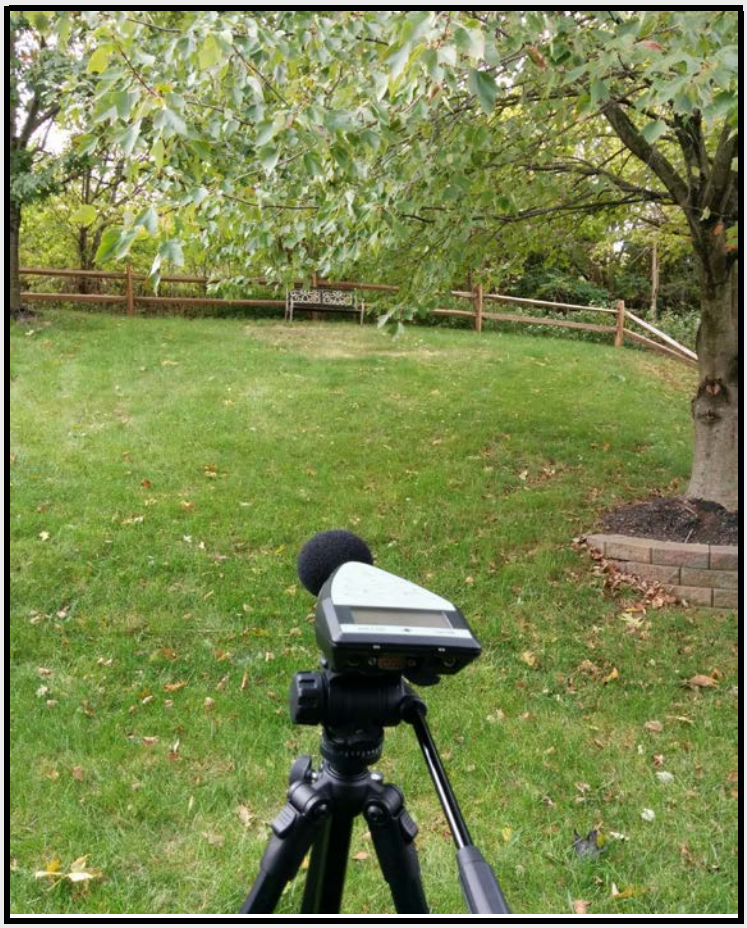
**Notes:**



# Section M1B - SR 0422 Pottstown Bypass Express Reconstruction Project

**Site #** M6
**Done By:** MC
**Meter:** BK

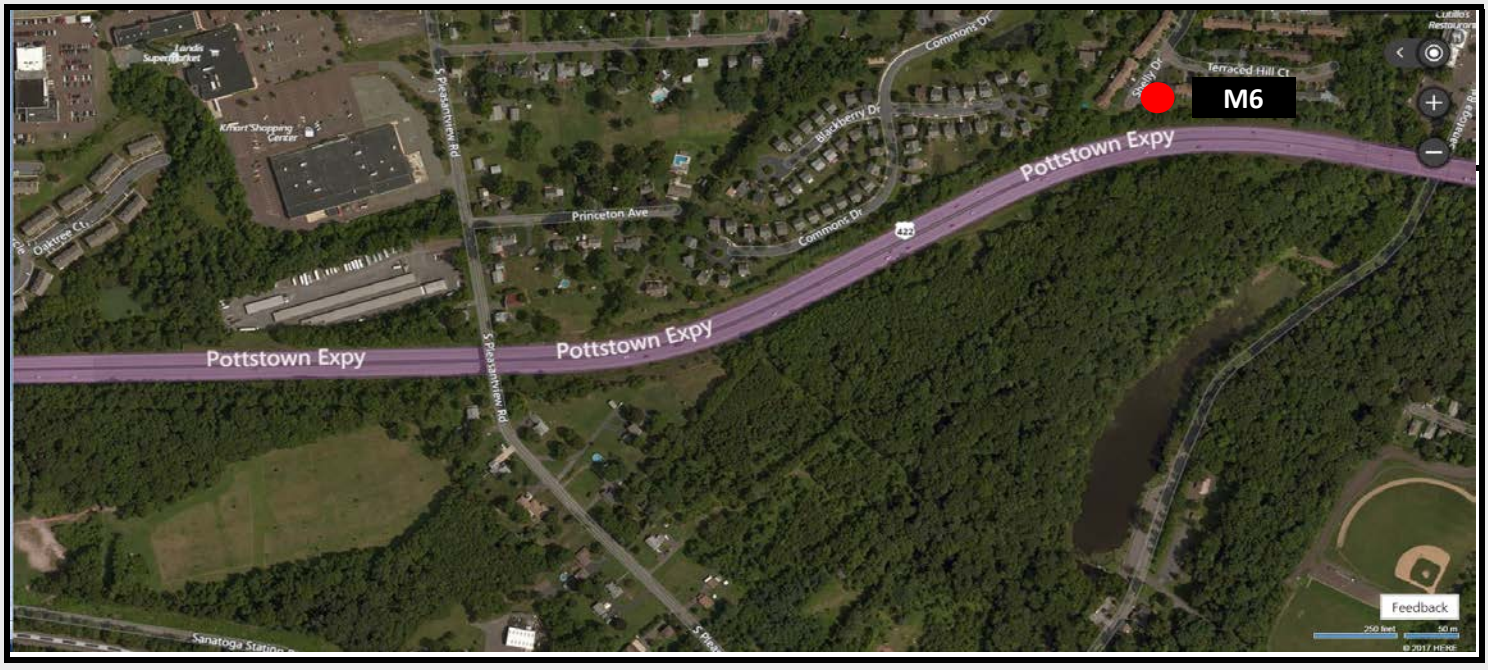
**Description : 2558 Terraced Hill Court**



| | Start | End |
|---|---|---|
| **Date** | 10/12/2016 | 10/12/2016 |
| **Time** | 11:04 AM | 11:26 AM |

| **Traffic** | **NB/EB** | **SB/WB** |
|---|---|---|
| **Cars** | 390 | 341 |
| **MT** | 16 | 26 |
| **HT** | 23 | 41 |
| **Buses** | 0 | 2 |
| **Motorcycles** | 0 | 0 |
| **Total** | **429** | **410** |

**Notes:**




**Jacobs Engineering Group, Inc.**

# Section M1B - SR 0422 Pottstown Bypass Express Reconstruction Project

**Site #** M7
**Done By:** MC
**Meter:** BK

**Description : 205 S Park Road**



| | Start | End |
|---|---|---|
| **Date** | 10/12/2016 | 10/12/2016 |
| **Time** | 9:33 AM | 9:54 AM |

| **Traffic** | **NB/EB** | **SB/WB** |
|---|---|---|
| **Cars** | 456 | 294 |
| **MT** | 11 | 37 |
| **HT** | 39 | 32 |
| **Buses** | 0 | 3 |
| **Motorcycles** | 0 | 1 |
| **Total** | **506** | **367** |

**Notes:**



# Section M1B - SR 0422 Pottstown Bypass Express Reconstruction Project

**Site #** M8
**Done By:** MC
**Meter:** BK

**Description : 115 Evergreen Road**



| | Start | End |
|---|---|---|
| **Date** | 10/12/2016 | 10/12/2016 |
| **Time** | 8:52 AM | 9:12 AM |

| **Traffic** | **NB/EB** | **SB/WB** |
|---|---|---|
| **Cars** | 514 | 284 |
| **MT** | 6 | 43 |
| **HT** | 29 | 35 |
| **Buses** | 1 | 2 |
| **Motorcycles** | 1 | 0 |
| **Total** | **551** | **364** |

