PENNSYLVANIA TURNPIKE COMMISSION | MON/FAYETTE TRANSPORTATION PROJECT PA ROUTE 51 TO I-376

FINAL DESIGN NOISE ANALYSIS REPORT

Construction Section 53A2
Borough of West Mifflin
Allegheny County, Pennsylvania

Prepared for:

U.S. Department of Transportation
Federal Highway Administration

and

Commonwealth of Pennsylvania
Pennsylvania Turnpike Commission

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1.0 EXECUTIVE SUMMARY

The Pennsylvania Turnpike Commission (PTC) is currently in the final design engineering phase for Construction Section 53A2 of the Mon/Fayette Expressway (MFE) project in the Borough of West Mifflin, Allegheny County, Pennsylvania. **Figure 1** provides a Project Location Map to present the limits of the project area on USGS Quadrangle Mapping.

To support the MFE Reevaluation of the Final Environmental Impact Statement (FEIS), the 2017 MFE Preliminary Engineering Noise Analysis Report was developed and then reviewed and approved by FHWA on April 10, 2017. The Preliminary Engineering Noise Analysis provides a complete assessment of the noise environment and traffic noise abatement recommendations considered for the entire project corridor (from PA Route 51 to I-376) during the preliminary engineering design phase. The FEIS Reevaluation for the project was approved on March 8, 2019. This Final Design Noise Analysis Report documents the portion of the larger project area that falls within Construction Section 53A2, centered along Camp Hollow Road between Coal Valley Road and Curry Hollow Road in West Mifflin, PA.

The project proposes to construct a new four-lane, limited access, tolled expressway to provide safe and efficient regional transportation improvements. Construction Section 53A2 will also include a proposed interchange at Camp Hollow Road, featuring a relocation of Camp Hollow Road and incorporation of two roundabouts and associated mainline access ramps. Additionally, there will be local improvements to the Camp Hollow Road/Lebanon Church Road intersection, adjacent to the Allegheny County Airport.

The proposed project is considered a Type 1 Transportation Improvement Project and is eligible for consideration of noise abatement, if warranted, following the final design noise analyses and community input regarding the desire for noise abatement in the corridor. The "Type 1" determination is based on the magnitude of the proposed improvements, as described below:

- the construction of a new four-lane highway and associated ramp access on new location; and
- substantial horizontal and vertical alteration of relocated Camp Hollow Road.

This final design analysis documents existing (2015) and design year (2045) traffic noise conditions within the MFE Section 53A2 corridor. The noise analysis involved noise monitoring of existing conditions, and noise modeling of existing and future conditions using the Federal Highway Administration (FHWA) Traffic Noise Model (TNM), version 2.5. Noise modeling was performed to predict noise levels throughout the project area under worst-case, peak-hour traffic conditions associated with existing conditions, the design year No-Build Alternative, and the design year Build Alternative.

Note that Section 53A2 includes portions of five Noise Study Areas (NSAs) from the preliminary engineering phase: NSAs 5, 36, 37, 38 and 39. These NSAs are depicted on

Figure 2. However, assessment of NSA 5 has been excluded from this analysis as the acoustically-dominant portions of the proposed roadways and any potential abatement features relevant to impacted parcels within NSA 5 (located east of the relocated Camp Hollow Road roundabouts and ramps) would be constructed under Section 53B1A contracts and schedules. A separate Section 53B1A Final Design Noise Analysis Report will be developed and include recommendations relative to NSA 5.

Design changes have been proposed to the Camp Hollow Road Interchange subsequent to approval of the preliminary engineering noise analysis. This action necessitated supplemental impact and abatement assessment during final design. Changes to predicted noise levels due to revised engineering design do not affect the original recommendations for three of the remaining NSAs in Section 53A2 (NSAs 37, 38 and 39), as they are not located in close proximity to the interchange. A 'due-diligence' review of prior and current roadway and grading design confirmed the preliminary engineering results; therefore, those NSAs have been excluded from discussion in this final design noise analysis. These NSAs were not found to be impacted, and therefore abatement consideration was not warranted.

Changes to the interchange design do have an effect on the preliminary engineering results for NSA 36, which had identified that although abatement was warranted, it was not feasible and/or reasonable due to the requirement to maintain vehicular and/or pedestrian access to the impacted parcels, all directly adjacent to Camp Hollow Road. The results of the updated final design analysis indicate that noise levels are still anticipated to approach or exceed the PennDOT/FHWA Noise Abatement Criteria (NAC) at multiple noise sensitive receptors within NSA 36. Therefore, an evaluation of noise abatement was warranted. Abatement in the form of a vertical noise barrier has been identified to be both feasible and reasonable for a portion of the identified impacted areas. This Section 53A2 final design noise analysis documents noise abatement evaluation for NSA 36.

Following PTC/FHWA review and approval of the Draft Final Design Highway Traffic Noise Report, the project team will initiate noise-specific public involvement activities. This allows the community the opportunity to provide input based on the proposed location, type, height, length, and other aesthetic considerations of the noise abatement feature.

A Final Report will be developed to comprehensively document reasonableness of the proposed abatement alternative shown on **Figure 2 and Figure 3** of this report, including barrier-specific feedback received as a result of public outreach.

2.0 INTRODUCTION

The PTC has authorized the development of final design engineering for Section 53A2 of the MFE, located in the Borough of West Mifflin in Allegheny County, Pennsylvania. **Figure 1** provides a Project Location Map to present the limits of the project area on USGS Quadrangle Mapping.

MFE Section 53A2 involves the construction of an approximate 1.9-mile new four-lane, limited access, tolled expressway on new location. Proposed improvements will also include an interchange at Camp Hollow Road, featuring a relocation of Camp Hollow Road to the east, elevation of the local roadway over the top of the new four-lane roadway, and incorporation of two roundabouts and associated mainline access ramps, serving both northbound and southbound mainline travel patterns. Additionally, there will be local improvements to the Camp Hollow Road/ Lebanon Church Road intersection, adjacent to the Allegheny County Airport. Note that no noise sensitive land use was identified in close proximity to this local intersection, and therefore no analysis of that design feature/area is included in either the preliminary engineering or final design noise analysis. The limits of work extend from approximately .4 miles south of the New England Road/Camp Hollow Road intersection to approximately .5 miles north of the Camp Hollow Road/Lebanon School Road intersection. The relocated section of Camp Hollow Road extends approximately 3,700 feet, from the Philip Murray Road intersection north to the Skyport Road intersection.

Section 53A2 is one of seven (7) construction sections currently undergoing final design refinement. Section 53A1 is located directly south of Section 53A2, and extends from the termination of existing SR 43 (near the existing crossing over PA 51) to north of Coal Valley Road. Section 53B1A is adjacent to the north, and extends to just north of Pittsburgh McKeesport Boulevard/Richland Avenue. Section 53B2 continues north of Section 53B1A to south of Homeville Road. Section 53C1 runs from Homeville Road to a new interchange (Exit 61) and connector road to a new Overland Avenue Extension. Section 53C2 is centered on improvements to the local roadway network adjacent to proposed Exit 61 including Commonwealth Avenue and Hoffman Boulevard in Duquesne. Section 53C3 is the northernmost construction section, and includes tie-ins to PA Route 837 (Duquesne Boulevard) as well as a new Lower Connector Road to a proposed Overland Avenue Extension.

The purpose of the southern portion of the MFE project (of which Section 53A2 is a part) is to provide safe, efficient transportation improvements from PA Route 51 in the Borough of Jefferson Hills to PA Route 837 in the City of Duquesne. These improvements will complement the regional transportation network, improve roadway capacity, improve safety of the traveling public, enhance accessibility to social and emergency services and support economic development and redevelopment of brownfield sites within the Monongahela River Valley.

Noise sensitive land uses are present in the project corridor. Land use relevant to this study is primarily composed of single-family detached residences, as well as the Clara Barton

Elementary School. Residential parcels are generally oriented in low-density clusters, with the exception of the community represented as NSA 36, centered around Camp Hollow Road and Lebanon Manor Drive.

A comprehensive noise analysis of the project area was conducted during the preliminary engineering phase of the project. This assessment is documented in the "Mon/Fayette Transportation Project, PA Route 51 to I-376, Preliminary Noise Analysis Report", dated April 2017. A digital copy of that report is available upon request. Public outreach occurred on April 3,4, and 5, 2018 at the Georgetown Centre, 526 East Bruceton Road; the public provided an initial response to the preliminary engineering noise study at that time.

As documented in the preliminary design noise analysis, design year (2045) noise levels are projected to approach or exceed the PennDOT/FHWA Noise Abatement Criteria (NAC) at various locations throughout the limits of the project area. NSA 36 was the only NSA in Section 53A2 found to contain impacts in the preliminary engineering assessment. Based on the presence of impacts and the scale of subsequent changes to the interchange design, this final design noise analysis focuses only on this NSA, with the goal of refining and optimizing the noise abatement options to final design specifications.

This final design noise assessment has been prepared to provide an overview of existing and future-predicted noise levels in NSA 36; verify that noise abatement continues to be warranted in this area in light of engineering design refinements, including the Camp Hollow Road interchange alignment; determine if noise abatement measures are potentially feasible and reasonable for this area; and if so, optimize those noise abatement measures to meet PennDOT/FHWA noise reduction design criteria and goals. The following sections of this report provide a complete assessment of the noise environment in those NSAs, documents the noise abatement alternatives designed and evaluated to feasibly and reasonably alleviate anticipated noise impacts, and presents the final noise abatement measures (noise barrier alternative) that are recommended for construction as part of the project.

3.0 NOISE ANALYSIS METHODOLOGY

The methodologies applied to this noise analysis are in accordance with PennDOT's *Project Level Highway Traffic Noise Handbook,* Publication No. 24, May 2019. PennDOT guidelines are based on the U.S. Department of Transportation, Federal Highway Administration (FHWA), Federal Aid Policy Guide 23, Code of Federal Regulations (CFR), Part 772 – *Procedures for Abatement of Highway Traffic Noise and Construction Noise*. Additional guidance and policy interpretation applied to this analysis is based on the U.S. Department of Transportation, Federal Highway Administration, *Highway Traffic Noise Analysis and Abatement Guidance* (FHWA-HEP-10-025, December 2011).

The proposed project, as described in Section 2.0 of this report, is considered a Type 1 transportation improvement project. Specifically, the project proposes to construct a new four-lane, limited access, tolled expressway. Construction Section 53A2 will also include a proposed interchange at Camp Hollow Road, featuring a relocation of Camp Hollow Road and incorporation of two roundabouts and associated mainline access ramps. Additionally, there will be local improvements to the Camp Hollow Road/Lebanon Church Road intersection, adjacent to the Allegheny County Airport.

Given the magnitude of the proposed improvements, detailed noise analyses were conducted during both the preliminary and final engineering design phases of the project, in accordance with PennDOT/FHWA procedures. Analyses included noise monitoring of existing (2016) conditions to allow for computer modeling of worst-case existing (2015) and design year (2045) conditions using the FHWA TNM 2.5 computer model.

Table 1 provides the PennDOT/FHWA Land Use Activity Categories, along with descriptions of specific land uses associated with each Activity Category. Also included in **Table 1** are the Noise Abatement Criteria (NAC) for each of the identified Activity Categories. Noise impacts are described as impacts that occur when predicted (design year) noise levels approach or exceed the NAC shown in **Table 1**. The term "approach" has been defined by PennDOT as 1-dBA below the criteria identified in **Table 1** for Activity Categories A, B, C, D and E.

In addition to the absolute criteria defined in **Table 1**, noise impacts can also occur when design year noise levels substantially exceed existing noise levels. PennDOT defines the "Substantial Noise Increase" Criteria for Activity Categories A, B, C, D and E Land Uses as increases of 10-dBA or greater when comparing worst-case existing noise levels to worst-case design year conditions. A 10-dBA (or more) increase in noise levels reflects the generally accepted range of increase which is likely to cause sporadic to widespread complaints, and is perceived by the human ear as a doubling of traffic noise emissions. Noise levels at receptors that satisfy either of the criteria described above "warrant" further consideration for noise abatement to mitigate the predicted impacts.

The evaluation of noise abatement (where "warranted") is performed in two phases. Noise abatement must be evaluated for "feasibility" and for "reasonableness" to determine if it is appropriate to incorporate noise abatement measures into the final roadway design plans.

Noise abatement feasibility addresses acoustical and engineering parameters to determine if a specific abatement measure is effective at reducing noise levels, as well as if that abatement measure can be constructed without introducing significant engineering or safety problems which would preclude construction.

There are seven (7) parameters that must be satisfied in order for noise abatement at a specific location to be determined feasible. For noise abatement (e.g., noise barrier) to be found feasible, the answers to all seven (7) parameters must be "yes". The parameters to be considered when determining noise barrier feasibility are:

1. Can a noise reduction of at least 5-dBA be achieved at the majority of the impacted receptor units (i.e., 50% or greater)?
2. Can the noise barrier be designed and physically constructed at the proposed location?
3. Can the noise barrier be constructed without causing a safety problem?
4. Can the noise barrier be constructed without restricting access to vehicular or pedestrian travel?
5. Can the noise barrier be constructed in a manner that allows for access for required maintenance and inspection operations?
6. Can the noise barrier be constructed in a manner that allows utilities to adequately function?
7. Can the noise barrier be constructed in a manner that allows drainage features to adequately function?

Noise barriers that successfully pass the feasibility test, considering the parameters above, are then evaluated for reasonableness to ensure noise abatement is appropriate for a given area or project. As per PennDOT Publication No. 24, noise barrier reasonableness is determined by assessing multiple issues including (1) Noise Barrier Cost Reasonableness Values; (2) Noise Reduction Design Criteria and Goals; and (3) Consideration of Viewpoints (of benefitted receptors). Following is a summary of each of the items that are evaluated to determine if a specific noise abatement measure (i.e., typically a noise barrier) is reasonable.

PennDOT's "Noise Barrier Cost Reasonableness Value" is based upon a Maximum Square Footage of Abatement per Benefitted Receptor (MaxSF/BR) value of 2,000 or less. This MaxSF/BR criterion is applied statewide as part of the reasonableness determination process for all projects. In determining the "Square Footage per Benefitted Receptor (SF/BR)" value, the total square footage (SF) of a noise barrier is divided by the total number of "Benefitted Receptors" (BR) to determine if the abatement measure would be considered "reasonable". Any receptor that receives a 5-dBA or greater noise reduction (or insertion loss (IL)) is considered a "Benefitted Receptor" and included in the MaxSF/BR calculation and index comparison. Noise abatement measures that are calculated with a MaxSF/BR value of 2,000 or less are further considered for incorporation into the project.

PennDOT's "Noise Reduction Design Criteria and Goals" are intended to ensure that an optimized noise barrier design is established to achieve the most effective noise barrier in terms of both noise reduction and cost. While a 5-dBA noise reduction at the majority of the impacted receptors is required as part of the feasibility criteria, the following (tiered) noise barrier abatement goals should be addressed when evaluating the reasonableness of any abatement measure for Activity Category A, B, C, and E land use facilities:

1. It is required that exterior noise levels be reduced by at least 7-dBA for at least one (1) benefitted receptor.
2. While conforming to the MaxSF/BR Criteria, it is desirable to obtain the 7-dBA minimum exterior insertion loss for additional impacted receptor sites if justified by a "point of diminishing returns" evaluation.
3. While conforming to the MaxSF/BR Criteria, it is desirable to provide additional exterior insertion loss above the 7-dBA minimum if justified by a "point of diminishing returns" evaluation.
4. If possible, it is desirable to reduce exterior noise levels to the low-60-decibel range (60-63) for Category B and C receptors and the upper-60-decible range (65-68) for Category E receptors.
5. If possible, it is desirable to reduce future exterior noise levels back to existing exterior noise levels.