**Notes:**

**Little ditch, road slightly lower but at-grade.**




**Jacobs Engineering Group, Inc.**

# Appendix E

## Noise Meter Outputs

## Noise Meter Outputs

| | | | |
|---|---|---|---|
| Bruel & Kjaer<br>SLM Type 2236<br><br>SETTINGS:<br>F 30-110 dB<br>RMS: A Peak: C<br><br>**RECORD NO.: 9 (Site M1)**<br>10/12/2016 15:53<br>Elapsed Time 0000:20:35<br>Pauses 0<br>Overload 0.0 %<br><br>MaxP 104.9 dB<br>MaxL 79.4 dB<br>MinL 54.6 dB<br><br>Leq 63.3 dB<br>SEL 94.3 dB<br>LEPd (Te= 0h01) 36.5 dB<br><br>L10 65.0 dB<br>L50 62.5 dB<br>L90 60.0 dB | Bruel & Kjaer<br>SLM Type 2236<br><br>SETTINGS:<br>F 30-110 dB<br>RMS: A Peak: C<br><br>**RECORD NO.: 10 (Site M2)**<br>10/12/2016 16:40<br>Elapsed Time 0000:20:01<br>Pauses 0<br>Overload 0.0 %<br><br>MaxP 91.4 dB<br>MaxL 72.4 dB<br>MinL 52.9 dB<br><br>Leq 59.0 dB<br>SEL 89.8 dB<br>LEPd (Te= 0h01) 32.2 dB<br><br>L10 60.0 dB<br>L50 58.0 dB<br>L90 56.0 dB | Bruel & Kjaer<br>SLM Type 2236<br><br>SETTINGS:<br>F 30-110 dB<br>RMS: A Peak: C<br><br>**RECORD NO.: 11 (Site M3)**<br>10/12/2016 17:37<br>Elapsed Time 0000:20:40<br>Pauses 0<br>Overload 0.0 %<br><br>MaxP 94.0 dB<br>MaxL 77.6 dB<br>MinL 58.0 dB<br><br>Leq 62.6 dB<br>SEL 93.6 dB<br>LEPd (Te= 0h01) 35.8 dB<br><br>L10 64.0 dB<br>L50 62.0 dB<br>L90 60.5 dB | Bruel & Kjaer<br>SLM Type 2236<br><br>SETTINGS:<br>F 30-110 dB<br>RMS: A Peak: C<br><br>**RECORD NO.: 12 (Site M4)**<br>10/12/2016 18:25<br>Elapsed Time 0000:20:57<br>Pauses 0<br>Overload 0.0 %<br><br>MaxP 94.0 dB<br>MaxL 73.5 dB<br>MinL 57.7 dB<br><br>Leq 66.2 dB<br>SEL 97.3 dB<br>LEPd (Te= 0h01) 39.4 dB<br><br>L10 68.0 dB<br>L50 65.5 dB<br>L90 62.5 dB |
| Bruel & Kjaer<br>SLM Type 2236<br><br>SETTINGS:<br>F 30-110 dB<br>RMS: A Peak: C<br><br>**RECORD NO.: 13 (Site M8)**<br>10/13/2016 8:52<br>Elapsed Time 0000:20:02<br>Pauses 0<br>Overload 0.0 %<br><br>MaxP 103.7 dB<br>MaxL 88.2 dB<br>MinL 61.9 dB<br><br>Leq 77.6 dB<br>SEL 108.4 dB<br>LEPd (Te= 0h01) 50.8 dB<br><br>L10 80.5 dB<br>L50 76.0 dB<br>L90 71.5 dB | Bruel & Kjaer<br>SLM Type 2236<br><br>SETTINGS:<br>F 30-110 dB<br>RMS: A Peak: C<br><br>**RECORD NO.: 14 (Site M7)**<br>10/13/2016 9:33<br>Elapsed Time 0000:20:57<br>Pauses 0<br>Overload 0.0 %<br><br>MaxP 96.3 dB<br>MaxL 77.1 dB<br>MinL 55.2 dB<br><br>Leq 67.3 dB<br>SEL 98.4 dB<br>LEPd (Te= 0h01) 40.5 dB<br><br>L10 70.0 dB<br>L50 66.5 dB<br>L90 62.0 dB | Bruel & Kjaer<br>SLM Type 2236<br><br>SETTINGS:<br>F 30-110 dB<br>RMS: A Peak: C<br><br>**RECORD NO.: 15 (Site M5)**<br>10/13/2016 10:29<br>Elapsed Time 0000:22:05<br>Pauses 0<br>Overload 0.0 %<br><br>MaxP 95.1 dB<br>MaxL 69.2 dB<br>MinL 45.0 dB<br><br>Leq 59.1 dB<br>SEL 90.3 dB<br>LEPd (Te= 0h01) 32.3 dB<br><br>L10 62.0 dB<br>L50 57.5 dB<br>L90 53.0 dB | Bruel & Kjaer<br>SLM Type 2236<br><br>SETTINGS:<br>F 30-110 dB<br>RMS: A Peak: C<br><br>**RECORD NO.: 16 (Site M6)**<br>10/13/2016 11:04<br>Elapsed Time 0000:21:35<br>Pauses 0<br>Overload 0.0 %<br><br>MaxP 100.7 dB<br>MaxL 73.2 dB<br>MinL 48.9 dB<br><br>Leq 59.2 dB<br>SEL 90.3 dB<br>LEPd (Te= 0h01) 32.4 dB<br><br>L10 61.5 dB<br>L50 57.5 dB<br>L90 54.0 dB |

# Appendix F

## Traffic Noise Modeling and Abatement Results

| Noise level approaching or exceeding the NAC | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Noise reduction of 5+ dBA | | | | | | | | |
| Noise reduction of 7+ dBA | | | | | | | | |
| **Receptor** | **NAC** | **Land Use** | **Dwelling Units** | **Modeled Noise Levels (dBA)** | | | | |
| | | | | **Existing** | **No Build** | **Build Alternative** | | |
| | | | | | | **No Barrier** | **With Barrier** | **Insertion Loss*** |
| A-001 | D | Interior | 1 | 34 | 35 | 36 | - | - |
| A-002 | D | Interior | 1 | 36 | 37 | 37 | - | - |
| A-003 | D | Interior | 1 | 40 | 41 | 41 | - | - |
| A-004 | D | Interior | 1 | 44 | 44 | 45 | - | - |
| A-005 | D | Interior | 1 | 44 | 45 | 45 | - | - |
| A-006 | D | Interior | 1 | 45 | 46 | 47 | - | - |
| B-001 | B | Residence | 1 | 69 | 70 | 71 | 63 | 7 |
| B-002 | B | Residence | 1 | 68 | 69 | 70 | 59 | 11 |
| B-003 | B | Residence | 1 | 67 | 68 | 68 | 59 | 9 |
| B-004 | B | Residence | 1 | 68 | 69 | 69 | 60 | 9 |
| B-005 | B | Residence | 1 | 67 | 68 | 68 | 59 | 9 |
| B-006 | B | Residence | 2 | 68 | 69 | 69 | 60 | 9 |
| B-007 | B | Residence | 2 | 68 | 69 | 68 | 60 | 8 |
| B-008 | B | Residence | 2 | 67 | 68 | 68 | 61 | 8 |
| B-009 | B | Residence | 2 | 62 | 63 | 64 | 57 | 7 |
| B-010 | B | Residence | 2 | 63 | 64 | 64 | 57 | 7 |
| B-011 | B | Residence | 1 | 67 | 68 | 68 | 60 | 8 |
| B-012 | B | Residence | 1 | 68 | 69 | 69 | 60 | 9 |
| B-013 | B | Residence | 1 | 69 | 70 | 70 | 61 | 9 |
| B-014 | B | Residence | 1 | 70 | 71 | 71 | 62 | 9 |
| B-015 | B | Residence | 1 | 54 | 55 | 55 | 51 | 5 |
| B-016 | B | Residence | 1 | 54 | 55 | 56 | 51 | 5 |
| B-017 | B | Residence | 1 | 54 | 55 | 56 | 51 | 5 |
| B-018 | B | Residence | 1 | 54 | 55 | 56 | 52 | 4 |
| B-019 | B | Residence | 1 | 55 | 56 | 56 | 52 | 4 |
| B-020 | B | Residence | 1 | 67 | 68 | 68 | 61 | 7 |
| B-021 | B | Residence | 1 | 64 | 65 | 65 | 60 | 5 |
| B-022 | B | Residence | 1 | 63 | 64 | 64 | 58 | 5 |
| B-023 | B | Residence | 1 | 62 | 63 | 63 | 58 | 5 |
| B-024 | B | Residence | 1 | 61 | 62 | 62 | 57 | 5 |
| B-025 | B | Residence | 1 | 60 | 61 | 61 | 57 | 5 |
| B-026 | B | Residence | 1 | 66 | 67 | 67 | 59 | 8 |
| B-027 | B | Residence | 1 | 67 | 68 | 68 | 59 | 8 |
| B-028 | B | Residence | 1 | 69 | 70 | 69 | 60 | 9 |
| B-029 | B | Residence | 1 | 70 | 71 | 71 | 61 | 10 |
| B-030 | B | Residence | 1 | 72 | 73 | 73 | 63 | 10 |
| B-031 | B | Residence | 1 | 74 | 75 | 74 | 63 | 11 |
| B-032 | B | Residence | 1 | 74 | 75 | 74 | 63 | 11 |
| B-033 | B | Residence | 1 | 74 | 75 | 74 | 63 | 11 |
| B-034 | B | Residence | 1 | 74 | 75 | 74 | 63 | 10 |

| Noise level approaching or exceeding the NAC | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Noise reduction of 5+ dBA | | | | | | | | |
| Noise reduction of 7+ dBA | | | | | | | | |
| **Receptor** | **NAC** | **Land Use** | **Dwelling Units** | **Modeled Noise Levels (dBA)** | | | | |
| | | | | **Existing** | **No Build** | **Build Alternative** | | |
| | | | | | | **No Barrier** | **With Barrier** | **Insertion Loss*** |
| B-035 | B | Residence | 1 | 73 | 74 | 73 | 63 | 11 |
| B-036 | B | Residence | 1 | 73 | 74 | 73 | 62 | 11 |
| B-037 | B | Residence | 3 | 73 | 74 | 73 | 62 | 11 |
| B-038 | B | Residence | 3 | 74 | 75 | 74 | 62 | 12 |
| B-039 | B | Residence | 3 | 74 | 75 | 74 | 62 | 12 |
| B-040 | B | Residence | 3 | 75 | 76 | 75 | 62 | 13 |
| B-041 | B | Residence | 3 | 75 | 76 | 74 | 62 | 12 |
| B-042 | B | Residence | 3 | 74 | 75 | 73 | 61 | 12 |
| B-043 | B | Residence | 2 | 73 | 74 | 72 | 61 | 11 |
| B-044 | B | Residence | 2 | 71 | 72 | 71 | 60 | 11 |
| B-045 | B | Residence | 2 | 68 | 69 | 69 | 59 | 10 |
| B-046 | B | Residence | 2 | 67 | 68 | 67 | 59 | 8 |
| B-047 | B | Residence | 1 | 67 | 68 | 67 | 59 | 8 |
| B-048 | B | Residence | 2 | 66 | 67 | 67 | 59 | 7 |
| B-049 | B | Residence | 2 | 66 | 67 | 66 | 59 | 7 |
| B-050 | B | Residence | 1 | 66 | 66 | 66 | 59 | 7 |
| B-051 | B | Residence | 1 | 65 | 66 | 66 | 59 | 7 |
| B-052 | B | Residence | 1 | 65 | 66 | 65 | 59 | 6 |
| B-053 | B | Residence | 1 | 65 | 66 | 65 | 59 | 6 |
| B-054 | B | Residence | 1 | 64 | 65 | 65 | 59 | 6 |
| B-055 | B | Residence | 1 | 64 | 65 | 64 | 59 | 5 |
| B-056 | B | Residence | 1 | 64 | 65 | 64 | 59 | 5 |
| B-057 | B | Residence | 1 | 64 | 65 | 64 | 59 | 5 |
| B-058 | B | Residence | 1 | 63 | 64 | 63 | 59 | 4 |
| B-059 | B | Residence | 1 | 63 | 64 | 63 | 59 | 4 |
| B-060 | B | Residence | 2 | 57 | 58 | 58 | 52 | 6 |
| B-061 | B | Residence | 1 | 57 | 58 | 58 | 53 | 5 |
| B-062 | B | Residence | 2 | 58 | 58 | 58 | 53 | 6 |
| B-063 | B | Residence | 2 | 57 | 58 | 58 | 53 | 6 |
| B-064 | B | Residence | 2 | 58 | 59 | 59 | 54 | 5 |
| B-065 | C | Playground | 1 | 69 | 70 | 71 | 63 | 7 |
| B-066 | C | Playground | 1 | 68 | 69 | 69 | 63 | 6 |
| B-067 | B | Residence | 1 | 65 | 66 | 67 | 63 | 4 |
| B-068 | B | Residence | 2 | 64 | 65 | 66 | 63 | 3 |
| B-069 | B | Residence | 2 | 64 | 64 | 65 | 63 | 2 |
| B-070 | B | Residence | 1 | 62 | 63 | 63 | 61 | 2 |
| B-071 | B | Residence | 2 | 62 | 63 | 64 | 61 | 3 |
| B-072 | B | Residence | 2 | 63 | 64 | 65 | 62 | 3 |
| B-073 | B | Residence | 2 | 52 | 52 | 53 | 50 | 3 |

| Noise level approaching or exceeding the NAC | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Noise reduction of 5+ dBA | | | | | | | | |
| Noise reduction of 7+ dBA | | | | | | | | |
| **Receptor** | **NAC** | **Land Use** | **Dwelling Units** | **Modeled Noise Levels (dBA)** | | | | |
| | | | | **Existing** | **No Build** | **Build Alternative** | | |
| | | | | | | **No Barrier** | **With Barrier** | **Insertion Loss*** |
| B-074 | B | Residence | 2 | 52 | 53 | 53 | 50 | 3 |
| B-075 | B | Residence | 2 | 52 | 53 | 53 | 50 | 3 |
| B-076 | B | Residence | 1 | 57 | 58 | 58 | 54 | 4 |
| B-077 | B | Residence | 1 | 56 | 57 | 57 | 53 | 4 |
| B-078 | B | Residence | 1 | 61 | 62 | 63 | 59 | 4 |
| B-079 | B | Residence | 3 | 50 | 51 | 50 | 49 | 2 |
| B-080 | B | Residence | 2 | 48 | 49 | 49 | 46 | 3 |
| B-081 | B | Residence | 2 | 48 | 49 | 48 | 45 | 3 |
| B-082 | B | Residence | 2 | 46 | 47 | 47 | 44 | 3 |
| B-083 | B | Residence | 2 | 54 | 55 | 54 | 51 | 3 |
| B-084 | B | Residence | 2 | 58 | 59 | 58 | 51 | 7 |
| B-085 | B | Residence | 2 | 61 | 62 | 61 | 52 | 9 |
| B-086 | B | Residence | 3 | 51 | 52 | 52 | 47 | 4 |
| B-087 | B | Residence | 3 | 49 | 50 | 50 | 44 | 5 |
| B-088 | B | Residence | 3 | 51 | 52 | 52 | 48 | 4 |
| B-089 | B | Residence | 3 | 51 | 52 | 51 | 47 | 5 |
| B-090 | B | Residence | 3 | 50 | 51 | 50 | 47 | 3 |
| B-091 | B | Residence | 3 | 49 | 50 | 50 | 47 | 3 |
| B-092 | B | Residence | 3 | 48 | 49 | 48 | 46 | 2 |
| B-093 | B | Residence | 2 | 48 | 49 | 49 | 46 | 3 |
| B-094 | B | Residence | 2 | 48 | 49 | 48 | 46 | 2 |
| B-095 | B | Residence | 1 | 48 | 49 | 49 | 46 | 3 |
| B-096 | B | Residence | 3 | 49 | 50 | 49 | 47 | 3 |
| B-097 | B | Residence | 3 | 47 | 48 | 48 | 46 | 1 |
| B-098 | B | Residence | 2 | 47 | 48 | 47 | 46 | 1 |
| B-099 | B | Residence | 3 | 50 | 51 | 52 | 50 | 2 |
| B-100 | B | Residence | 2 | 51 | 52 | 52 | 50 | 1 |
| B-101 | B | Residence | 2 | 49 | 50 | 50 | 48 | 2 |
| B-102 | B | Residence | 3 | 50 | 51 | 52 | 50 | 2 |
| B-103 | B | Residence | 3 | 46 | 47 | 47 | 46 | 1 |
| B-104 | B | Residence | 3 | 47 | 48 | 48 | 47 | 1 |
| B-105 | B | Residence | 2 | 53 | 54 | 55 | 52 | 3 |
| B-106 | B | Residence | 2 | 51 | 52 | 52 | 50 | 2 |
| B-107 | B | Residence | 1 | 50 | 51 | 51 | 50 | 2 |
| B-108 | B | Residence | 1 | 56 | 57 | 57 | 54 | 3 |
| B-109 | B | Residence | 3 | 54 | 55 | 54 | 52 | 2 |
| B-110 | B | Residence | 1 | 53 | 54 | 54 | 53 | 1 |
| B-111 | B | Residence | 2 | 52 | 53 | 53 | 52 | 1 |
| B-112 | B | Residence | 2 | 52 | 53 | 53 | 52 | 1 |