When optimizing a potential noise barrier, the tiered sets of required and desirable abatement goals listed above are evaluated in terms of establishing noise reductions for impacted receptors only, and not for non-impacted receptors.

The final test associated with noise abatement reasonableness is the "Consideration of Viewpoints" (of property owners and residences benefitted by the proposed abatement). During this step, the viewpoints of all benefitted receptors are solicited in order to document the desires for a specific noise abatement option that is being considered for incorporation into the project. 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 the Final Design Noise Analysis Report has been approved for circulation to the public by PennDOT and FHWA.

This final step of the noise abatement reasonableness determination allows the affected community the opportunity to provide input based on the proposed location, type, height, and length of the noise abatement feature. The abatement design is often further refined to include the community's comments and to optimize the abatement feature. Community input on a specific noise abatement measure (such as a noise barrier) includes input on the desires of the affected community regarding the construction of the abatement measure, as well as input on the color and texture of a noise barrier (assuming it is accepted by the community). When considering a specific noise abatement option, 50% or greater of the "benefitted receptors" must be in favor of the option in order for that option to be considered reasonable. Noise abatement options that are not supported by 50% or greater of the benefitted receptors are typically determined to be not reasonable. Generally, this phase of the reasonableness analysis cannot be determined until the end of the final design phase of the project.

The final design noise analysis for MFE Section 53A2 has been performed in accordance with the methodology outlined above. This methodology is in accordance with current PennDOT and FHWA procedures, as detailed in PennDOT's Publication No. 24. The results of this analysis are fully documented within this report.

4.0 EXISTING HIGHWAY TRAFFIC NOISE ENVIRONMENT

The noise analysis was initiated during the preliminary design phase by studying the project area to identify the locations of noise-sensitive land uses within meaningful proximity to the proposed improvements. The selection of noise monitoring locations was guided by the location of noise-sensitive land uses, influence of non-highway noise sources on ambient sound levels, the location of existing (local) roadways in the project area, and the limits and design specifics associated with the proposed improvements. **Figure 2** provides an overview of project mapping for the MFE Section 53A2 project area.

Noise-sensitive land uses listed in **Table 1** are present and adjacent to the proposed transportation facility. Residential structures, classified as Land Use Activity Category B receptors, represent the majority land uses in this section. Residential parcels are typified by detached single-family homes. Additionally, there is an outdoor use associated with the Clara Barton Elementary School, which qualifies for assessment as an Activity Category C receptor.

For organizational purposes, the project was split into multiple individual NSAs based on common areas of highway traffic noise influence. NSAs are groupings of noise-sensitive land uses that have similar noise levels and common noise influences. NSAs are also useful for considering the benefits of noise abatement and evaluating noise abatement measures for feasibility and reasonableness. **Figure 2** identifies the locations of the NSAs that have been evaluated for MFE Section 53A2.

The preliminary design noise analysis concluded that noise abatement assessment was warranted, but <u>not feasible and/or reasonable</u> for NSA 36. As noted previously, subsequent changes to the mainline roadway, interchange configuration, access ramps, and local roadway configurations have necessitated a re-evaluation of these findings. This final design noise analysis focuses solely on potential noise abatement in this NSA. The final design engineering details and local area conditions for the other NSAs in Section 53A2 are similar to that of the preliminary design noise analysis; therefore, the determination that noise mitigation would not be warranted for all other NSAs remains valid. NSA 5, located in the northern portion of the Section, has been affected by the proposed Camp Hollow Road interchange design change, but will be assessed and documented as part of the adjacent Section 53B1A final design noise analysis.

4.1 Noise Monitoring

In order to evaluate existing noise levels and provide data to assist with noise model validation, noise monitoring was conducted at a total of two (2) locations within NSA 36 for short-term (15-minute) durations. The locations of the noise modeling sites are displayed on **Figure 3**. Noise monitoring receptor site data is shown in **Table 2**.

Noise Monitoring was performed at each of the selected noise monitoring locations using RION NL-42 sound analyzers. Readings were taken on the A-weighted scale and reported in decibels (dBA). The noise monitoring equipment meets all requirements of the American National Standard Specifications for Sound Level Meters, ANSI S1.4-1983 (R2006), and meets all requirements as defined by FHWA. Noise monitoring was conducted in accordance with the methodologies contained in FHWA-PD-96-046, *Measurement of Highway-Related Noise* (FHWA, May 1996).

It was determined that 24-hour monitoring was not necessary for the noise analysis since the project is a new limited access highway on new alignment, surrounded by local roads that are not typical commuter routes that influence existing noise levels. In general, noise levels are consistent throughout the day adjacent to the local roadway network while other rural areas are dominated by non-roadway background ambient noise sources.

Noise levels were monitored for 15-minute durations at each monitoring location. Noise level data was recorded at 10-second intervals for the 15-minute duration of each sample. Data collected by the sound analyzers include date, time, average noise level (Lav) and maximum noise level (Lmax) for each 10-second interval. Additional data collected at each monitoring location included atmospheric conditions, wind speed, background noise sources, and atypical or non-traffic-related noise influences. Traffic data (vehicle volume and speed) were also video-recorded on all roadways which were visible from the monitoring sites and substantially contributed to the overall noise levels. Traffic was grouped into one (1) of five (5) categories: automobiles, medium trucks, heavy trucks, busses, and motorcycles, as per PennDOT/FHWA procedures. Copies of the noise monitoring data sheets and noise monitoring data are included in **Appendix B**.

Short-term noise monitoring was conducted between 6:09 PM and 6:24 PM on June 21, 2016. During the monitoring sessions, traffic on contributing roadways was generally free flow, allowing for TNM model calibration where local roadways are the dominant noise source.

The following is a summary of monitored noise levels in the NSA being carried forward into final design phase analysis:

NSA 36

NSA 36 is located South of Camp Hollow Road, from Skyport Drive to Lebanon Manor Drive. This NSA includes multiple single-family residential units on Camp Hollow Road, Beverly Drive, Alberta Drive, Lebanon Manor Drive, and Sunnyside Drive. Parcels in the western leg of NSA 36 are generally at-grade relative to Camp Hollow Road. Parcels along Lebanon Manor Drive are at a variety of elevations, steadily decreasing in elevation moving south with level terraced sections at both north and south ends of the community.

NSA 36 is comprised of Category B (residential) and Category C (school playground) land uses. NSA 36 includes two monitored sites (R53 and R54) and fifty-eight (58) modeled sites (36-A through 36-FFF), representing 116 residences and one school playground.

Site R53 represents multiple residential units along Camp Hollow Road in the vicinity of Beverly Drive, and is acoustically influenced by local traffic sources. Site R54 represents multiple residential units along Lebanon Manor Drive, facing the proposed mainline roadway. Non-traffic noise sources are the primary acoustical influence at this receptor. Noise levels at these sites were monitored at 61 and 48 dBA, respectively.

4.2 Noise Modeling of Existing Conditions

Computer modeling is the accepted technique for predicting and evaluating existing and future noise levels associated with traffic-induced noise. Currently, the FHWA Traffic Noise Model (TNM) version 2.5 is the FHWA-approved highway noise prediction computer model. The TNM software package has been established as a reliable tool for predicting noise generated by highway traffic. TNM incorporates specific engineering design information and project mapping elements to evaluate traffic-induced noise levels. The information applied to the modeling effort includes geo-referenced base-mapping, existing and proposed contour files, existing and proposed roadway design files (including profiles and cross-sections), and existing and future traffic data (including vehicle volume, composition, and speed).

Additional features identified in the field and accounted for in the TNM noise modeling effort include existing terrain features, tree zones and building rows, as well as existing local roadways that provide measurable noise influences at adjacent noise receptors. Base mapping and field views were used to identify noise-sensitive land uses within the project corridor, as well as areas of frequent outdoor human activity for Category C land uses.

The noise modeling process is initiated with computer model validation, as per PennDOT/FHWA requirements. This is accomplished by comparing monitored noise levels with noise levels generated by TNM, using traffic characteristics that were present during the noise monitoring effort. This comparison ensures that reported changes in noise levels between existing and future conditions are due to changes in roadway/traffic conditions and not to discrepancies between monitoring and modeling techniques. Differences of three (3) decibels or less between monitored and modeled levels are considered acceptable for TNM validation, as this is the limit of change detectable by the typical human ear and is used by PennDOT as the calibration benchmark.

Table 2 provides a summary of the model validation for NSA 36. Column 6 of **Table 2** provides the monitored noise level at two (2) locations. Column 7 provides the modeled noise levels using traffic characteristics witnessed in the field during the noise monitoring phase. Column 8 displays the difference between monitored and modeled values. Receptor R53 shows a difference of 3 dBA or less between monitored and modeled values, indicating the model accurately represents the existing conditions at that location. Receptor R54 was not able to be validated by the model, as ambient noise levels are dominated by non-traffic noise sources. For consistency, the ambient noise level of 51 dBA in NSA 36 used in the preliminary engineering noise study has been maintained for this final design analysis.

Following the noise model validation phase, additional noise modeling was performed to more comprehensively evaluate existing (2015) noise levels under worst-case traffic conditions. As part of the worst-case existing condition modeling effort, additional "modeled-only" sites were added to thoroughly predict existing traffic noise levels and propagation characteristics throughout the project corridor.

The locations of all noise modeling sites are displayed on **Figure 3**. The modeling sites used in the final design phase differ from those utilized and reported in the preliminary design phase, as models were refined to more accurately predict noise levels at individual properties. Additional non-reported sites were also implemented to ensure accurate representation of the full extent of noise sensitive parcels, particularly at barrier transitions and end points.

Noise modeling sites were selected to be representative of one or more noise-sensitive receptors present within the NSAs. In most cases the modeling sites represent single-family detached residences. However, given the presence of a Category C land use within the project area (the Clara Barton Elementary School), noise receptor attributes for the school were developed using the Equivalent Residential Unit (ERU) guidelines set forth in Appendix E of PennDOT's Publication 24. The ERU value is developed to represent the degree of use which occurs at a given site. Therefore, while the ERU for a single-family dwelling is always one, ERU values for other sites will vary based on a variety of factors. The guidelines outlined in Appendix E of Publication 24 allow for development of ERUs utilizing "any reasonably supported approach" at the discretion of the noise analyst. For consistency, the ERU value of one (1) used in the preliminary engineering noise study has been maintained for this final design analysis.

The worst-case existing condition modeling effort relies on worst-case existing traffic data (supplied by the project's traffic engineering team) to predict peak noise levels. Traffic data employed for the noise analysis can be found in **Appendix C**. Review of the traffic data indicated that the PM peak traffic volumes and speeds represent the worst-case existing condition.

Column 6 of **Table 3** provides a summary of worst-case existing (2015) noise levels throughout the project area under peak travel periods.

Based on a review of the modeling data, existing peak-hour noise levels currently approach or exceed the PennDOT/FHWA NAC in the portions of NSA 36. Existing noise impacts are limited to front-row receptors adjacent to Camp Hollow Road.

5.0 FUTURE HIGHWAY TRAFFIC NOISE ENVIRONMENT

There is currently one (1) design alternative being evaluated as part of the final design phase of MFE Section 53A2. **Figure 2** displays the section limits and general engineering details associated with the project. See **Section 2.0 Introduction** for a complete description of the proposed improvements. There are multiple displacements associated with the proposed improvements, adjacent to both sides of Camp Hollow Road in the vicinity of the proposed Camp Hollow Road interchange. Displaced parcels are shown on **Figure 3**, and have been excluded from this analysis.

PennDOT Publication 24 and associated FHWA guidance requires the prediction and reporting of both Future No-Build (the existing roadway network, absent the MFE Section 53A2 design) and Build (incorporating all design elements) condition worst-case traffic noise levels.

The design year No-Build models were created by incorporating design year (2045) No-Build peak hour traffic into the existing-condition baseline TNM models. Design year traffic volumes, vehicle composition, and speeds were assigned to existing roadways represented in the models.

The design-year Build-condition noise models were created by incorporating the proposed future roadway improvements (including the new limited access highway, changes to existing roadway's vertical and horizontal alignment as well as necessary re-grading of terrain along traffic-noise propagation pathways) to the validated (Existing condition) noise model. Design year (2045) traffic volumes, vehicle composition, and speeds were then assigned to all modeled roadways in the project study area.

5.1 Design Year (2045) No-Build Conditions

Design year (2045) traffic noise levels were evaluated for the No-Build Alternative for comparative purposes, as required by PennDOT/FHWA procedures and guidelines.

As shown in Column 7 of **Table 3,** the design-year No-Build traffic noise levels are not anticipated to change at receptors within the project area. This is in accordance with expectations given the relative increases in traffic volumes on the local roadway network identified by the traffic study.

5.2 Design Year (2045) Build Conditions

Design year (2045) Build Alternative traffic noise levels were modeled to determine if future noise levels are projected to approach or exceed the PennDOT/FHWA NAC under the current project design. The prediction of design year (2045) Build Alternative noise levels was performed consistent with PennDOT/FHWA procedures. If the PennDOT/FHWA NAC are approached or exceeded at any receptor under the Build Alternative, noise abatement consideration is warranted for those locations. Column 8 of

Table 3 provides a summary of design year worst-case noise levels at each receptor site under the Build Alternative. The following discussion provides a summary of the Build Alternative noise levels for NSA 36. Digital copies of all FHWA TNM noise modeling files for the project are available upon request.

NSA 36

As shown in column 8 of **Table 3**, future design year (2045) worst-case noise levels associated with the Build Alternative are projected to range from 51 (ambient) to 73 dBA. Based on the noise modeling results, design year noise levels are predicted to increase up to 10 dBA, as compared to existing (2015) conditions. However, noise levels are predicted to decrease at sites closest to the relocated section of Camp Hollow Road, as the associated local roadway traffic moves further away from these parcels, and the terrain and proposed interchange ramps shield these receptors from mainline traffic noise influence.

Seven (7) modeled receptor sites (36-K, 36-L, 36-SS through 36-WW) representing 15 residences are predicted to approach or exceed the PennDOT/FHWA NAC for Activity Category B under the Build Alternative. Impacts are due to both the absolute and substantial noise increase criteria. Therefore, noise abatement consideration is warranted for NSA 36 and will be discussed in the following sections of this report.

6.0 HIGHWAY TRAFFIC NOISE CONSIDERATION AND ABATEMENT OPTIONS

Design year noise levels associated with the Build Alternative are projected to approach or exceed the PennDOT/FHWA NAC in NSA 36. Therefore, as per PennDOT/FHWA procedures, noise abatement consideration is warranted for the impacted receptors within each NSA. This section of the report documents the noise abatement alternatives that were considered to reduce noise levels within each NSA, and evaluate those potential abatement measures for feasibility and reasonableness.

Section 3.0 NOISE ANALYSIS METHODOLOGY provides a summary of the PennDOT/FHWA noise analysis procedures and explains the three-phased approach associated with noise abatement warrants, feasibility, and reasonableness. This methodology is fully documented in PennDOT *Project Level Highway Traffic Noise* Handbook, Publication No. 24.