| Noise level approaching or exceeding the NAC | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Noise reduction of 5+ dBA | | | | | | | | |
| Noise reduction of 7+ dBA | | | | | | | | |
| **Receptor** | **NAC** | **Land Use** | **Dwelling Units** | **Modeled Noise Levels (dBA)** | | | | |
| | | | | **Existing** | **No Build** | **Build Alternative** | | |
| | | | | | | **No Barrier** | **With Barrier** | **Insertion Loss*** |
| B-113 | B | Residence | 2 | 55 | 56 | 56 | 53 | 3 |
| B-114 | B | Residence | 3 | 54 | 55 | 55 | 54 | 1 |
| B-115 | B | Residence | 3 | 53 | 54 | 54 | 53 | 1 |
| B-116 | B | Residence | 2 | 43 | 44 | 44 | 42 | 1 |
| B-117 | B | Residence | 2 | 52 | 53 | 53 | 52 | 1 |
| B-118 | B | Residence | 3 | 57 | 58 | 57 | 54 | 2 |
| B-119 | B | Residence | 3 | 59 | 60 | 59 | 57 | 2 |
| B-120 | B | Residence | 3 | 60 | 61 | 60 | 56 | 5 |
| B-121 | B | Residence | 3 | 60 | 61 | 60 | 55 | 5 |
| B-122 | B | Residence | 3 | 59 | 60 | 59 | 55 | 4 |
| B-123 | B | Residence | 3 | 57 | 58 | 57 | 55 | 3 |
| C-001 | B | Residence | 1 | 63 | 64 | 64 | 64 | 0 |
| C-002 | B | Residence | 1 | 66 | 67 | 68 | 62 | 5 |
| C-003 | B | Residence | 1 | 61 | 62 | 62 | 58 | 4 |
| C-004 | B | Residence | 1 | 63 | 64 | 66 | 61 | 5 |
| C-005 | B | Residence | 1 | 66 | 67 | 69 | 62 | 7 |
| C-006 | B | Residence | 1 | 68 | 69 | 67 | 62 | 5 |
| C-007 | B | Residence | 1 | 67 | 67 | 67 | 60 | 8 |
| C-008 | B | Residence | 1 | 66 | 67 | 66 | 58 | 9 |
| C-009 | B | Residence | 1 | 65 | 66 | 65 | 57 | 8 |
| C-010 | B | Residence | 1 | 64 | 64 | 64 | 55 | 9 |
| C-011 | B | Residence | 3 | 67 | 68 | 67 | 58 | 8 |
| C-012 | B | Residence | 1 | 69 | 70 | 67 | 59 | 9 |
| C-013 | B | Residence | 1 | 71 | 72 | 68 | 60 | 9 |
| C-014 | B | Residence | 1 | 71 | 72 | 66 | 60 | 7 |
| C-015 | B | Residence | 1 | 68 | 69 | 64 | 59 | 5 |
| C-016 | B | Residence | 1 | 63 | 64 | 59 | 55 | 4 |
| C-017 | B | Residence | 3 | 68 | 69 | 63 | 61 | 2 |
| C-018 | B | Residence | 3 | 67 | 68 | 64 | 62 | 2 |
| C-019 | B | Residence | 3 | 67 | 68 | 63 | 61 | 1 |
| C-020 | B | Residence | 3 | 66 | 67 | 63 | 61 | 2 |
| C-021 | B | Residence | 1 | 67 | 67 | 66 | 61 | 5 |
| C-022 | B | Residence | 1 | 69 | 69 | 68 | 62 | 7 |
| C-023 | B | Residence | 1 | 69 | 70 | 69 | 62 | 7 |
| C-024 | B | Residence | 1 | 69 | 70 | 70 | 62 | 8 |
| C-025 | B | Residence | 1 | 70 | 71 | 71 | 62 | 9 |
| C-026 | B | Residence | 1 | 70 | 71 | 72 | 63 | 9 |
| C-027 | B | Residence | 2 | 60 | 61 | 61 | 60 | 0 |
| C-028 | B | Residence | 1 | 58 | 59 | 59 | 57 | 2 |

Noise level approaching or exceeding the NAC

Noise reduction of 5+ dBA

Noise reduction of 7+ dBA

| Receptor | NAC | Land Use | Dwelling Units | Modeled Noise Levels (dBA) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Existing | No Build | Build Alternative | | |
| | | | | | | No Barrier | With Barrier | Insertion Loss* |
| C-029 | B | Residence | 1 | 58 | 58 | 58 | 57 | 2 |
| C-030 | B | Residence | 1 | 57 | 58 | 59 | 57 | 2 |
| C-031 | B | Residence | 1 | 58 | 59 | 59 | 55 | 4 |
| C-032 | B | Residence | 1 | 60 | 61 | 60 | 55 | 5 |
| C-033 | B | Residence | 1 | 61 | 62 | 61 | 56 | 6 |
| C-034 | B | Residence | 3 | 63 | 64 | 63 | 56 | 7 |
| C-035 | B | Residence | 3 | 65 | 66 | 65 | 56 | 8 |
| C-036 | B | Residence | 1 | 66 | 67 | 66 | 56 | 9 |
| C-037 | B | Residence | 1 | 66 | 66 | 66 | 56 | 10 |
| C-038 | B | Residence | 1 | 66 | 67 | 66 | 57 | 9 |
| C-039 | B | Residence | 1 | 64 | 65 | 64 | 56 | 9 |
| C-040 | B | Residence | 1 | 62 | 63 | 62 | 54 | 8 |
| C-041 | B | Residence | 1 | 59 | 60 | 59 | 54 | 5 |
| C-042 | B | Residence | 1 | 60 | 61 | 60 | 55 | 5 |
| C-043 | B | Residence | 2 | 61 | 62 | 61 | 54 | 7 |
| C-044 | B | Residence | 3 | 61 | 62 | 61 | 54 | 7 |
| C-045 | B | Residence | 3 | 61 | 62 | 62 | 55 | 7 |
| C-046 | B | Residence | 5 | 58 | 59 | 58 | 52 | 6 |
| C-047 | B | Residence | 1 | 59 | 59 | 57 | 51 | 6 |
| C-048 | B | Residence | 1 | 59 | 60 | 58 | 52 | 6 |
| C-049 | B | Residence | 1 | 60 | 61 | 57 | 53 | 5 |
| C-050 | B | Residence | 1 | 64 | 64 | 60 | 56 | 5 |
| C-051 | B | Residence | 1 | 61 | 62 | 59 | 53 | 5 |
| C-052 | B | Residence | 1 | 60 | 61 | 58 | 53 | 5 |
| C-053 | B | Residence | 3 | 58 | 59 | 57 | 52 | 5 |
| C-054 | B | Residence | 3 | 55 | 56 | 54 | 49 | 5 |
| C-055 | B | Residence | 3 | 53 | 54 | 53 | 48 | 5 |
| C-056 | B | Residence | 3 | 49 | 49 | 49 | 47 | 2 |
| C-057 | B | Residence | 3 | 48 | 48 | 48 | 47 | 1 |
| C-058 | B | Residence | 3 | 48 | 49 | 49 | 49 | 0 |
| C-059 | B | Residence | 1 | 49 | 50 | 50 | 49 | 0 |
| C-060 | B | Residence | 1 | 48 | 49 | 49 | 48 | 0 |
| C-061 | B | Residence | 1 | 48 | 49 | 48 | 48 | 0 |
| C-062 | B | Residence | 3 | 58 | 59 | 58 | 57 | 1 |
| C-063 | B | Residence | 3 | 57 | 58 | 57 | 54 | 3 |
| C-064 | B | Residence | 4 | 55 | 56 | 56 | 50 | 6 |
| C-065 | B | Residence | 3 | 57 | 58 | 57 | 52 | 5 |
| C-066 | B | Residence | 5 | 48 | 49 | 48 | 47 | 2 |
| C-067 | B | Residence | 4 | 49 | 50 | 50 | 49 | 0 |
| C-068 | B | Residence | 5 | 58 | 59 | 58 | 58 | 0 |

| Noise level approaching or exceeding the NAC | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Noise reduction of 5+ dBA | | | | | | | | |
| Noise reduction of 7+ dBA | | | | | | | | |
| **Receptor** | **NAC** | **Land Use** | **Dwelling Units** | **Modeled Noise Levels (dBA)** | | | | |
| | | | | **Existing** | **No Build** | **Build Alternative** | | |
| | | | | | | **No Barrier** | **With Barrier** | **Insertion Loss*** |
| D-001 | B | Residence | 1 | 75 | 76 | 77 | 69 | 9 |
| D-002 | B | Residence | 1 | 65 | 65 | 65 | 60 | 5 |
| D-003 | B | Residence | 1 | 62 | 63 | 63 | 63 | 0 |
| D-004 | B | Residence | 1 | 59 | 60 | 61 | 61 | 0 |
| D-005 | B | Residence | 1 | 59 | 60 | 60 | 60 | 0 |
| D-006 | B | Residence | 1 | 57 | 58 | 58 | 58 | 0 |
| D-007 | B | Residence | 1 | 57 | 58 | 58 | 58 | 0 |
| D-008 | B | Residence | 1 | 53 | 53 | 53 | 53 | 0 |
| D-009 | B | Residence | 1 | 53 | 54 | 54 | 54 | 0 |
| E-001 | B | Residence | 1 | 72 | 73 | 72 | 67 | 6 |
| E-002 | B | Residence | 1 | 71 | 72 | 70 | 62 | 8 |
| E-003 | B | Residence | 1 | 70 | 71 | 70 | 63 | 7 |
| E-004 | B | Residence | 1 | 66 | 67 | 65 | 60 | 5 |
| E-005 | B | Residence | 1 | 67 | 68 | 65 | 60 | 5 |
| E-006 | B | Residence | 1 | 67 | 68 | 66 | 61 | 5 |
| E-007 | B | Residence | 1 | 67 | 68 | 65 | 61 | 5 |
| E-008 | B | Residence | 1 | 63 | 64 | 62 | 60 | 2 |
| E-009 | B | Residence | 1 | 64 | 65 | 62 | 59 | 4 |
| E-010 | B | Residence | 1 | 64 | 65 | 62 | 59 | 3 |
| E-011 | B | Residence | 1 | 64 | 65 | 62 | 59 | 3 |
| E-012 | B | Residence | 1 | 63 | 64 | 62 | 61 | 1 |
| E-013 | B | Residence | 1 | 62 | 63 | 61 | 59 | 2 |
| E-014 | B | Residence | 1 | 63 | 64 | 61 | 58 | 3 |
| E-015 | B | Residence | 1 | 62 | 63 | 60 | 58 | 1 |
| E-016 | B | Residence | 1 | 61 | 62 | 59 | 57 | 2 |
| E-017 | B | Residence | 1 | 62 | 63 | 60 | 58 | 2 |
| E-018 | B | Residence | 3 | 61 | 62 | 60 | 60 | 1 |
| E-019 | B | Residence | 3 | 59 | 60 | 58 | 57 | 1 |
| F-001 | B | Residence | 3 | 77 | 78 | 78 | 63 | 15 |
| F-002 | B | Residence | 3 | 76 | 77 | 77 | 62 | 14 |
| F-003 | B | Residence | 3 | 75 | 76 | 75 | 62 | 13 |
| F-004 | B | Residence | 3 | 74 | 74 | 74 | 61 | 13 |
| F-005 | B | Residence | 3 | 72 | 73 | 72 | 60 | 11 |
| F-006 | B | Residence | 3 | 70 | 71 | 69 | 59 | 10 |
| F-007 | B | Residence | 3 | 69 | 70 | 66 | 59 | 7 |
| F-008 | B | Residence | 2 | 68 | 69 | 65 | 58 | 6 |
| F-009 | B | Residence | 1 | 66 | 67 | 63 | 58 | 5 |
| F-010 | B | Residence | 1 | 66 | 67 | 62 | 58 | 4 |
| F-011 | B | Residence | 1 | 65 | 66 | 62 | 58 | 4 |

| Noise level approaching or exceeding the NAC | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Noise reduction of 5+ dBA | | | | | | | | |
| Noise reduction of 7+ dBA | | | | | | | | |
| **Receptor** | **NAC** | **Land Use** | **Dwelling Units** | **Modeled Noise Levels (dBA)** | | | | |
| | | | | **Existing** | **No Build** | **Build Alternative** | | |
| | | | | | | **No Barrier** | **With Barrier** | **Insertion Loss*** |
| F-012 | B | Residence | 1 | 64 | 65 | 61 | 58 | 4 |
| F-013 | B | Residence | 5 | 73 | 74 | 73 | 62 | 12 |
| F-014 | B | Residence | 5 | 72 | 73 | 72 | 62 | 11 |
| F-015 | B | Residence | 5 | 71 | 71 | 70 | 59 | 12 |
| F-016 | B | Residence | 5 | 68 | 69 | 67 | 58 | 9 |
| F-017 | B | Residence | 3 | 67 | 67 | 64 | 57 | 7 |
| F-018 | B | Residence | 2 | 65 | 66 | 63 | 58 | 6 |
| F-019 | B | Residence | 1 | 65 | 66 | 62 | 57 | 5 |
| F-020 | B | Residence | 1 | 64 | 65 | 62 | 57 | 4 |
| F-021 | B | Residence | 1 | 64 | 64 | 61 | 57 | 4 |
| F-022 | B | Residence | 1 | 63 | 64 | 60 | 57 | 3 |
| F-023 | B | Residence | 1 | 74 | 75 | 75 | 63 | 12 |
| F-024 | B | Residence | 1 | 73 | 74 | 74 | 63 | 11 |
| F-025 | B | Residence | 1 | 72 | 73 | 73 | 63 | 10 |
| F-026 | B | Residence | 1 | 71 | 72 | 72 | 62 | 10 |
| F-027 | B | Residence | 1 | 70 | 71 | 71 | 61 | 9 |
| F-028 | B | Residence | 2 | 69 | 70 | 70 | 61 | 8 |
| F-029 | B | Residence | 2 | 68 | 69 | 69 | 62 | 6 |
| F-030 | B | Residence | 1 | 66 | 67 | 67 | 60 | 6 |
| F-031 | B | Residence | 5 | 70 | 71 | 71 | 63 | 7 |
| F-032 | B | Residence | 5 | 70 | 71 | 71 | 63 | 7 |
| F-033 | B | Residence | 2 | 69 | 70 | 70 | 63 | 7 |
| F-034 | B | Residence | 3 | 64 | 65 | 64 | 61 | 4 |
| F-035 | B | Residence | 3 | 64 | 65 | 65 | 61 | 4 |
| F-036 | B | Residence | 1 | 64 | 65 | 65 | 60 | 4 |
| F-037 | B | Residence | 1 | 65 | 65 | 64 | 61 | 3 |
| F-038 | B | Residence | 3 | 65 | 66 | 64 | 61 | 3 |
| F-039 | B | Residence | 3 | 66 | 67 | 65 | 61 | 4 |
| F-040 | B | Residence | 3 | 66 | 67 | 65 | 61 | 5 |
| F-041 | B | Residence | 3 | 66 | 67 | 65 | 61 | 5 |
| F-042 | B | Residence | 1 | 66 | 67 | 64 | 61 | 4 |
| F-043 | B | Residence | 2 | 64 | 64 | 64 | 59 | 5 |
| F-044 | B | Residence | 2 | 63 | 64 | 63 | 58 | 4 |
| F-045 | B | Residence | 3 | 58 | 59 | 58 | 58 | 0 |
| F-046 | B | Residence | 3 | 60 | 61 | 59 | 59 | 0 |
| F-047 | B | Residence | 3 | 61 | 62 | 61 | 58 | 4 |
| F-048 | B | Residence | 3 | 59 | 60 | 60 | 56 | 3 |

*Noise values, comparisons, and insertion losses are calculated to the tenth of a dBA and then rounded for presentation purposes.

# Appendix G

## Point of Diminishing Acoustical Return on Barrier Height

| Barrier | Dwelling Units | Impacted | Abatement Metrics | Optimized Design** | NBOT Height Scenario (feet) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| B | 221 | 65 | Benefited @ 5 dBA | **105** | 24 | 56 | 66 | 82 | 91 | **105** | 114 | 121 | 124 | 126 | 130 | 134 |
| | | | Impacted & Benefited @ 7 dBA | **61** | 0 | 17 | 28 | 47 | 56 | **61** | 61 | 61 | 61 | 61 | 61 | 61 |
| | | | Area (square feet) | **48,264** | 21,676 | 27,095 | 32,514 | 37,933 | 43,352 | **48,771** | 54,190 | 59,609 | 65,028 | 70,447 | 75,866 | 81,285 |
| | | | Effectiveness / Cost Ratio* | **31.4** | 0.0 | 8.3 | 13.5 | 24.0 | 27.8 | **31.1** | 30.4 | 29.3 | 27.5 | 25.8 | 24.7 | 23.8 |
| C | 124 | 21 | Benefited @ 5 dBA | **71** | 10 | 35 | 41 | 51 | **71** | 72 | 72 | 79 | 82 | 88 | 89 | 89 |
| | | | Impacted & Benefited @ 7 dBA | **17** | 0 | 5 | 12 | 15 | **17** | 17 | 18 | 19 | 20 | 21 | 21 | 21 |
| | | | Area (square feet) | **31,050** | 16,284 | 20,468 | 25,477 | 30,555 | **37,829** | 43,068 | 48,307 | 53,547 | 58,785 | 64,024 | 69,264 | 74,503 |
| | | | Effectiveness / Cost Ratio* | **88.1** | 0.0 | 19.4 | 43.8 | 56.8 | **72.4** | 64.4 | 60.8 | 63.6 | 63.3 | 65.5 | 61.2 | 56.9 |
| F | 115 | 63 | Benefited @ 5 dBA | **80** | 6 | 33 | 42 | 53 | 67 | 72 | **80** | 81 | 81 | 83 | 84 | 84 |
| | | | Impacted & Benefited @ 7 dBA | **60** | 0 | 0 | 12 | 39 | 42 | 45 | **60** | 62 | 63 | 63 | 63 | 63 |
| | | | Area (square feet) | **28,736** | 10,065 | 12,582 | 15,098 | 17,614 | 20,130 | 22,647 | **25,163** | 27,679 | 30,196 | 32,712 | 35,228 | 37,745 |
| | | | Effectiveness / Cost Ratio* | **42.1** | 0.0 | 0.0 | 8.4 | 29.6 | 35.2 | 36.0 | **48.1** | 45.7 | 42.6 | 40.3 | 37.8 | 35.3 |

*The data bar compares each E/C to the twelve height scenarios studied. When a data bar is full (indicated by a red border,) the point of diminishing acoustical return on increasing barrier height is met.