PennDOT and FHWA guidelines recommend a variety of noise abatement measures which 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 abatement, additional abatement measures exist that have the potential to provide considerable noise reductions under certain circumstances. Noise Abatement measures to be considered for a given project include:

- Construction of noise barriers (or earth berms), including acquisition of property rights, either within or outside the highway right-of-way. Landscaping is not a viable noise abatement feature.
- Traffic management measures including, but not limited to, traffic-control devices and signing for the prohibition of certain vehicle types, time-use restrictions for certain vehicle types, modified speed limits, and exclusive land designations.
- Alteration of horizontal and vertical alignments.
- Acquisition of real property or interests therein (predominately unimproved property) to serve as a buffer zone to preempt development which would be adversely impacted by traffic noise. This measure may be included in Type 1 projects only.
- Noise Insulation of Activity Category D land use facilities listed in **Table 1**. Post installation maintenance and operational costs for noise insulation are not eligible for State or Federal-aid funding.

Based on the project need (see Section 2.0 INTRODUCTION) and the nature of the proposed improvements, traffic management and control measures were not considered an appropriate solution. Opportunities for alignment modifications are limited given the challenging terrain and existing development adjacent to the corridor. Property acquisition (to provide buffer zones or to construct/provide noise abatement) is not necessary or supported by the analysis. Noise insulation of Activity Category D land uses is also not necessary or supported by the noise analysis, since no (interior) noise impacts are anticipated to Category D Land Uses as a result of the proposed project. Therefore, noise barriers and/or earth berms were considered the only form of noise abatement having the potential to reduce future noise levels at impacted receptor sites.

Noise barriers and earth berms are often implemented into the highway design in response to identified noise impacts. The effectiveness of a free-standing (post and panel) noise barrier and an earth berm of equivalent height are relatively consistent; however, an earth berm is often perceived as a more aesthetically pleasing option. Therefore, where possible, earth berms are typically preferred over noise barriers. Unfortunately, the use of earth berms is not always an option due to the excessive space they require within the roadway corridor. At a standard slope of 2:1, every one (1) foot of berm height requires approximately four (4) feet of horizontal width to accommodate the required slopes. This requirement becomes more complex in roadway corridors where previously-developed parcels are adjacent to the proposed corridor right-of-way. In these situations, the implementation of earth berms can require significant property acquisition to accommodate noise abatement. Due to the desire to minimize right-of-way acquisition and the lack of space to accommodate a viable berm for the impacted areas identified in MFE Section 53A2, berms were not considered an option for this project. Therefore, noise barriers appear to be the only form of noise abatement available to reduce noise impacts. Accordingly, noise barriers were evaluated for NSA 36, where noise impacts were identified.

When designing abatement, barrier footprints are typically located at the top of a cut-slope no less than ten (10) feet inside the existing ROW (in cut conditions) and/or along the top of the fill-slope, typically adjacent to the roadway shoulder (in fill conditions). In areas where a break in the barrier is required to accommodate utilities or other design considerations, an overlap section is developed wherein the length of the overlapped panels is typically a minimum of three times the distance between the two barrier sections. For example, a gap of fifteen (15) feet between overlapping barriers would typically require an overlap section forty-five (45) feet or greater in length.

As discussed in Section 3.0 NOISE ANALYSIS METHODOLOGY, noise abatement measures must be evaluated for feasibility and reasonableness, and must satisfy the applicable parameters associated with each criterion in order to be recommended as part of the final design of the project. These parameters are identified and listed in PennDOT's Noise Barrier Warranted, Feasibility and Reasonableness Worksheets. Copies of the Noise Barrier Warranted, Feasible, and Reasonable Worksheets for each noise abatement option evaluated in the MFE Section 53A2 project area are provided in **Appendix D.**

Noise abatement was evaluated to achieve the requirements necessary to pass PennDOT's feasibility and reasonableness criteria. These parameters include the requirement to provide noise reductions of at least 5 dBA for the majority of the impacted receptors in a given NSA. Additionally, as per PennDOT's reasonableness criteria, it is required that exterior noise levels be reduced by at least 7 dBA for at least one (1) benefitted receptor. PennDOT's Noise Barrier Cost Reasonableness Value is based on a Maximum Square Footage of Abatement per Benefitted Receptor (MaxSF/BR). As per PennDOT procedures, noise abatement measures that are calculated with a MaxSF/BR value of 2,000 or less are considered "reasonable".

Once a barrier has been developed that addresses minimum performance goals for feasibility, it is further optimized to a "point of diminishing returns". The relationship between noise barrier square footage and noise barrier performance is non-linear. This means that noise benefits typically increase with increased barrier height and/or length; however, at some point, further increases in barrier height and/or length result in reduced increases in benefit until a point of diminishing returns is reached. A point can be identified where a potential noise barrier provides the best balance between square footage and benefit. All barriers presented in this analysis were developed in an attempt to achieve feasibility and reasonableness design goals first, then optimized to the point of diminishing returns while still maintaining feasibility and reasonableness objectives.

Noise barriers presented in this final design study were not proposed for construction during the preliminary engineering phase. This is due to multiple factors, most notably the subsequent refinements to the project roadway and grading design (a revised Camp Hollow Road interchange alignment). The final design noise models incorporated additional receptor sites to provide a more concise understanding of traffic noise propagation through the noise-sensitive areas proposed for abatement consideration. Noise barriers were evaluated using reduced iterative gradations in panel length and height (i.e., one-foot perturbations - or less - in final design, versus two-foot perturbations used in the preliminary design study). Additionally, logical termini for barrier panels were also considered to resolve aesthetic, engineering design, and public acceptance considerations during the final design phase.

Following PennDOT/FHWA concurrence and approval of the Final Design Highway Traffic Noise Draft Report, and approval of the barrier options under consideration, these options will be presented to the public to solicit input on the desires for noise mitigation. Following is a summary of the options that were developed, refined, and optimized to provide feasible and reasonable noise abatement.

6.1 NSA 36 Barrier

Noise impacts are found within two distinct areas within this NSA. The first area includes receptors 36-SS through 36-WW, representing eleven (11) residences with direct access to Camp Hollow Road. A noise barrier in this area is infeasible, given the need to maintain vehicular and pedestrian access for the impacted parcels. No feasible barrier system can be developed for these receptors that would provide meaningful benefits given that it would be segmented by driveway and/or sidewalk access points.

The second area where impacts have been identified is at receptors 36-K and 36-L, representing four (4) homes close to the mid-point of Lebanon Manor Drive. A continuous post-and-panel noise barrier was modeled in an attempt to identify feasible and reasonable noise abatement for these receptors. A noise barrier was evaluated throughout the limits of NSA 36, then refined in both height and length based on PennDOT feasibility and reasonableness considerations.

As shown in **Figure 3** (moving from west to east), the refined noise barrier for NSA 36 was modeled between approximate mainline stations 1828 +25 and 1842 +00, along the edge-of-shoulder of the southbound on-ramp to the mainline. The NSA 36 noise barrier was modeled at multiple heights ranging from six (6) feet above ground level to 20 feet above ground level, at one (1) foot increments. The noise barrier was then optimized for the purposes of evaluating noise barrier feasibility and reasonableness, as well as establishing logical termini for barrier end points.

Table 4, columns 5 and 6, provides a noise barrier summary for the optimized noise barrier evaluated for impacted sites 36-K and 36-L. As shown, the evaluated noise barrier provides noise reductions of 8 to 9 dBA for the impacted sites, indicating the optimized barrier option is feasible relative to performance goals. As summarized in **Table 4**, the optimized barrier has a total length of 1,312 feet. The optimized barrier ranges from 10 to 19 feet in height and has a total area of 23,056 square feet. Providing benefits to 46 residential units, the barrier for NSA 36 has a MaxSF/BR Value of 501, indicating that the optimized barrier option is reasonable.

Therefore, the optimized barrier design is recommended for further consideration and public input through the final design phase of the project. PennDOT's Noise Abatement Warranted, Feasible and Reasonable Worksheet has been updated for this NSA and included in **Appendix D**.

7.0 CONSTRUCTION NOISE CONSIDERATION AND ABATEMENT OPPORTUNITIES

Throughout the construction phase of the project, noise sensitive land uses in close proximity to proposed improvements are susceptible to construction noise impacts. Activities and equipment associated with construction are likely to temporarily elevate noise within the project area. Sensitive receptors within close proximity to proposed improvements may experience varying noise levels and durations, depending on the nature of the activity, the type of equipment being used, and the relative distance from the temporary noise source.

Reductions in noise emissions at the source are an effective means of reducing construction noise impacts. Contractors should perform regular maintenance and upkeep of vehicles and equipment. Common areas of focus include engine and exhaust maintenance (including muffler systems), and regular lubrication of moving parts.

Additional methods should be considered to further reduce or respond to construction noise concerns. Implementation of workplace protocols should be considered, including elimination of “tailgate banging”, consideration of the location of “staging” areas, and potential incorporation of smart back-up alarms. Restrictions on work-hours should also be considered, where appropriate. Where construction noise impacts are unavoidable, the use of temporary noise barriers should be considered. Community input on sequencing of operations as well as a complaint-response mechanism may also serve to reduce construction noise impacts on the community.

The PTC should make an attempt to coordinate with the local municipality to determine potential issues with construction noise, including any constraints on active work periods. Municipal officials have not formally expressed construction noise concerns, and time of day restrictions for construction activities have not been discussed. Any municipal concerns will be addressed through the PTC’s ongoing public involvement processes. If construction noise specifications are required for inclusion in the Plans, Specifications, and Estimates package, detailed coordination is suggested between the PTC and the local municipality.

8.0 PUBLIC INVOLVEMENT PROCESS

The MFE Section 53A2 project has been active for a number of years. Public and municipal involvement has been ongoing throughout the life of the project. In April 2018, public plans display meetings were held during the preliminary design phase to present the engineering specifics and environmental concerns associated with the project. As documented in Section 3.0 NOISE ANALYSIS METHODOLOGY, the public involvement phase is also necessary during final design to conclude the reasonableness evaluation for the proposed noise barrier concepts presented in the draft noise report. Final design noise abatement concepts have been developed in order to provide the benefitted receptors with the details necessary to make an informed decision.

Noise-specific public involvement will be conducted for NSA 36 following PTC, PennDOT and FHWA conditional approval of the Draft Final Design Noise Report. Community-specific public outreach will be conducted with benefitted property owners and residents within NSA 36. The goal of the community-specific public outreach will be to formally solicit input from the affected community related to the desires for noise abatement, as well as aesthetic options on the community side for the proposed barrier options.

The benefited property owners and renters will be provided detailed information about the noise analysis process employed, and the specific abatement measures proposed for construction as part of this project. Copies of the public outreach participation list, as well as all public outreach informational sheets, graphics, and survey forms, will be provided in the final version of the Final Design Noise Report.

TABLES

Table 1
PennDOT and FHWA
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.

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

** PennDOT has chosen to use Leq(h) [not L10(h)] on all of its transportation improvement projects.*

Table 2

Mon/Fayette Expressway - Section 53A2

Existing (2018) Monitored Noise Levels (Leq(h) in dBA)

(1) NSA	(2) Site ID	(3) Site Description	(4) PennDOT/FHWA Activity Category	(5) Noise Abatement Criteria (NAC)* in dBA	(6) Existing (2016) Monitored Noise Level	(7) Validation Modeled Noise Level	(8) Difference
36	R53	762 Camp Hollow Road, West Miflin, PA, 15122	B	66	61.3	63.5	2.2
	R54	205 Lebanon Manor Drive, West Miflin, PA 15122	B	66	47.7	ambient	---

* Noise levels that are within 1 dBA of the PennDOT/FHWA NAC (Table 1)

[shaded box] Monitored level dominated by non-traffic noise influences

Table 3
Mon/Fayette Expressway - Section 53A2
Noise Level Summary (Leq(h))

(1) NSA	(2) Site Descriptor	(3) Site Representation	(4) PennDOT/FHWA Activity Category	(5) Noise Abatement Criteria (NAC)*	(6) Existing (2015) Peak Hour Noise Level	(7) Design Year (2045) No Build Noise Level	(8) Design Year (2045) Build Noise Level
36	R53	1 residence	B	66	66	66	65
	R54	1 residence	B	66	51	51	56
	36-A	1 residence	B	66	51	51	54
	36-B	2 residences	B	66	51	51	54
	36-C	2 residences	B	66	51	51	55
	36-D	2 residences	B	66	51	51	56
	36-E	2 residences	B	66	51	51	56
	36-F	2 residences	B	66	51	51	57
	36-G	2 residences	B	66	51	51	57
	36-H	2 residences	B	66	51	51	58
	36-I	2 residences	B	66	51	51	59
	36-J	2 residences	B	66	51	51	59
	36-K	2 residences	B	66	51	51	61
	36-L	2 residences	B	66	51	51	61
	36-M	2 residences	B	66	51	51	60
	36-N	2 residences	B	66	51	51	60
	36-O	3 residences	B	66	51	51	59
	36-P	2 residences	B	66	51	51	55
	36-Q	2 residences	B	66	51	51	52
	36-R	2 residences	B	66	51	51	55
	36-S	2 residences	B	66	53	53	61
	36-T	1 residence	B	66	57	57	65
	36-U	2 residences	B	66	51	51	53
	36-V	2 residences	B	66	51	51	55
	36-W	2 residences	B	66	51	51	56
	36-X	2 residences	B	66	51	51	56
	36-Y	2 residences	B	66	51	51	56
	36-Z	2 residences	B	66	51	51	57
	36-AA	2 residences	B	66	51	51	55
	36-BB	2 residences	B	66	51	51	56
	36-CC	2 residences	B	66	51	51	57
	36-DD	2 residences	B	66	51	51	57
	36-EE	2 residences	B	66	51	51	58
	36-FF	1 residence	B	66	51	51	57
	36-GG	2 residences	B	66	51	51	56
	36-HH	2 residences	B	66	51	51	57

Table 3
Mon/Fayette Expressway - Section 53A2
Noise Level Summary (Leq(h))

(1) NSA	(2) Site Descriptor	(3) Site Representation	(4) PennDOT/FHWA Activity Category	(5) Noise Abatement Criteria (NAC)*	(6) Existing (2015) Peak Hour Noise Level	(7) Design Year (2045) No Build Noise Level	(8) Design Year (2045) Build Noise Level
36	36-II	2 residences	B	66	51	51	56
	36-JJ	2 residences	B	66	51	51	55
	36-KK	2 residences	B	66	51	51	54
	36-LL	2 residences	B	66	51	51	55
	36-MM	1 residence	B	66	55	55	59
	36-NN	1 residence	B	66	67	67	62
	36-OO	3 residences	B	66	69	69	61
	36-PP	2 residences	B	66	68	68	60
	36-QQ	2 residences	B	66	68	68	61
	36-RR	1 residence	B	66	66	66	63
	36-SS	1 residence	B	66	67	67	67
	36-TT	2 residences	B	66	66	66	70
	36-UU	3 residences	B	66	66	66	72
	36-VV	2 residences	B	66	67	67	73
	36-WW	3 residences	B	66	68	68	73
	36-XX	3 residences	B	66	57	57	51
	36-YY	2 residences	B	66	56	56	51
	36-ZZ	2 residences	B	66	56	56	52
	36-AAA	2 residences	B	66	56	56	53
	36-BBB	3 residences	B	66	52	52	51
	36-CCC	1 residence	B	66	52	52	51
	36-DDD	3 residences	B	66	51	51	51
	36-EEE	1 ERU (school playground)	B	66	51	51	53
	36-FFF	3 residences	B	66	54	54	61

* Noise levels that are within 1 dBA of the PennDOT/FHWA NAC (Table 1) OR exceed existing noise levels by 10 dBA or greater WARRANT abatement consideration.