**Abatement metrics for the recommended noise barrier design that achieves the optimal balance between minimizing cost and maximizing benefit.

# Appendix H

## Warranted, Feasible, and Reasonable Worksheets

**Highway Traffic Noise Abatement**
**Warranted, Feasible, and Reasonable Worksheet – Noise Wall**

| | |
|---|---|
| Date | 3/1/2018 |
| Project Name | State Route (SR) 0422 Pottstown Bypass Express Reconstruction Project |
| County | Montgomery |
| SR, Section | SR 0422, Section M1B |
| Community Name and/or NSA # | NSA A |
| Noise Wall Identification (i.e., Wall 1) | N/A |

General

| | |
|---|---|
| 1. Type of project (new location, reconstruction, etc.): | Reconstruction |

2. Total number of impacted receptor units in community

| | |
|---|---|
| Category A units impacted | 0 |
| Category B units impacted | 0 |
| Category C units impacted | 0 |
| Category D units impacted (if interior analysis required) | 0 |
| Category E units impacted | 0 |

Warranted

1. Community Documentation

| | |
|---|---|
| a. Date community was permitted (for new developments or developments planned for or under construction) | N/A |
| b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): | CEE 5/17/2006<br>CE Re-Evaluation 12/22/2010 |

c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate* ."

N/A Yes N/A No

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.

| | | |
|---|---|---|
| a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? | ____ Yes | ✓ No |
| b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? | ____ Yes | ✓ No |
| c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? | ____ Yes | ✓ No |

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

1. Impacted receptor units
   a. Total number of impacted receptor units: N/A
   b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: N/A
   c. Is the percentage 50 or greater? N/A Yes N/A No
2. Can the noise wall be designed and physically constructed at the proposed location? N/A Yes N/A No
3. Can the noise wall be constructed without causing a safety problem? N/A Yes N/A No
4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? N/A Yes N/A No
5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? N/A Yes N/A No
6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? N/A Yes N/A No
7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? N/A Yes N/A No

Reasonableness

1. Community Desires Related to the Barrier
   a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." N/A Yes N/A No

2. Square Footage Per Benefited Receptor (SF/BR) Evaluation
   a. Area (SF) of the proposed noise wall N/A
   b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) N/A
   c. SF/BR = 2a/2b N/A
   d. Is 2c less than or equal to the MaxSF/BR value of 2000? N/A Yes N/A No

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

a. Does the noise wall reduce design year exterior noise levels by at least 7 dB(A) for at least one benefited receptor? N/A Yes N/A No

b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? N/A Yes N/A No

c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? N/A Yes N/A No

d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? N/A Yes N/A No

e. Does the noise wall reduce design year noise levels back to existing levels? N/A Yes N/A No

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

a. Does noise wall reduce design year interior noise levels by at least 7 dB(A) for the facility's analysis point? N/A Yes N/A No

b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum N/A Yes N/A No

Decision

| | | | | |
|---|---|---|---|---|
| Is the Noise Wall WARRANTED? | | Yes | ✓ | No |
| Is the Noise Wall FEASIBLE? | N/A | Yes | N/A | No |
| Is the Noise Wall REASONABLE? | N/A | Yes | N/A | No |

Additional Reasons for Decision:

Responsible/Qualified Individuals Making the Above Decisions

| | |
|---|---|
| PennDOT, Engineering District Environmental Manager | Date |
| Miles Cheang, Traffic Noise Abatement Specialist, Jacobs Engineering | 3/1/2018 |
| Qualified Professional Performing the Analysis (name, title, and company name) | Date |

**Highway Traffic Noise Abatement**
**Warranted, Feasible, and Reasonable Worksheet – Noise Wall**

| | |
|---|---|
| Date | 3/1/2018 |
| Project Name | State Route (SR) 0422 Pottstown Bypass Express Reconstruction Project |
| County | Montgomery |
| SR, Section | SR 0422, Section M1B |
| Community Name and/or NSA # | NSA B |
| Noise Wall Identification (i.e., Wall 1) | Barrier B |

General

| | |
|---|---|
| 1. Type of project (new location, reconstruction, etc.): | Reconstruction |

2. Total number of impacted receptor units in community

| | |
|---|---|
| Category A units impacted | 0 |
| Category B units impacted | 63 |
| Category C units impacted | 2 |
| Category D units impacted (if interior analysis required) | 0 |
| Category E units impacted | 0 |

Warranted

1. Community Documentation

| | |
|---|---|
| a. Date community was permitted (for new developments or developments planned for or under construction) | N/A |
| b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): | CEE 5/17/2006<br>CE Re-Evaluation 12/22/2010 |

c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate* ."

N/A Yes N/A No

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.

| | | |
|---|---|---|
| a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? | ✓ Yes | No |
| b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? | Yes | ✓ No |
| c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? | Yes | ✓ No |

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

| | | |
|---|---|---|
| 1. Impacted receptor units | | |
| a. Total number of impacted receptor units: | 65 | |
| b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: | 95% | |
| c. Is the percentage 50 or greater? | ✓ Yes | No |
| 2. Can the noise wall be designed and physically constructed at the proposed location? | ✓ Yes | No |
| 3. Can the noise wall be constructed without causing a safety problem? | ✓ Yes | No |
| 4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? | ✓ Yes | No |
| 5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? | ✓ Yes | No |
| 6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? | ✓ Yes | No |
| 7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? | ✓ Yes | No |

Reasonableness

| | | |
|---|---|---|
| 1. Community Desires Related to the Barrier | | |
| a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." | TBD Yes | TBD No |
| 2. Square Footage Per Benefited Receptor (SF/BR) Evaluation | | |
| a. Area (SF) of the proposed noise wall | 48,264 | |
| b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) | 105 | |
| c. SF/BR = 2a/2b | 460 | |
| d. Is 2c less than or equal to the MaxSF/BR value of 2000? | ✓ Yes | No |

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

| | | |
|---|---|---|
| a. Does the noise wall reduce design year exterior noise levels by at least 7 dB(A) for at least one benefited receptor? | ✓ Yes | No |
| b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? | ✓ Yes | No |
| c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? | ✓ Yes | No |
| d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? | ✓ Yes | No |
| e. Does the noise wall reduce design year noise levels back to existing levels? | ✓ Yes | No |

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

| | | |
|---|---|---|
| a. Does noise wall reduce design year interior noise levels by at least 7 dB(A) for the facility's analysis point? | N/A Yes | N/A No |
| b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum | N/A Yes | N/A No |

Decision

| | | |
|---|---|---|
| Is the Noise Wall WARRANTED? | ✓ Yes | No |
| Is the Noise Wall FEASIBLE? | ✓ Yes | No |
| Is the Noise Wall REASONABLE? | ✓ Yes | No |

Additional Reasons for Decision:

Responsible/Qualified Individuals Making the Above Decisions

| | |
|---|---|
| PennDOT, Engineering District Environmental Manager | Date |
| Miles Cheang, Traffic Noise Abatement Specialist, Jacobs Engineering | 3/1/2018 |
| Qualified Professional Performing the Analysis (name, title, and company name) | Date |

**Highway Traffic Noise Abatement**
**Warranted, Feasible, and Reasonable Worksheet – Noise Wall**

| | |
|---|---|
| Date | 3/1/2018 |
| Project Name | State Route (SR) 0422 Pottstown Bypass Express Reconstruction Project |
| County | Montgomery |
| SR, Section | SR 0422, Section M1B |
| Community Name and/or NSA # | NSA C |
| Noise Wall Identification (i.e., Wall 1) | Barrier C |

General

| | |
|---|---|
| 1. Type of project (new location, reconstruction, etc.): | Reconstruction |

2. Total number of impacted receptor units in community

| | |
|---|---|
| Category A units impacted | 0 |
| Category B units impacted | 21 |
| Category C units impacted | 0 |
| Category D units impacted (if interior analysis required) | 0 |
| Category E units impacted | 0 |

Warranted

1. Community Documentation

| | |
|---|---|
| a. Date community was permitted (for new developments or developments planned for or under construction) | N/A |
| b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): | CEE 5/17/2006<br>CE Re-Evaluation 12/22/2010 |

c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate* ."