[shaded box] Noise level approaches or exceeds PennDOT/FHWA NAC or exceeds exisitng noise levels by 10 dBA or greater

Predicted noise levels below ambient have been reported at the ambient level of 51 dBA

Table 4
Mon/Fayette Expressway - Section 53A2
NSA 36 - Noise Barrier Analysis

(1) NSA	(2) Site Descriptor	(3) Site Representation	(4) Design year (2045) AM Peak Noise Level*	(5) 1. Optimized Barrier: Mitigated Noise Level*	(6) 1. Optimized Barrier: Insertion Loss*
36	R53	1 residence	65	65	0
	R54	1 residence	56	56	1
	36-A	1 residence	54	51	3
	36-B	2 residences	54	51	3
	36-C	2 residences	55	51	4
	36-D	2 residences	56	51	5
	36-E	2 residences	56	51	5
	36-F	2 residences	57	51	6
	36-G	2 residences	57	51	6
	36-H	2 residences	58	51	7
	36-I	2 residences	59	51	8
	36-J	2 residences	59	51	8
	36-K	2 residences	61	53	8
	36-L	2 residences	61	52	9
	36-M	2 residences	60	51	9
	36-N	2 residences	60	51	9
	36-O	3 residences	59	51	8
	36-P	2 residences	55	51	4
	36-Q	2 residences	52	52	1
	36-R	2 residences	55	54	1
	36-S	2 residences	61	61	0
	36-T	1 residence	65	65	0
	36-U	2 residences	53	51	2
	36-V	2 residences	55	51	4
	36-W	2 residences	56	51	5
	36-X	2 residences	56	51	5
	36-Y	2 residences	56	51	5
	36-Z	2 residences	57	51	6
	36-AA	2 residences	55	51	4
	36-BB	2 residences	56	51	5
	36-CC	2 residences	57	51	6
	36-DD	2 residences	57	51	6
	36-EE	2 residences	58	51	7
	36-FF	1 residence	57	51	6
	36-GG	2 residences	56	51	5
	36-HH	2 residences	57	51	5
	36-II	2 residences	56	52	4
	36-JJ	2 residences	55	53	2
	36-KK	2 residences	54	53	1
	36-LL	2 residences	55	54	0

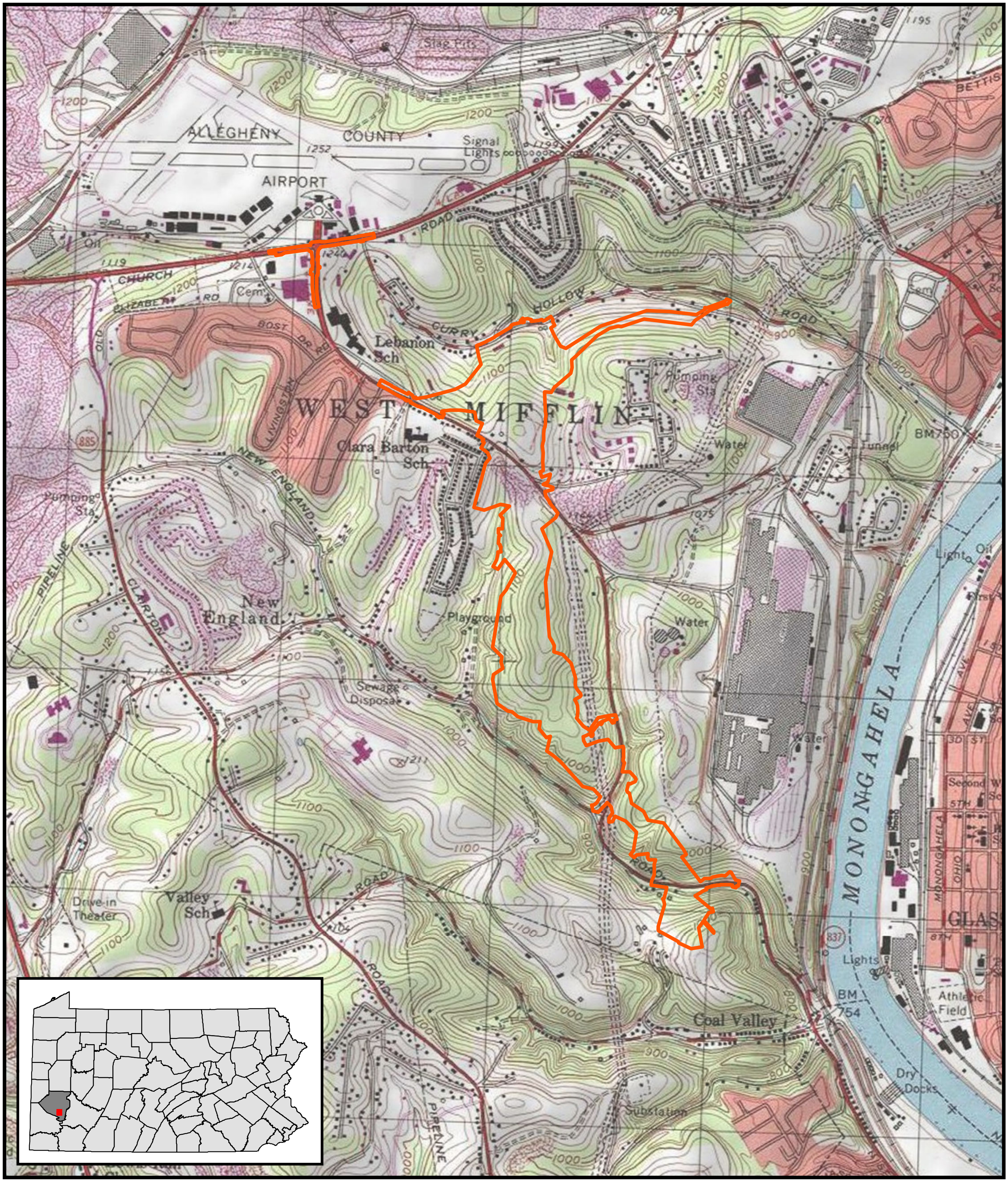
Table 4
Mon/Fayette Expressway - Section 53A2
NSA 36 - Noise Barrier Analysis

(1)	(2)	(3)	(4)	(5)	(6)
				1. Optimized Barrier	
NSA	Site Descriptor	Site Representation	Design year (2045) AM Peak Noise Level*	Mitigated Noise Level*	Insertion Loss*
36	36-MM	1 residence	59	59	0
	36-NN	1 residence	62	61	1
	36-OO	3 residences	61	61	0
	36-PP	2 residences	60	60	0
	36-QQ	2 residences	61	61	0
	36-RR	1 residence	63	63	0
	36-SS	1 residence	67	67	0
	36-TT	2 residences	70	70	0
	36-UU	3 residences	72	72	0
	36-VV	2 residences	73	73	0
	36-WW	3 residences	73	73	0
	36-XX	3 residences	51	51	0
	36-YY	2 residences	51	51	0
	36-ZZ	2 residences	52	52	0
	36-AAA	2 residences	53	53	0
	36-BBB	3 residences	51	51	0
	36-CCC	1 residence	51	51	1
	36-DDD	3 residences	50	50	0
	36-EEE	1 ERU	53	53	0
	36-FFF	3 residences	61	61	0

Barrier Analysis	NSA or Receiver(s)	Number of Benefits	Barrier Length	Minimum Height (ft.)	Maximum Height (ft.)	Total Area (Sq./Ft.)	MaxSF/BR Value	Barrier Feasible?	Barrier Reasonable?
1. Optimized	NSA 36	46	1,312	10	19	23,056	501	Yes	Yes

Noise level approaches or exceeds PennDOT/FHWA NAC or exceeds exisitng noise levels by 10 dBA or greater
Insertion Loss of 5 dBA or greater
Insertion loss of 7 dBA or greater
* Noise values, comparisons and Insertion Loss are calculated to the tenth of a dBA and then rounded for presentation purposes

FIGURES



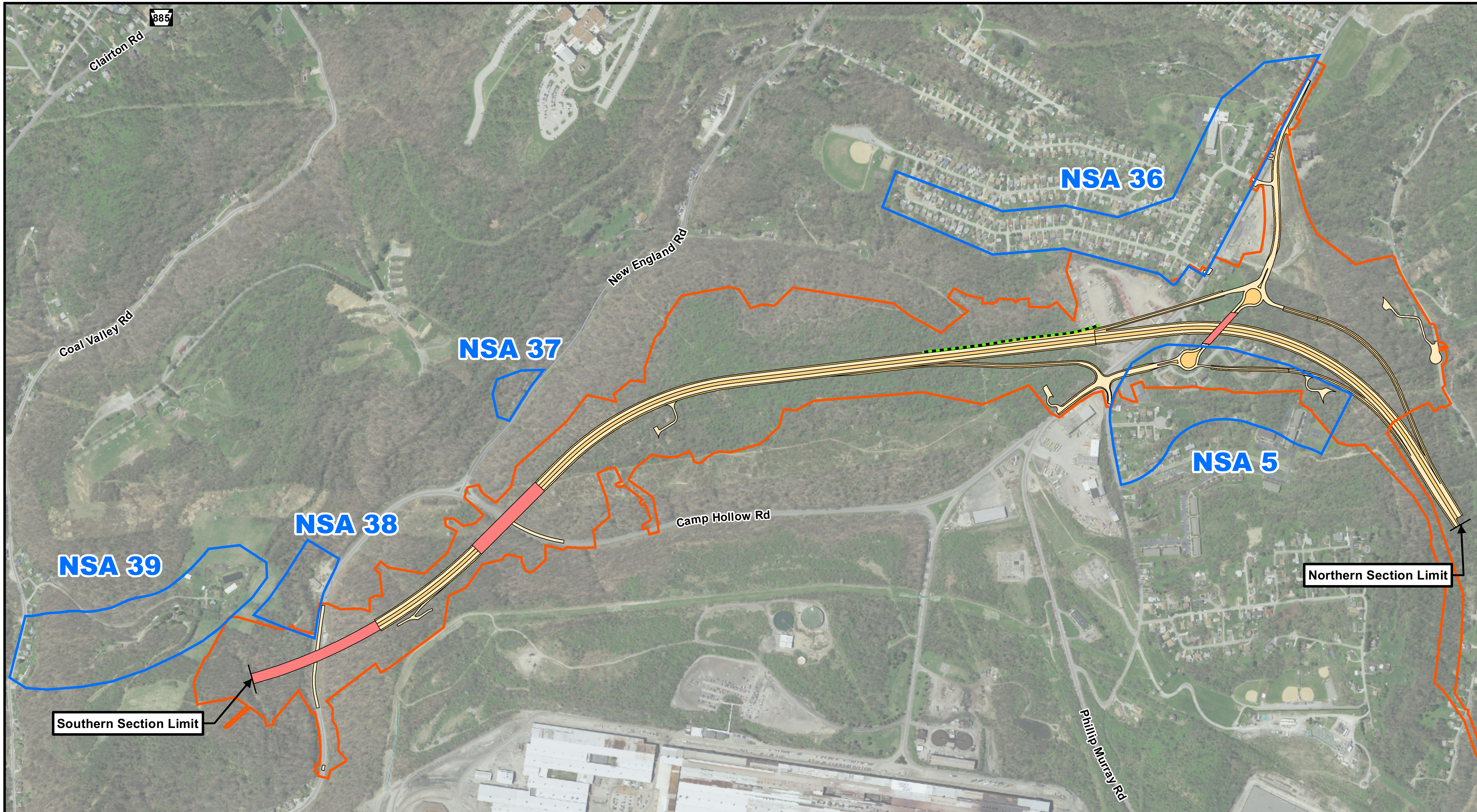
5764_04_053_NoiseTechMemo53A2_Fig1_8x11 3/17/2023 5:05:15 PM

53A2 LOD (Aug 2022)

Figure 1
Project Location Map
MFE Section 53A2
Final Design Noise Analysis Report
West Mifflin Borough
Source: Streaming USGS Map Service

N W E S

0 2,000
Feet



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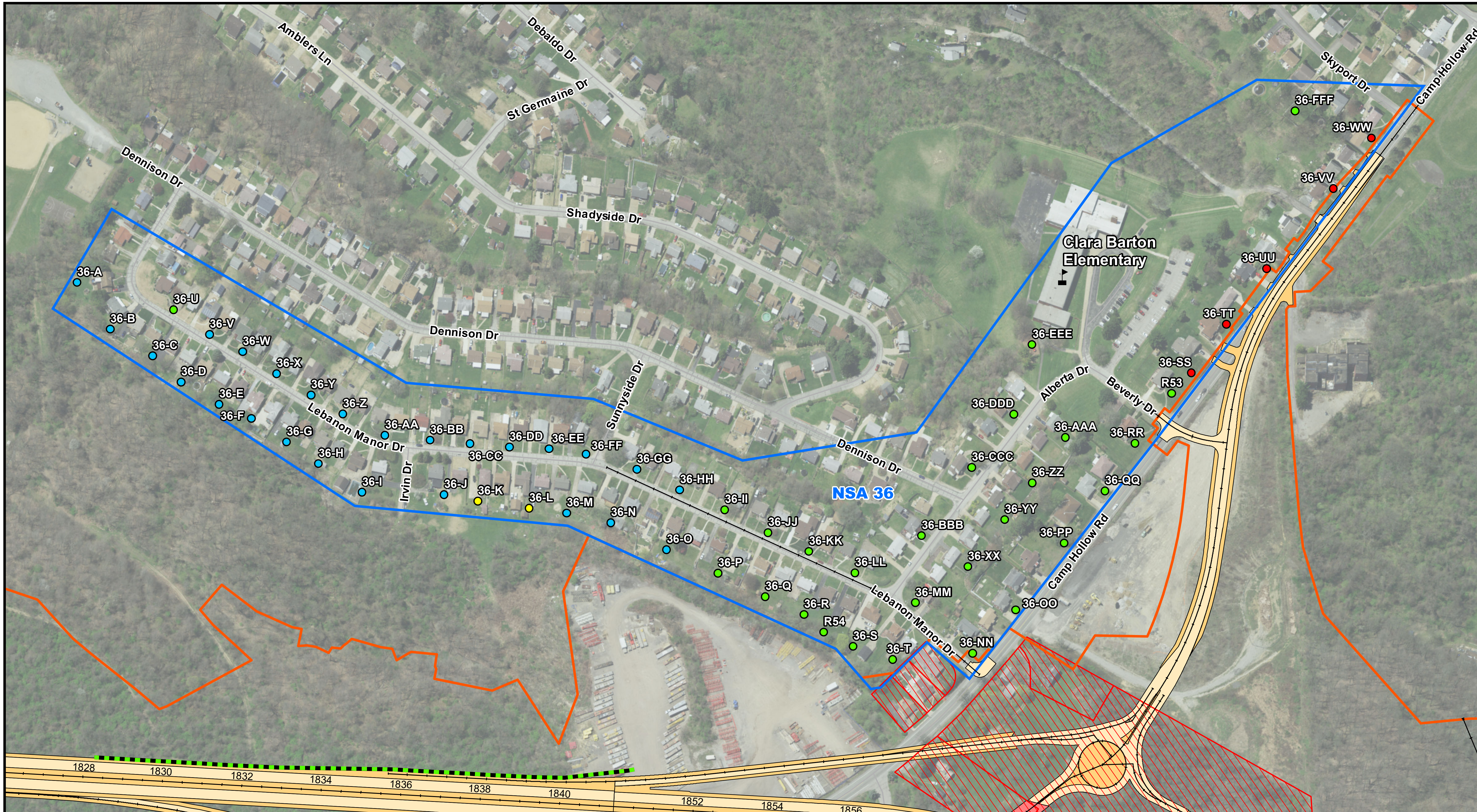
53A2 LOD (Aug 2022)
Noise Sensitive Area (NSA)
NSA 36 Proposed Barrier
Lane
Shoulder
Bridge

Figure 2
Project NSA Locations
MFE Section 53A2
Final Design Noise Analysis Report
West Mifflin Borough
Source: PEMA, 2018

W N S E
0 700
Feet



53A2 LOD (Aug 2022)
Noise Sensitive Area (NSA)
NSA 36 Proposed Barrier
Displacement Parcels

Lane
Shoulder
Bridge

NSA 36 Receptors
- Impact, Benefit
- Impact, No Benefit
- Not Impacted, Benefit
- Not Impacted, No Benefit

Figure 3
NSA 36 Barrier
MFE Section 53A2
Final Design Noise Analysis Report
West Mifflin Borough
Source: PEMA, 2018

0 250 Feet

APPENDICES

Appendix A

List of Preparers

List of Preparers and Reviewers

Name: Nathaniel Weinstock
Organization: Navarro & Wright Consulting Engineers, Inc.
Role: Noise Modeling, Abatement Analysis, Report Development, QA/QC
Experience: 23 years
Education: BS, Public Service

Name: Robert C. Kolmansberger
Organization: Navarro & Wright Consulting Engineers, Inc.
Role: Noise Modeling, Abatement Analysis, Report Development, QA/QC
Experience: 31 years
Education: BA, Geography and Environmental Planning

Name: Frederick E. Schiller
Organization: Navarro & Wright Consulting Engineers, Inc.
Role: Noise Modeling, Abatement Analysis, Report Development, QA/QC
Experience: 16 years
Education: Associates Degree, General Studies

Appendix B

Noise Monitoring Data

Site #	R53	**Description :**		
Meter #	1			
Done By:	JCL			

Monitoring Data:	AM Peak		Off-Peak		PM Peak	
Date					6/21/16	
Start Time					6:09 PM	
End Time					6:24 PM	
Duration	MIN		MIN		15 MIN	
Leq.					**61.3**	
Traffic Data						
Roadway			Lebonan School		Camp Hollow Rd	
Direction						
Traffic Count:	0	0	6	0	135	
Cars			6		133	
MT					1	
HT					1	
Weather Conditions						

Atmospheric Data	
Wind Speed (mph)	5
Temp. (°F)	82
Humidity (%)	60

Site Data: Site Surface (alpha): ____ Shielding Factor : ____ Pavement Type : ____

Profile View:

Monitoring Notes

AM Peak:

Off-Peak:

PM Peak

*Distances in photo to left are from noise meter to nearest structure and from noise meter to edge of closeset travel lane measured in ***feet.***

McCormick Taylor, Inc

Site # R54

Meter # 6

Done By: JCL

Description :

Monitoring Data:

	AM Peak	Off-Peak	PM Peak
Date			6/21/16
Start Time			6:09 PM
End Time			6:24 PM
Duration	MIN	MIN	15 MIN
Leq.			47.7

Atmospheric Data	
Wind Speed (mph)	5
Temp. (°F)	82
Humidity (%)	60

Traffic Data

	AM Peak		Off-Peak		PM Peak	
Roadway						
Direction						
Traffic Count:	0	0	0	0		
Cars						
MT						
HT						

Weather Conditions

Site Data: Site Surface (alpha): ____ Shielding Factor : ____ Pavement Type : ____

Profile View: Ambient

Monitoring Notes

AM Peak:

Off-Peak:

PM Peak

*Distances in photo to left are from noise meter to nearest structure and from noise meter to edge of closeset travel lane measured in ***feet.***

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.34210

Instrument:	**Sound Level Meter**	*Date Calibrated:* **7/7/2015**	*Cal Due:*
Model:	**NL42**		
Manufacturer:	**Rion**		
Serial number:	**01122580**		
Tested with:	**Microphone UC52 s/n 144597** **Preamplifier NH24 s/n 22621**		
Type (class):	**2**		
Customer:	**McCormick Taylor, Inc.**		
Tel/Fax:	**215-592-4200 ext.1313 /**		

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

Contains non-accredited tests: __Yes **X** No
Calibration service: __ **Basic** **X** **Standard**
Address: **5511 Capital Center Drive, Suite 560 Raleigh, NC 27606**

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/22/2012
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	31052	Oct 7, 2014	Scantek, Inc./ NVLAP	Oct 7, 2015
DS-360-SRS	Function Generator	33584	Sep 30, 2013	ACR Env./ A2LA	Sep 30, 2015
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Oct 1, 2014	ACR Env. / A2LA	Oct 1, 2015
HM30-Thommen	Meteo Station	1040170/39633	Oct 3, 2014	ACR Env./ A2LA	Oct 3, 2015
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2014	Scantek, Inc./ NVLAP	Nov 10, 2015
4226-Brüel&Kjær	Multifunction calibrator	2305103	Jul 28, 2014	Scantek, Inc./ NVLAP	Jul 28, 2015

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 (%)
24.2	100.25	49.1

Calibrated by:	Lydon Dawkins	**Authorized signatory:**	Valentin Buzduga
Signature	Lydon Dawkins	Signature	[signature]
Date	7/7/2015	Date	7/07/2015

Document stored Z:\Calibration Lab\SLM 2015\RIONL42_01122580_M1.doc

Meter # 2

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.34205

Instrument:	**Sound Level Meter**	*Date Calibrated:* **7/2/2015**	*Cal Due:*	
Model:	**NL42**	*Status:*	**Received**	**Sent**
Manufacturer:	**Rion**	*In tolerance:*	**X**	**X**
Serial number:	**01222875_017997**	*Out of tolerance:*		
Tested with:	**Microphone UC52 s/n 144499** **Preamplifier NH24 s/n 22922**	*See comments:*		

Contains non-accredited tests: __ **Yes** _X_ **No**

Calibration service: __ **Basic** _X_ **Standard**

Type (class): **2**

Customer: **Mccormick Taylor**

Address: **5 Capital Drive, Suite 400, Harrisburg, PA 17110**

Tel/Fax: **717-540-6040 /**

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/22/2012
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	31052	Oct 7, 2014	Scantek, Inc./ NVLAP	Oct 7, 2015
DS-360-SRS	Function Generator	33584	Sep 30, 2013	ACR Env./ A2LA	Sep 30, 2015
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Oct 1, 2014	ACR Env. / A2LA	Oct 1, 2015
HM30-Thommen	Meteo Station	1040170/39633	Oct 3, 2014	ACR Env./ A2LA	Oct 3, 2015
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2014	Scantek, Inc./ NVLAP	Nov 10, 2015
4226-Brüel&Kjær	Multifunction calibrator	2305103	Jul 28, 2014	Scantek, Inc./ NVLAP	Jul 28, 2015

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	99.78	69.1

Calibrated by:	Lydon Dawkins	**Authorized signatory:**	Valentin Buzduga
Signature	Lydon Dawkins	Signature	[signature]
Date	7/2/2015	Date	7/02/2015

Document stored Z:\Calibration Lab\SLM 2015\RIONL42_01222875_017997_M1.doc

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.34211

Instrument:	**Sound Level Meter**	*Date Calibrated:* **7/7/2015**	*Cal Due:*
Model:	**NL42**	*Status:*	**Received** / **Sent**
Manufacturer:	**Rion**	*In tolerance:*	X / X
Serial number:	**01222874_017995**	*Out of tolerance:*	
Tested with:	**Microphone UC52 s/n 144498** **Preamplifier NH24 s/n 22921**	*See comments:*	
		Contains non-accredited tests:	__Yes X No
Type (class):	**2**	*Calibration service:*	__ Basic X Standard
Customer:	**McCormick Taylor, Inc.**	*Address:*	**5511 Capital Center Drive, Suite 560 Raleigh, NC 27606**
Tel/Fax:	**215-592-4200 ext.1313 /**		

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/22/2012
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	31052	Oct 7, 2014	Scantek, Inc./ NVLAP	Oct 7, 2015
DS-360-SRS	Function Generator	33584	Sep 30, 2013	ACR Env./ A2LA	Sep 30, 2015
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Oct 1, 2014	ACR Env. / A2LA	Oct 1, 2015
HM30-Thommen	Meteo Station	1040170/39633	Oct 3, 2014	ACR Env./ A2LA	Oct 3, 2015
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2014	Scantek, Inc./ NVLAP	Nov 10, 2015
4226-Brüel&Kjær	Multifunction calibrator	2305103	Jul 28, 2014	Scantek, Inc./ NVLAP	Jul 28, 2015

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 (%)
25.0	100.26	44.5

Calibrated by:	Lydon Dawkins	**Authorized signatory:**	Valentin Buzduga
Signature	Lydon Dawkins	Signature	
Date	7/7/2015	Date	7/07/2015

Document stored Z:\Calibration Lab\SLM 2015\RIONL42_01222874_017995_M1.doc

RION

Supplied Accessories

Model	NL-42	Product Name	Sound Level Meter, Class 2

Ensure all the items below are in the package.
If there is a missing part, please contact your supplier.

Type	Description	Quantity	Note
NL-42	Main unit	1	# 00245570
NL-42-025	Storage case	1	UC-52# 150894
WS-10	Windscreen	1	NH-24 # 35571
NL-42-033	Windscreen fall prevention rubber	1	attached to the main unit
VM-63-017	Hand strap	1	
LR6	Size AA alkaline batteries	4	
	CD-ROM (Instruction manual, Serial Interface manual, Technical notes, Program option manual)	1	
	Description for IEC 61672-1	1	
	SD memory card (512 MByte)	1	only when NX-42EX is pre-installed
	Inspection certificate	1	This sheet
	Document for China RoHS	1	only to China

Inspection Certificate

INSPECTOR

M. Hidaka

We hereby certify that this product has been tested and calibrated at our factory according to RION specifications and that the product satisfies all relevant requirements.

RION CO., LTD.
3-20-41 Higashimotomachi, Kokubunji,
Tokyo 185-8533,
Japan

Sound and Vibration Measuring Instrument Section Product information and software downloads can be found on our web-site:
http://svmeas.rion.co.jp/
Please check it out.

№C11030302

8

RION

Supplied Accessories

Model	NL-42	Product Name	Sound Level Meter, Class 2

Ensure all the items below are in the package.
If there is a missing part, please contact your supplier.

Type	Description	Quantity	Note
NL-42	Main unit	1	00345989
NL-42-025	Storage case	1	UC-52-150797 NH-04-36127
WS-10	Windscreen	1	
NL-42-033	Windscreen fall prevention rubber	1	attached to the main unit
VM-63-017	Hand strap	1	
LR6	Size AA alkaline batteries	4	
	CD-ROM (Instruction manual, Serial interface manual, Technical notes, Program option manual)	1	
	Description for IEC 61672-1	1	
	SD memory card (512 MByte)	1	only when NX-42EX is pre-installed
	Inspection certificate	1	This sheet
	Document for China RoHS	1	only to China

Inspection Certificate

INSPECTOR

M. Kidaka

We hereby certify that this product has been tested and calibrated at our factory according to RION specifications and that the product satisfies all relevant requirements.

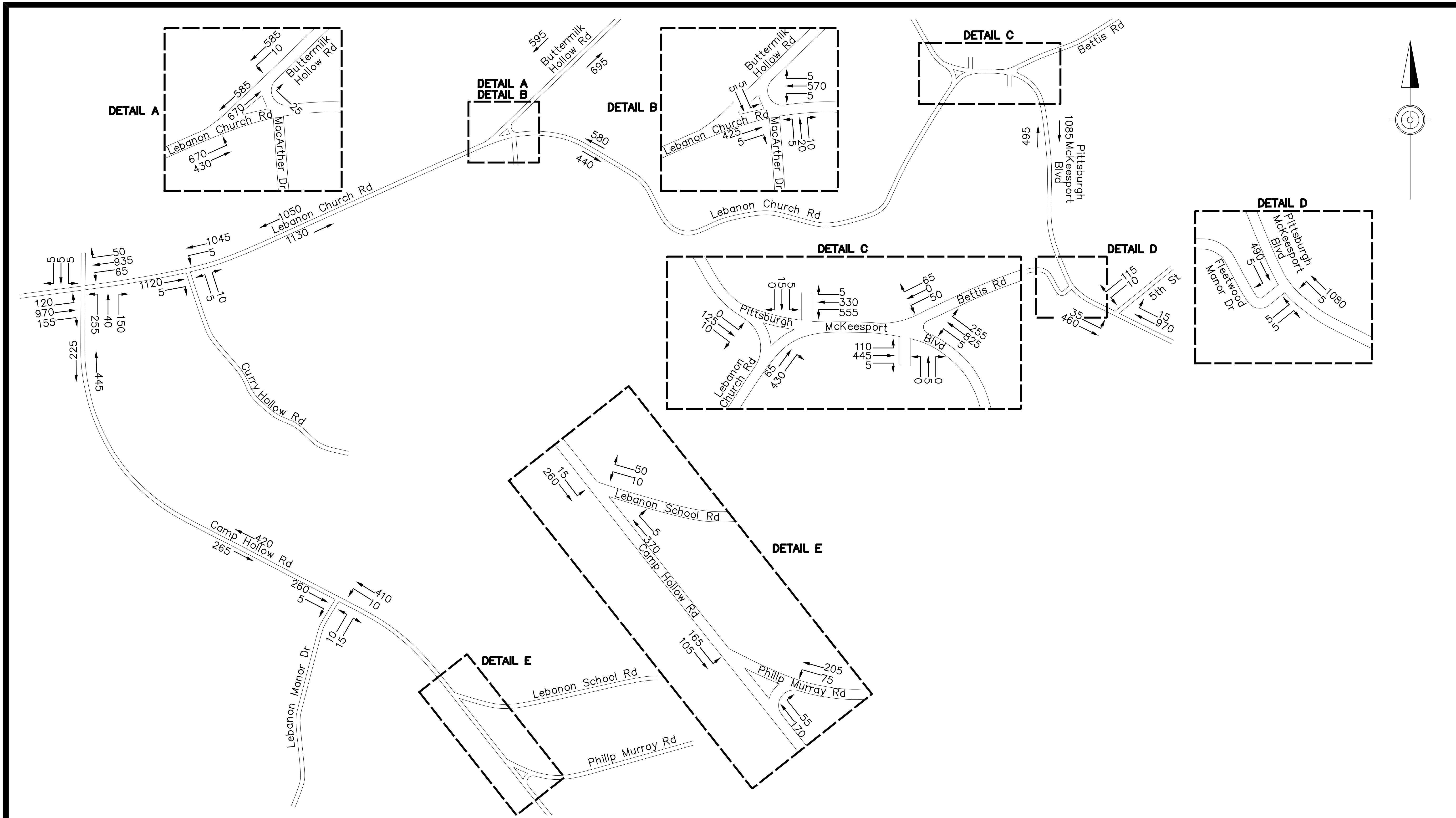
RION CO., LTD.
3-20-41 Higashimotomachi, Kokubunji,
Tokyo 185-8533,
Japan

Sound and Vibration Measuring Instrument Section Product information and software downloads can be found on our web-site:
http://svmeas.rion.co.jp/
Please check it out.