N/A Yes N/A No

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.

| | | |
|---|---|---|
| a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? | ✓ Yes | No |
| b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? | Yes | ✓ No |
| c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? | Yes | ✓ No |

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

| | | |
|---|---|---|
| 1. Impacted receptor units | | |
| a. Total number of impacted receptor units: | 21 | |
| b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: | 100% | |
| c. Is the percentage 50 or greater? | ✓ Yes | No |
| 2. Can the noise wall be designed and physically constructed at the proposed location? | ✓ Yes | No |
| 3. Can the noise wall be constructed without causing a safety problem? | ✓ Yes | No |
| 4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? | ✓ Yes | No |
| 5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? | ✓ Yes | No |
| 6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? | ✓ Yes | No |
| 7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? | ✓ Yes | No |

Reasonableness

| | | |
|---|---|---|
| 1. Community Desires Related to the Barrier | | |
| a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." | TBD Yes | TBD No |
| 2. Square Footage Per Benefited Receptor (SF/BR) Evaluation | | |
| a. Area (SF) of the proposed noise wall | 31,050 | |
| b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) | 71 | |
| c. SF/BR = 2a/2b | 437 | |
| d. Is 2c less than or equal to the MaxSF/BR value of 2000? | ✓ Yes | No |

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

| | | |
|---|---|---|
| a. Does the noise wall reduce design year exterior noise levels by at least 7 dB(A) for at least one benefited receptor? | ✓ Yes | No |
| b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? | ✓ Yes | No |
| c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? | ✓ Yes | No |
| d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? | ✓ Yes | No |
| e. Does the noise wall reduce design year noise levels back to existing levels? | ✓ Yes | No |

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

| | | |
|---|---|---|
| a. Does noise wall reduce design year interior noise levels by at least 7 dB(A) for the facility's analysis point? | N/A Yes | N/A No |
| b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum | N/A Yes | N/A No |

Decision

| | | |
|---|---|---|
| Is the Noise Wall WARRANTED? | ✓ Yes | No |
| Is the Noise Wall FEASIBLE? | ✓ Yes | No |
| Is the Noise Wall REASONABLE? | ✓ Yes | No |

Additional Reasons for Decision:

Responsible/Qualified Individuals Making the Above Decisions

| | |
|---|---|
| PennDOT, Engineering District Environmental Manager | Date |
| Miles Cheang, Traffic Noise Abatement Specialist, Jacobs Engineering | 3/1/2018 |
| Qualified Professional Performing the Analysis (name, title, and company name) | Date |

**Highway Traffic Noise Abatement**
**Warranted, Feasible, and Reasonable Worksheet – Noise Wall**

| | |
|---|---|
| Date | 3/1/2018 |
| Project Name | State Route (SR) 0422 Pottstown Bypass Express Reconstruction Project |
| County | Montgomery |
| SR, Section | SR 0422, Section M1B |
| Community Name and/or NSA # | NSA D |
| Noise Wall Identification (i.e., Wall 1) | Barrier D |

General

| | |
|---|---|
| 1. Type of project (new location, reconstruction, etc.): | Reconstruction |

2. Total number of impacted receptor units in community

| | |
|---|---|
| Category A units impacted | 0 |
| Category B units impacted | 1 |
| Category C units impacted | 0 |
| Category D units impacted (if interior analysis required) | 0 |
| Category E units impacted | 0 |

Warranted

1. Community Documentation

| | |
|---|---|
| a. Date community was permitted (for new developments or developments planned for or under construction) | N/A |
| b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): | CEE 5/17/2006<br>CE Re-Evaluation 12/22/2010 |

c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate* ."

N/A Yes N/A No

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.

| | | |
|---|---|---|
| a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? | ✓ Yes | No |
| b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? | Yes | ✓ No |
| c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? | Yes | ✓ No |

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

| | | |
|---|---|---|
| 1. Impacted receptor units | | |
| a. Total number of impacted receptor units: | 1 | |
| b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: | 100% | |
| c. Is the percentage 50 or greater? | ✓ Yes | No |
| 2. Can the noise wall be designed and physically constructed at the proposed location? | ✓ Yes | No |
| 3. Can the noise wall be constructed without causing a safety problem? | ✓ Yes | No |
| 4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? | ✓ Yes | No |
| 5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? | ✓ Yes | No |
| 6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? | ✓ Yes | No |
| 7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? | ✓ Yes | No |

Reasonableness

| | | |
|---|---|---|
| 1. Community Desires Related to the Barrier | | |
| a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." | N/A Yes | N/A No |
| 2. Square Footage Per Benefited Receptor (SF/BR) Evaluation | | |
| a. Area (SF) of the proposed noise wall | 5,085 | |
| b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) | 2 | |
| c. SF/BR = 2a/2b | 2,543 | |
| d. Is 2c less than or equal to the MaxSF/BR value of 2000? | Yes | ✓ No |

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

| | | |
|---|---|---|
| a. Does the noise wall reduce design year exterior noise levels by at least 7 dB(A) for at least one benefited receptor? | ✓ Yes | No |
| b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? | Yes | ✓ No |
| c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? | Yes | ✓ No |
| d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? | Yes | ✓ No |
| e. Does the noise wall reduce design year noise levels back to existing levels? | ✓ Yes | No |

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

| | | |
|---|---|---|
| a. Does noise wall reduce design year interior noise levels by at least 7 dB(A) for the facility's analysis point? | N/A Yes | N/A No |
| b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum | N/A Yes | N/A No |

Decision

| | | |
|---|---|---|
| Is the Noise Wall WARRANTED? | ✓ Yes | No |
| Is the Noise Wall FEASIBLE? | ✓ Yes | No |
| Is the Noise Wall REASONABLE? | Yes | ✓ No |

Additional Reasons for Decision:

Responsible/Qualified Individuals Making the Above Decisions

| | |
|---|---|
| PennDOT, Engineering District Environmental Manager | Date |
| Miles Cheang, Traffic Noise Abatement Specialist, Jacobs Engineering | 3/1/2018 |
| Qualified Professional Performing the Analysis (name, title, and company name) | Date |

**Highway Traffic Noise Abatement**
**Warranted, Feasible, and Reasonable Worksheet – Noise Wall**

| | |
|---|---|
| Date | 3/1/2018 |
| Project Name | State Route (SR) 0422 Pottstown Bypass Express Reconstruction Project |
| County | Montgomery |
| SR, Section | SR 0422, Section M1B |
| Community Name and/or NSA # | NSA E |
| Noise Wall Identification (i.e., Wall 1) | Barrier E |

General

| | |
|---|---|
| 1. Type of project (new location, reconstruction, etc.): | Reconstruction |

2. Total number of impacted receptor units in community

| | |
|---|---|
| Category A units impacted | 0 |
| Category B units impacted | 4 |
| Category C units impacted | 0 |
| Category D units impacted (if interior analysis required) | 0 |
| Category E units impacted | 0 |

Warranted

1. Community Documentation

| | |
|---|---|
| a. Date community was permitted (for new developments or developments planned for or under construction) | N/A |
| b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): | CEE 5/17/2006<br>CE Re-Evaluation 12/22/2010 |

c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate* ."