№C11030302

Appendix C

Traffic Data



MON/FAYETTE EXPRESSWAY PA 51 TO I-376

SECTION 53B

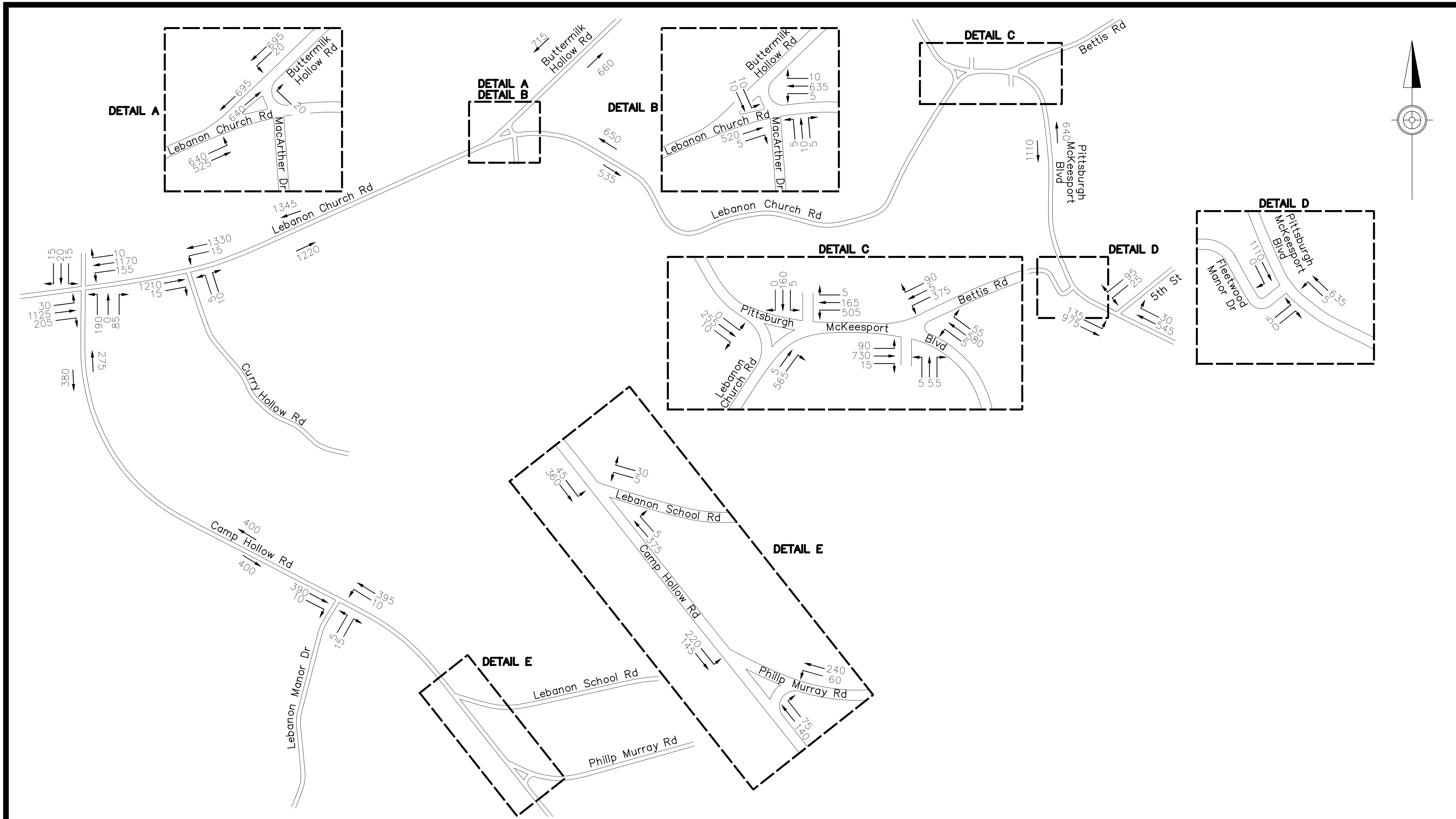
2020 NO-BUILD AM PEAK HOUR VOLUMES

AECOM

SHEET 22B

NOT TO SCALE

10-01-2020



MON/FAYETTE EXPRESSWAY PA 51 TO I-376

SECTION 53B

2020 NO-BUILD PM PEAK HOUR VOLUMES

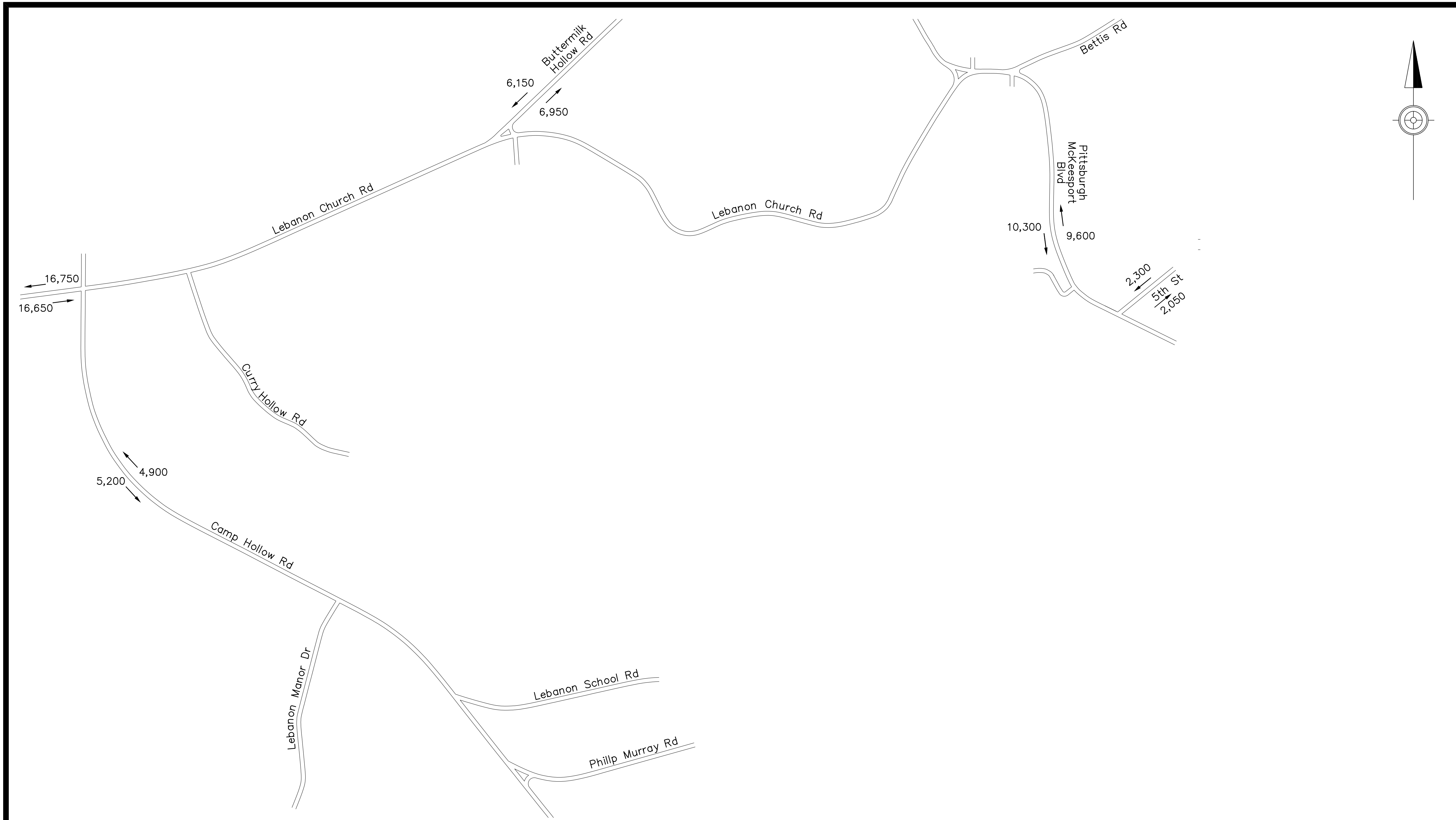
PENNA TURNPIKE

AECOM

SHEET 23B

NOT TO SCALE

10-01-2020



PENNA TURNPIKE

MON/FAYETTE EXPRESSWAY PA 51 TO I-376

SECTION 53B

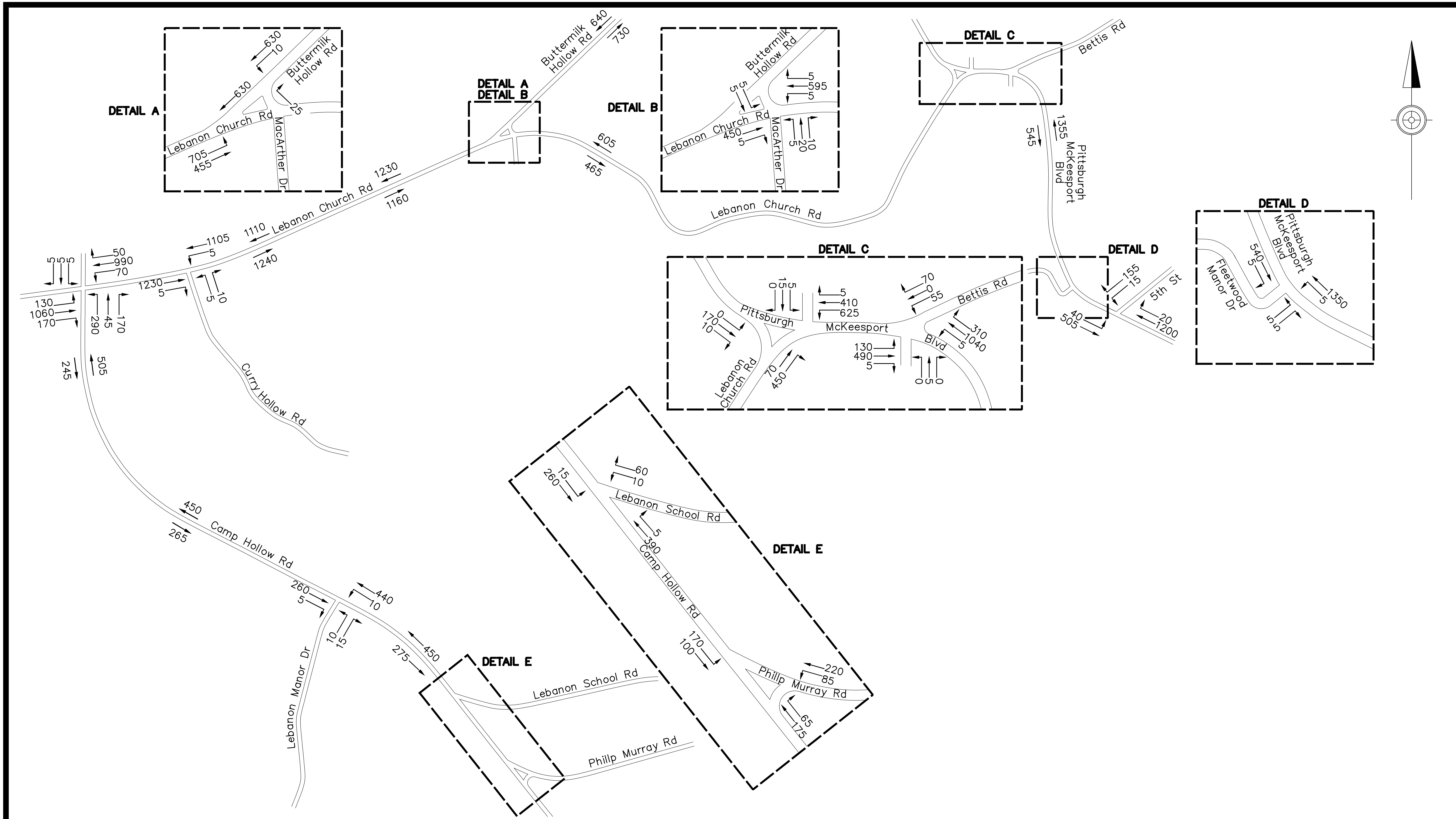
2020 NO-BUILD ADT VOLUMES

AECOM

SHEET 24B

NOT TO SCALE

10-01-2020



MON/FAYETTE EXPRESSWAY PA 51 TO I-376

SECTION 53B

2045 NO-BUILD AM PEAK HOUR VOLUMES

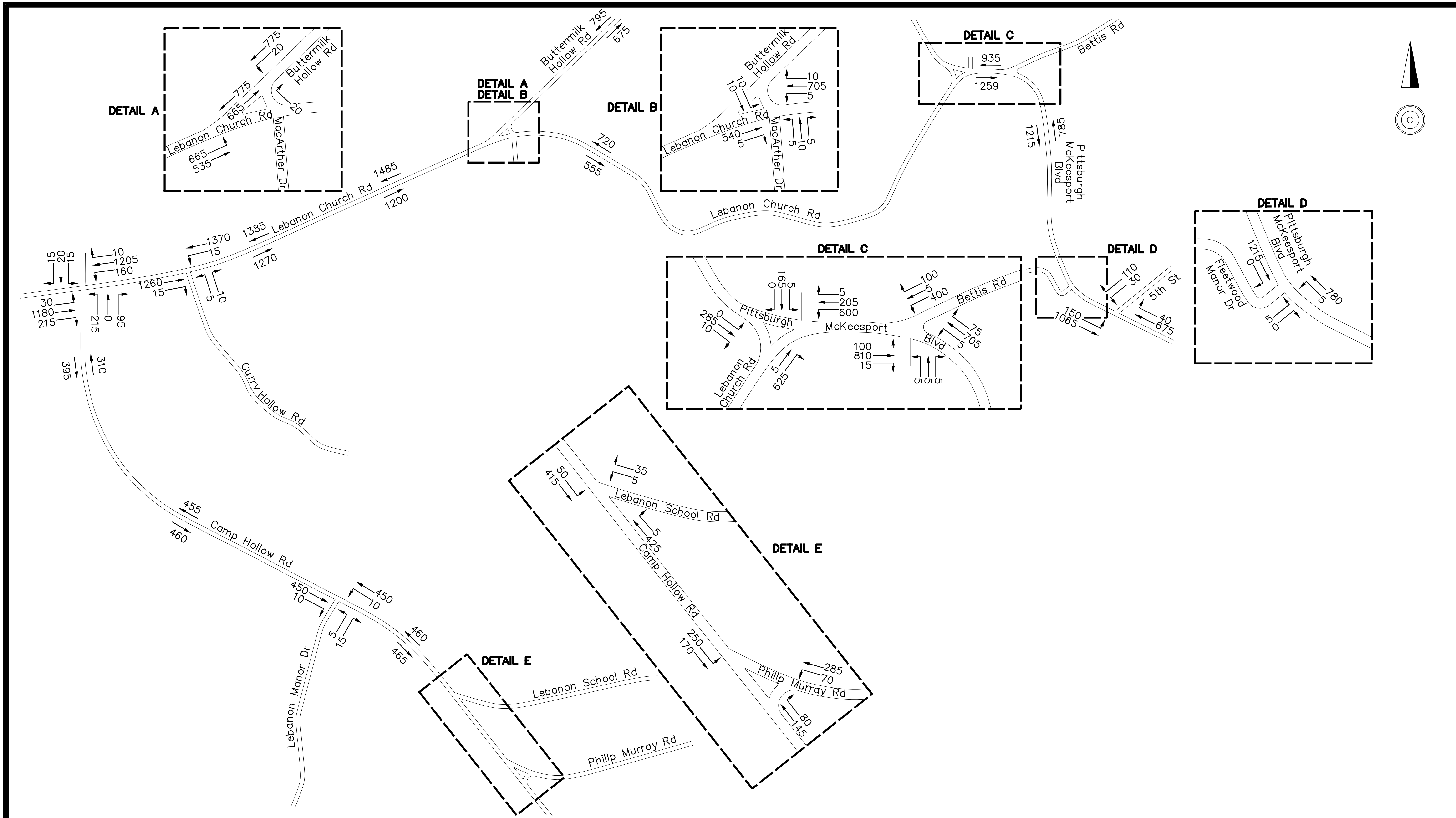
AECOM

SHEET 10B

NOT TO SCALE

10-01-2020

"rachel.myers" 10B 2045 No-Build AM Peak ...\124_MFE_53B_Figures.dgn



MON/FAYETTE EXPRESSWAY PA 51 TO I-376

SECTION 53B

2045 NO-BUILD PM PEAK HOUR VOLUMES

PENNA TURNPIKE

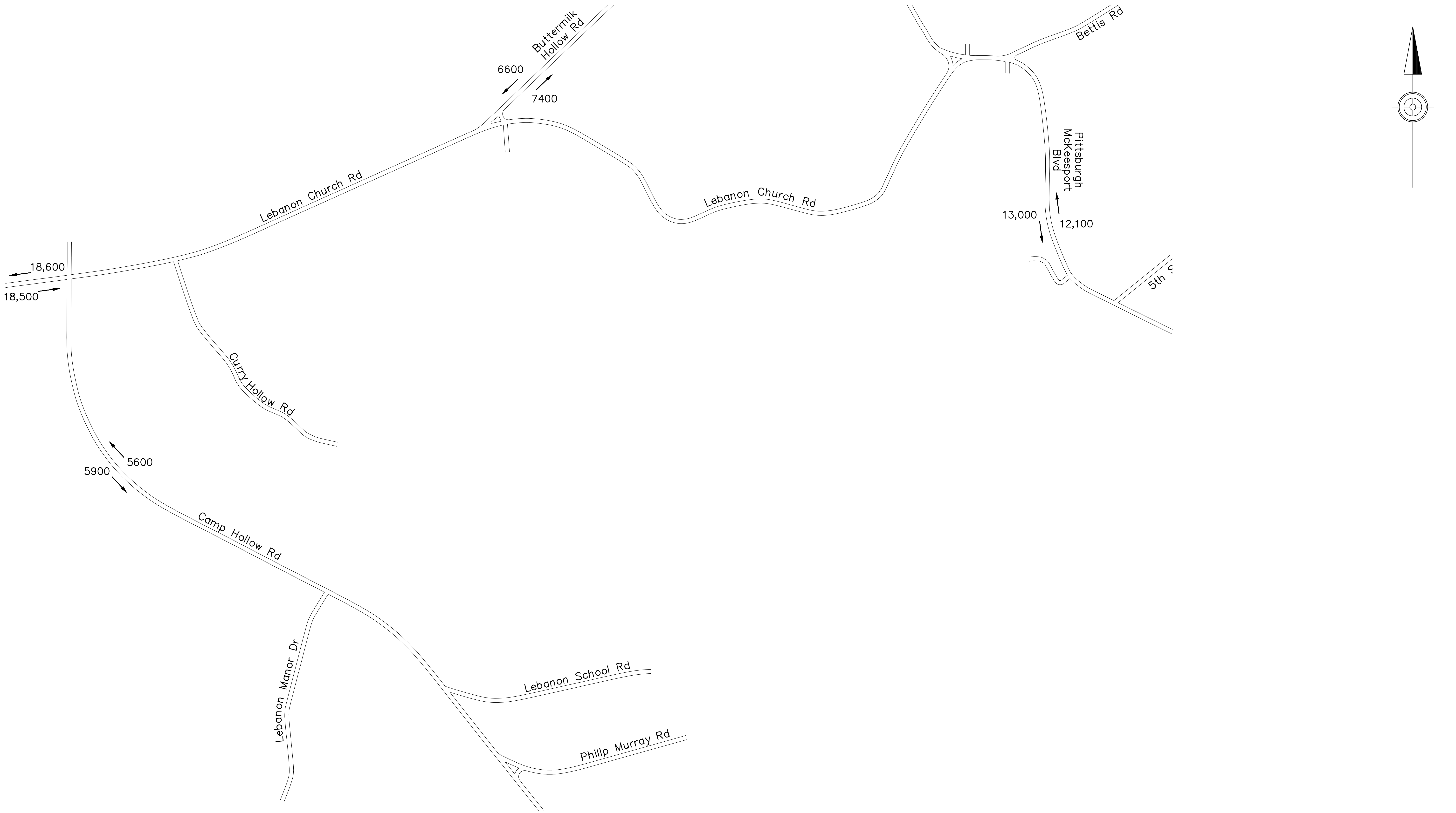
AECOM

SHEET 11B

REV. 2

NOT TO SCALE

10-01-2020



PENNA TURNPIKE

MON/FAYETTE EXPRESSWAY PA 51 TO I-376

SECTION 53B

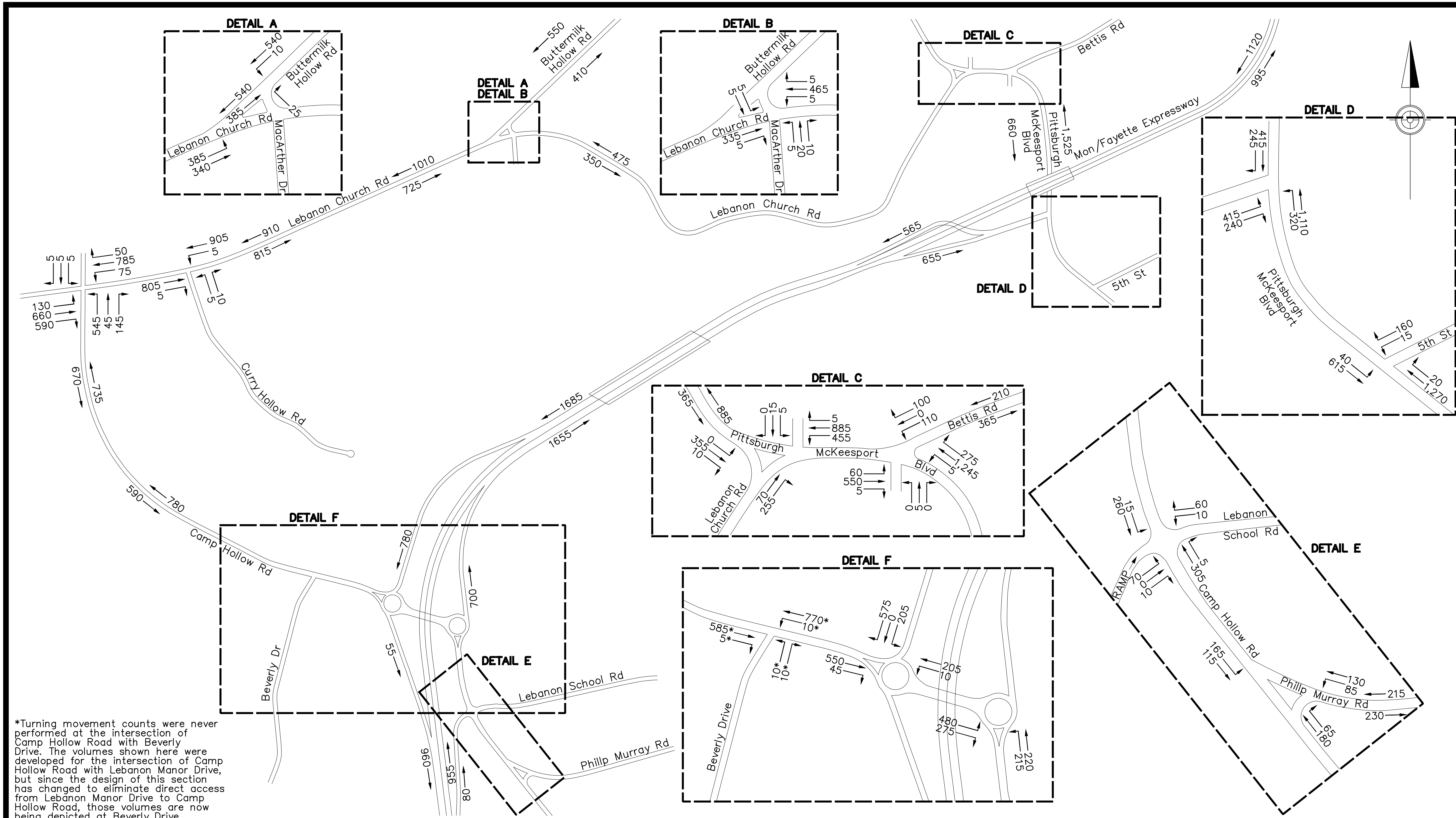
2045 NO-BUILD ADT VOLUMES

AECOM

SHEET 12B

NOT TO SCALE

10-01-2020



*Turning movement counts were never performed at the intersection of Camp Hollow Road with Beverly Drive. The volumes shown here were developed for the intersection of Camp Hollow Road with Lebanon Manor Drive, but since the design of this section has changed to eliminate direct access from Lebanon Manor Drive to Camp Hollow Road, those volumes are now being depicted at Beverly Drive.

PENNA TURNPIKE

MON/FAYETTE EXPRESSWAY PA 51 TO I-376

SECTION 53B

2045 BUILD AM PEAK HOUR VOLUMES

AECOM

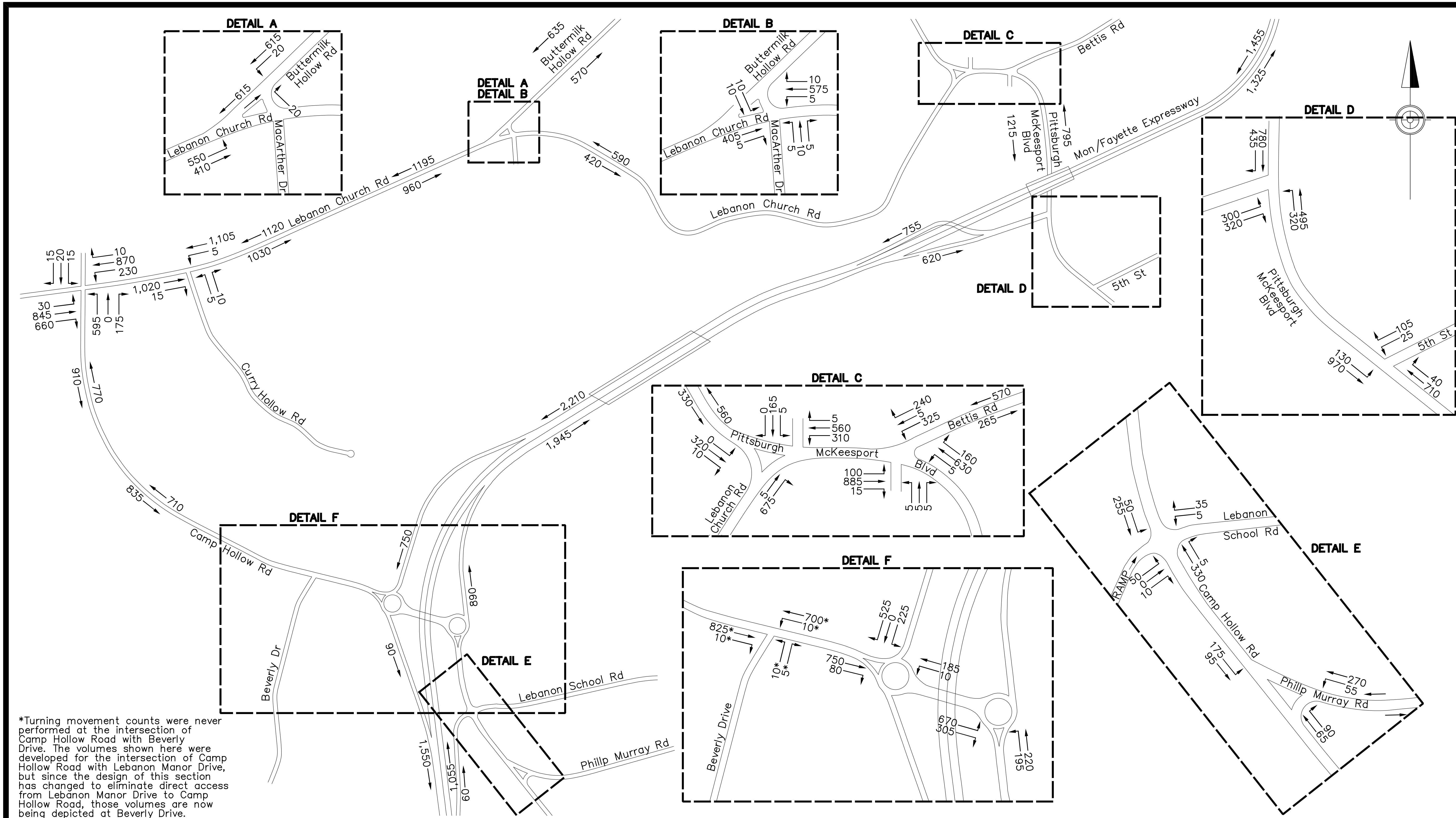
SHEET 13B

REV. 2

NOT TO SCALE

10-01-2020

"rachel.myers" 13B 2045 Build AM Peak ...\124_MFE_53B_Figures.dgn



*Turning movement counts were never performed at the intersection of Camp Hollow Road with Beverly Drive. The volumes shown here were developed for the intersection of Camp Hollow Road with Lebanon Manor Drive, but since the design of this section has changed to eliminate direct access from Lebanon Manor Drive to Camp Hollow Road, those volumes are now being depicted at Beverly Drive.