N/A Yes N/A No

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.

| | | |
|---|---|---|
| a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? | ✓ Yes | No |
| b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? | Yes | ✓ No |
| c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? | Yes | ✓ No |

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

| | | |
|---|---|---|
| 1. Impacted receptor units | | |
| a. Total number of impacted receptor units: | 4 | |
| b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: | 100% | |
| c. Is the percentage 50 or greater? | ✓ Yes | No |
| 2. Can the noise wall be designed and physically constructed at the proposed location? | ✓ Yes | No |
| 3. Can the noise wall be constructed without causing a safety problem? | ✓ Yes | No |
| 4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? | ✓ Yes | No |
| 5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? | ✓ Yes | No |
| 6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? | ✓ Yes | No |
| 7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? | ✓ Yes | No |

Reasonableness

| | | |
|---|---|---|
| 1. Community Desires Related to the Barrier | | |
| a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." | N/A Yes | N/A No |
| 2. Square Footage Per Benefited Receptor (SF/BR) Evaluation | | |
| a. Area (SF) of the proposed noise wall | 15,184 | |
| b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) | 7 | |
| c. SF/BR = 2a/2b | 2,169 | |
| d. Is 2c less than or equal to the MaxSF/BR value of 2000? | Yes | ✓ No |

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

| | | |
|---|---|---|
| a. Does the noise wall reduce design year exterior noise levels by at least 7 dB(A) for at least one benefited receptor? | ✓ Yes | No |
| b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? | Yes | ✓ No |
| c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? | Yes | ✓ No |
| d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? | Yes | ✓ No |
| e. Does the noise wall reduce design year noise levels back to existing levels? | ✓ Yes | No |

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

| | | |
|---|---|---|
| a. Does noise wall reduce design year interior noise levels by at least 7 dB(A) for the facility's analysis point? | N/A Yes | N/A No |
| b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum | N/A Yes | N/A No |

Decision

| | | |
|---|---|---|
| Is the Noise Wall WARRANTED? | ✓ Yes | No |
| Is the Noise Wall FEASIBLE? | ✓ Yes | No |
| Is the Noise Wall REASONABLE? | Yes | ✓ No |

Additional Reasons for Decision:

Responsible/Qualified Individuals Making the Above Decisions

| | |
|---|---|
| PennDOT, Engineering District Environmental Manager | Date |
| Miles Cheang, Traffic Noise Abatement Specialist, Jacobs Engineering | 3/1/2018 |
| Qualified Professional Performing the Analysis (name, title, and company name) | Date |

**Highway Traffic Noise Abatement**
**Warranted, Feasible, and Reasonable Worksheet – Noise Wall**

| | |
|---|---|
| Date | 3/1/2018 |
| Project Name | State Route (SR) 0422 Pottstown Bypass Express Reconstruction Project |
| County | Montgomery |
| SR, Section | SR 0422, Section M1B |
| Community Name and/or NSA # | NSA F |
| Noise Wall Identification (i.e., Wall 1) | Barrier F |

General

| | |
|---|---|
| 1. Type of project (new location, reconstruction, etc.): | Reconstruction |

2. Total number of impacted receptor units in community

| | |
|---|---|
| Category A units impacted | 0 |
| Category B units impacted | 63 |
| Category C units impacted | 0 |
| Category D units impacted (if interior analysis required) | 0 |
| Category E units impacted | 0 |

Warranted

1. Community Documentation

| | |
|---|---|
| a. Date community was permitted (for new developments or developments planned for or under construction) | N/A |
| b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): | CEE 5/17/2006<br>CE Re-Evaluation 12/22/2010 |

c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of *CE, ROD, or FONSI, as appropriate* ."

N/A Yes N/A No

2. Criteria requiring consideration of noise abatement (note N/A if category is not impacted or present or analysis not required). A "yes" answer to any of the following three questions requires the consideration of noise abatement.

| | | |
|---|---|---|
| a. With the proposed project, are design year noise levels predicted to approach or exceed the NAC level(s) in Table 1? | ✓ Yes | No |
| b. With the proposed project, is there predicted to be a substantial design year noise level increase of 10 dB(A) or more at Activity Category A, B, C, D, or E receptor(s)? | Yes | ✓ No |
| c. With the proposed project, are design year noise levels predicted to be less than existing noise levels, but still approach or exceed the NAC levels in Table 1 for the relevant Activity Category? | Yes | ✓ No |

Feasibility – Questions 1c through 7 must all be answered "yes" for a noise barrier to be determined to be feasible.

| | | |
|---|---|---|
| 1. Impacted receptor units | | |
| a. Total number of impacted receptor units: | 63 | |
| b. Percentage of impacted receptor units receiving 5 dB(A) or more insertion loss: | 100% | |
| c. Is the percentage 50 or greater? | ✓ Yes | No |
| 2. Can the noise wall be designed and physically constructed at the proposed location? | ✓ Yes | No |
| 3. Can the noise wall be constructed without causing a safety problem? | ✓ Yes | No |
| 4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? | ✓ Yes | No |
| 5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? | ✓ Yes | No |
| 6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? | ✓ Yes | No |
| 7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? | ✓ Yes | No |

Reasonableness

| | | |
|---|---|---|
| 1. Community Desires Related to the Barrier | | |
| a. Do at least 50 percent of the responding benefited receptor unit owner(s) and renters desire the noise wall? If yes, continue with Reasonableness questions. If no, the noise wall can be considered not to be reasonable. Proceed to "Decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the benefited receptor unit owners do not desire the noise wall." | TBD Yes | TBD No |
| 2. Square Footage Per Benefited Receptor (SF/BR) Evaluation | | |
| a. Area (SF) of the proposed noise wall | 28,736 | |
| b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss) | 80 | |
| c. SF/BR = 2a/2b | 359 | |
| d. Is 2c less than or equal to the MaxSF/BR value of 2000? | ✓ Yes | No |

3. Noise Reduction Design Goals (Activity Categories A, B, C, and E) A "yes" answer is required to Question 3a. for the noise wall to be determined to be reasonable. Questions 3b through 3e represent desirable goals that need not be met for a noise wall to be determined reasonable. However, they must be addressed and should be considered in the determination of the recommended noise wall.

| | | |
|---|---|---|
| a. Does the noise wall reduce design year exterior noise levels by at least 7 dB(A) for at least one benefited receptor? | ✓ Yes | No |
| b. Does the noise wall provide an insertion loss of at least 7 dB(A) for more receptors than required under 3a.while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? | ✓ Yes | No |
| c. Does the noise wall provide insertion losses of greater than 7 dB(A) while still conforming to the MaxSF/BR value of 2,000 and a "point of diminishing returns" evaluation? | ✓ Yes | No |
| d. Does the noise wall reduce future exterior levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60 dB(A) range (65-68) for Category E receptors? | ✓ Yes | No |
| e. Does the noise wall reduce design year noise levels back to existing levels? | ✓ Yes | No |

4. Noise Reduction Design Goals (Activity Category D) A "yes" answer is required to Question 4a. for the barrier to be determined to be reasonable. Question 4b represents a desirable goal that need not be met for a noise wall to be determined reasonable. However, this goal must be addressed and should be considered in the determination of the recommended noise wall.

| | | |
|---|---|---|
| a. Does noise wall reduce design year interior noise levels by at least 7 dB(A) for the facility's analysis point? | N/A Yes | N/A No |
| b. While conforming to the MaxSF/BR criteria and justified by a "point of diminishing returns' evaluation, does the noise wall provide an interior insertion loss above the 7 dB(A) minimum | N/A Yes | N/A No |

Decision

| | | |
|---|---|---|
| Is the Noise Wall WARRANTED? | ✓ Yes | No |
| Is the Noise Wall FEASIBLE? | ✓ Yes | No |
| Is the Noise Wall REASONABLE? | ✓ Yes | No |

Additional Reasons for Decision:

Responsible/Qualified Individuals Making the Above Decisions

| | |
|---|---|
| PennDOT, Engineering District Environmental Manager | Date |
| Miles Cheang, Traffic Noise Abatement Specialist, Jacobs Engineering | 3/1/2018 |
| Qualified Professional Performing the Analysis (name, title, and company name) | Date |

# Appendix I

## List of Preparers

# List of Preparers/Reviewers

**Jacobs Engineering**

**Dilip Radadia, PE**
Manager of Highways
Education: B.S., Civil Engineering
Professional Experience: 35 Years
Role: SR 0422 Project Manager

**Tom Cornell, PE**
Project Manager
Education: B.S., Civil Engineering
Professional Experience: 12 Years
Role: QA/QC, Report Preparation

**Sai Meing, PE**
Highway Engineer
Education: B.S., Civil Engineering
Professional Experience: 4 Years
Role: 3-D Roadway Surface Modeling

**Miles Cheang**
Environmental Planner, Principal Noise & Air
Education: B.A., Urban Planning
Professional Experience: 12 Years
Role: Noise Monitoring, Model Development, Impact and Abatement Analysis, Report Preparation

**Dana Ragusa**
Environmental Planner
Education: B.S., Environmental Science
Professional Experience: 17 years
Role: Noise Modeling, Report Preparation

**Thanh Le**
Transportation Engineer
Education: B.S., Civil Engineering
Professional Experience: 6 Years
Role: Report Preparation, Graphics, QA/QC

# Appendix J

## Noise Abatement Report Forms

## (To be included when available)