PENNA TURNPIKE

MON/FAYETTE EXPRESSWAY PA 51 TO I-376

SECTION 53B

2045 BUILD PM PEAK HOUR VOLUMES

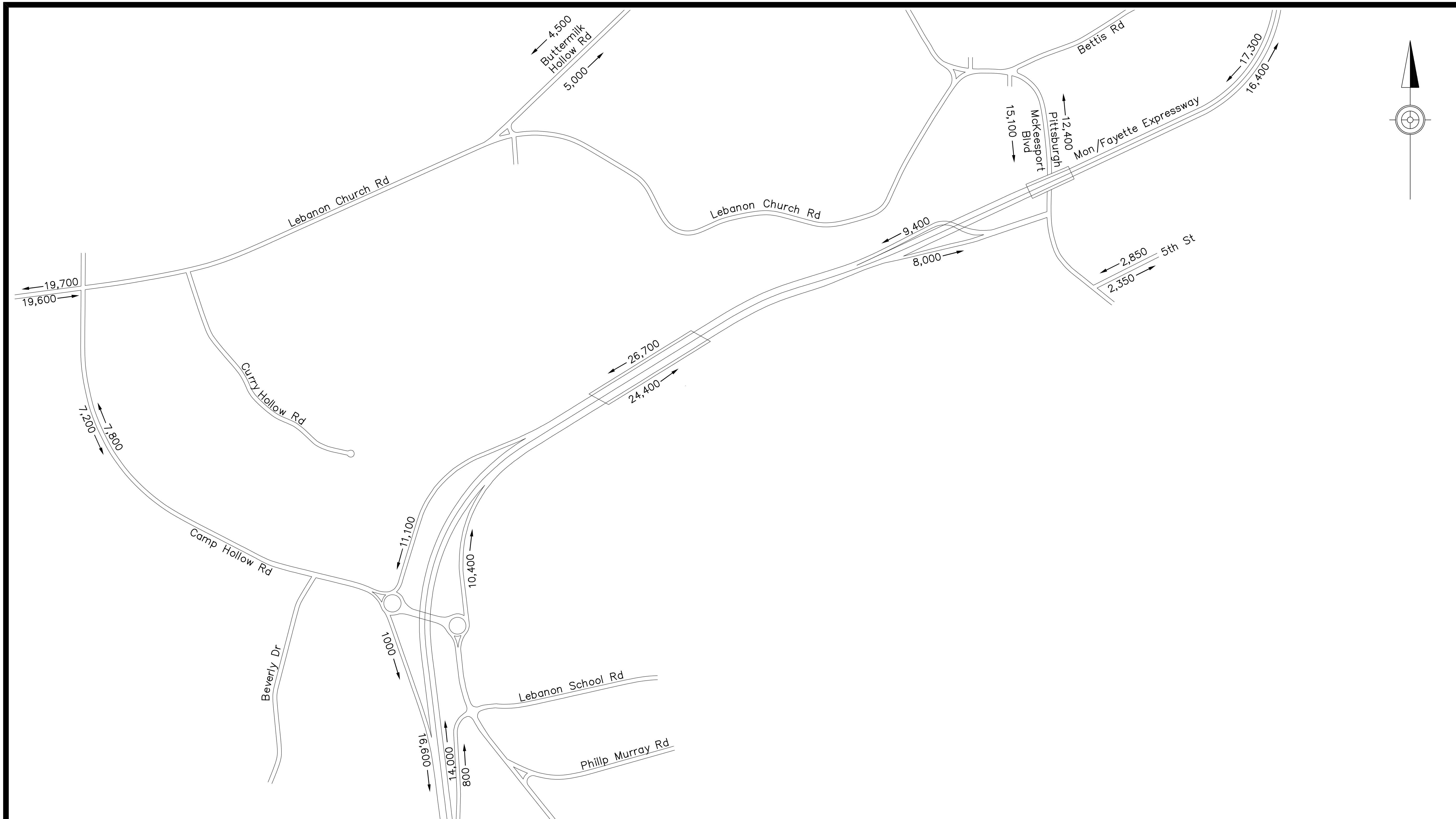
AECOM

SHEET 14B

REV. 3

NOT TO SCALE

10-01-2020



MON/FAYETTE EXPRESSWAY PA 51 TO I-376

SECTION 53B

2045 BUILD ADT VOLUMES

AECOM

SHEET 15B

NOT TO SCALE

10-01-2020

This Memorandum provides traffic design assumptions for Peak Hour Factors, Percent Trucks and traffic K factors for each design section for the Mon/Fayette Expressway PA 51 to I-376 Project

The memorandum is divided into the following Design Sections:

- 53A
- 53 B
- 53C-D
- 53E-F
- 53G

Please use the factors for your specific Design Section

Mon Fayette Expressway: Section 53B
Traffic Assumptions for Peak Hour Factors and Percent Trucks
& K Factors for Local Roads

Peak Hour Factors:
The Peak Hour Factor (PHF) is the relationship between the peak 15-minute flow rate and the full hourly volume. Lower values signify greater variability of flow within the subject hour, and higher values signify little flow variation. In the absence of field data the Highway Capacity Manual (HCM) provides typical PHF default values of 0.92 for urban areas and 0.88 for rural areas.

The project team has completed an extensive traffic volume data collection effort to establish the traffic model. From this data existing PHF for the intersections along Section 53B provide the following data seen in Table 1. At the bottom of the table, a weighted average PHF by volume has been calculated.

Table 1: Measured Intersection PHFs at Section 53B Project Intersections.

Intersection	AM PHF	PM PHF
Bettis Plant at Pittsburgh McKeesport Blvd	0.93	0.97
Buttermilk at Lebanon Church Rd Connector	0.98	0.95
Camp Hollow at Lebanon Church	0.92	0.97
Camp Hollow at Lebanon Manor	0.91	0.98
Camp Hollow at old Lebanon School	0.95	0.92
Camp Hollow at Philip Murray	0.92	0.92
Curry Hollow at Lebanon Church	0.91	0.95
Lebanon Church at Buttermilk Connector and MacArthur Dr.	0.84	0.97
Pittsburgh McKeesport Blvd at Fleetwood Manor	0.96	0.96
Pittsburgh McKeesport Blvd at Lebanon Church	0.93	0.96
Weighted Average PHF FOR SECTION 53B	**0.93**	**0.96**

Percent Trucks:
Heavy vehicles are vehicles that have more than four tires touching the pavement and include trucks, buses, and recreational vehicles. Heavy vehicles or just simply trucks affect the number of vehicles that can be served. Trucks affect traffic in two ways:

- They are larger than passenger cars and occupy more roadway space
- They have poorer operating capabilities than passenger cars, particularly accelerating, decelerating, and maintaining speed on upgrades.

For the future analysis, the percentage of trucks on the roadways will be assumed to equal the existing percentage. For the new roadways (i.e. the mainline section), the existing percentage of trucks for the adjacent roadways were used to determine the truck percentage. This information is provided below.

Table 2: Measured Truck Percentages on Section 53B Roadways.

Location	24 Hr. Truck Percent	AM Truck Percent	PM Truck Percent	Directional Distribution
Pittsburgh McKeesport Blvd NB	5.8%	8.9%	8.5%	52
Pittsburgh McKeesport Blvd SB	8.4%	8.9%	8.5%	
Buttermilk Hollow Rd NB	4.9%	4.4%	5.5%	53
Buttermilk Hollow Rd SB	8.0%	6.4%	3.7%	
Camp Hollow ~~EB~~ SB	5.6%	3.8%	1.5%	52
Camp Hollow ~~WB~~ NB	2.6%	3.6%	0.5%	
Lebanon Church Rd EB	2.5%	2.4%	1.5%	50
Lebanon Church Rd WB	4.7%	4.7%	2.6%	

Table 3: Projected Mainline Truck Percentages by Classification

VEHICLE CLASS	VEHICLE TYPE	% DISTRIBUTION
1	Motorcycles	1.80%
2	Cars	67.93%
3	2A - 4T	13.72%
4	Buses	4.82%
5	2A - SU	7.06%
6	3A - SU	1.22%
7	4A - SU	0.77%
8	4A - ST	0.89%
9	5A - ST	1.16%
10	6A - ST	0.31%
11	5A - MT	0.12%
12	6A - MT	0.10%
13	7A - MT	0.10%
TOTAL		100%

Table 4: Projected Mainline Truck Percentages by Number of Axles

No. of Axles	FHWA Classes	Distribution
2-AXLE	1,2,3 & 5	90.5%
3-AXLE	4 & 6	6.0%
4-AXLE	7 & 8	1.7%
5-AXLE	9 & 11	1.3%
6-AXLE	10,12 & 13	0.5%
TOTAL		100%

K Factors:
K factors are used for design and analysis of traffic flow on highways. This factor is typically used to determine peak hour volumes when compared to the AADT. It can also be applied to the highest of the AM or PM Peak hour traffic volumes to determine the ADT for side roads along the project corridor. K factors calculated from local road count locations along the project corridor are provided below.

Table 5: Local Road K Factors

Location	AM K	Mid K	PM K	Max
Jefferson Blvd EB	5.9	9.5	10.3	10.3
Jefferson Blvd WB	9.7	6.7	7.5	9.7
Buttermilk Hollow Rd NB	7.7	6.8	8.0	8.0
Buttermilk Hollow Rd SB	5.7	7.7	8.7	8.7
Camp Hollow EB	9.8	6.7	7.6	9.8
Camp Hollow WB	6.3	9.0	9.4	9.4
Commonwealth Ave EB	6.3	8.8	9.2	9.2
Commonwealth Ave WB	6.3	9.1	8.8	9.1
Hoffman Blvd EB	7.2	8.4	8.4	8.4
Hoffman Blvd WB	4.9	10.0	10.0	10.0
SR 2068 EB	4.6	7.7	10.3	10.3
SR 2068 WB	4.9	6.3	8.0	8.0
Braddock Ave EB	3.3	7.0	10.9	10.9
Braddock Ave WB	11.5	8.5	6.1	11.5
EB-Old Will. Penn Hwy East of Thompson	8.0	8.0	10.0	10.0
WB-Old Will. Penn Hwy East of Thompson	6.0	7.0	9.0	9.0
EB-Old Will. Penn Hwy West of Thompson	5.0	9.0	12.0	12.0
WB-Old Will. Penn Hwy West of Thompson	8.0	7.0	8.0	8.0
Thompson Run Rd	8.0	8.0	10.0	10.0
			LOCAL ROAD K FACTORS	**9.6**

Table 3: Projected Mainline Truck Percentages by Classification

VEHICLE CLASS	VEHICLE TYPE	% DISTRIBUTION
1	Motorcycles	1.80%
2	Cars	67.93%
3	2A - 4T	13.72%
4	Buses	4.82%
5	2A - SU	7.06%
6	3A - SU	1.22%
7	4A - SU	0.77%
8	4A - ST	0.89%
9	5A - ST	1.16%
10	6A - ST	0.31%
11	5A - MT	0.12%
12	6A - MT	0.10%
13	7A - MT	0.10%
TOTAL		100%

Table 4: Projected Mainline Truck Percentages by Number of Axles

No. of Axles	FHWA Classes	Distribution
2-AXLE	1,2,3 & 5	90.5%
3-AXLE	4 & 6	6.0%
4-AXLE	7 & 8	1.7%
5-AXLE	9 & 11	1.3%
6-AXLE	10,12 & 13	0.5%
TOTAL		100%

K Factors:

K factors are used for design and analysis of traffic flow on highways. This factor is typically used to determine peak hour volumes when compared to the AADT. It can also be applied to the highest of the AM or PM Peak hour traffic volumes to determine the ADT for side roads along the project corridor. K factors calculated from local road count locations along the project corridor are provided below.

Table 5: Local Road K Factors

Local Road K Factors				
Location	**AM K**	**Mid K**	**PM K**	**Max**
Jefferson Blvd EB	5.9	9.5	10.3	10.3
Jefferson Blvd WB	9.7	6.7	7.5	9.7
Buttermilk Hollow Rd NB	7.7	6.8	8.0	8.0
Buttermilk Hollow Rd SB	5.7	7.7	8.7	8.7
Camp Hollow EB	9.8	6.7	7.6	9.8
Camp Hollow WB	6.3	9.0	9.4	9.4
Commonwealth Ave EB	6.3	8.8	9.2	9.2
Commonwealth Ave WB	6.3	9.1	8.8	9.1
Hoffman Blvd EB	7.2	8.4	8.4	8.4
Hoffman Blvd WB	4.9	10.0	10.0	10.0
SR 2068 EB	4.6	7.7	10.3	10.3
SR 2068 WB	4.9	6.3	8.0	8.0
Braddock Ave EB	3.3	7.0	10.9	10.9
Braddock Ave WB	11.5	8.5	6.1	11.5
EB-Old Will. Penn Hwy East of Thompson	8.0	8.0	10.0	10.0
WB-Old Will. Penn Hwy East of Thompson	6.0	7.0	9.0	9.0
EB-Old Will. Penn Hwy West of Thompson	5.0	9.0	12.0	12.0
WB-Old Will. Penn Hwy West of Thompson	8.0	7.0	8.0	8.0
Thompson Run Rd	8.0	8.0	10.0	10.0
			LOCAL ROAD K FACTORS	**9.6**

Appendix D

PennDOT Noise Barrier Warranted, Feasible, and Reasonable Worksheets

Highway Traffic Noise Abatement
Warranted, Feasible, and Reasonable Worksheet – NSA 36

Date	3/8/2023
Project Name	Mon/Fayette Expressway
County	Allegheny
SR, Section	SR 0043, Section 53A2
Community Name and/or NSA #	NSA 36
Noise Wall Identification (i.e., Wall 1)	NSA 36

General

1. Type of project (new location, reconstruction, etc.): new construction/new location

2. Total number of impacted receptor units in community

Category A units impacted	
Category B units impacted	15*
Category C units impacted	
Category D units impacted (if interior analysis required)	
Category E units impacted	

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): ______
   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* ." ______ Yes ______ 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? X 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)? X 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 X 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? X Yes ___ No
2. Can the noise wall be designed and physically constructed at the proposed location? X Yes ___ No
3. Can the noise wall be constructed without causing a safety problem? X Yes ___ No
4. Can the noise wall be constructed without restricting access to vehicular or pedestrian travel? X Yes ___ No
5. Can the noise wall be constructed in a manner that allows for access for required maintenance and inspection operations? X Yes ___ No
6. Can the noise wall be constructed in a manner that permits utilities to function in a normal manner? X Yes ___ No
7. Can the noise wall be constructed in a manner that permits drainage features to function in a normal manner? X 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." ___ Yes ___ No

2. Square Footage Per Benefited Receptor (SF/BR) Evaluation
   a. Area (SF) of the proposed noise wall: 23,056
   b. Number of benefited receptor units (any unit receiving 5 dB(A) or more insertion loss): 46
   c. SF/BR = 2a/2b: 501
   d. Is 2c less than or equal to the MaxSF/BR value of 2000? X 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? X 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? X 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? X 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? X Yes ____ No

e. Does the noise wall reduce design year noise levels back to existing levels? ____ Yes X 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? ____ Yes ____ 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 ____ Yes ____ No

Decision

Is the Noise Wall WARRANTED?	X Yes	____ No
Is the Noise Wall FEASIBLE?	X Yes	____ No
Is the Noise Wall REASONABLE?	X Yes	____ No

Additional Reasons for Decision:
*Eleven (11) of the impacted receptors are located adjacent to Camp Hollow Road and maintain direct driveway access, and are currently impacted by traffic on Camp Hollow Road; no feasible abatement could be developed for these receptors. The four (4) impacted receptors benefited by the proposed abatement are impacts resulting from the proposed new highway on new alignment.

Responsible/Qualified Individuals Making the Above Decisions

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PennDOT, Engineering District Environmental Manager	Date
Frederick E Schiller, Acoustical Scientist, Navarro & Wright	3/8/2023
Qualified Professional Performing the Analysis (name, title, and company name)	Date