Appendix D: Noise Technical Report

for the

I-95 Access Improvements from Caton Avenue to Fort McHenry Tunnel – Environmental Assessment (EA)
Baltimore City, Maryland

Type I Technical Noise Report

Prepared for:

Maryland Transportation Authority

DEPARTMENT OF TRANSPORTATION BALTIMORE CITY

and

U.S. Department of Transportation Federal Highway Administration

March 2018

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EXECUTIVE SUMMARY

This project involves the design and construction of a suite of improvements to Interstate 95 (I-95) ramps and other nearby transportation facilities to support ongoing and planned redevelopment of the Port Covington peninsula in south Baltimore. These improvements are collectively known as the I-95 Access Improvements from Caton Avenue to the Fort McHenry Tunnel (I-95 Access Improvements) and also include sections of Hanover Street, McComas Street, and Key Highway. This report documents the Existing and Future Build noise levels associated with the highway and ramp improvements related to I-95 and those additional improvements along local roadways including Hanover Street, McComas Street, and Key Highway. These improvements include:

Element A: I-95 Northbound Off Ramps

- **New Ramps**
  - **Spur from Russell Street Ramp** – The existing auxiliary lane between the Caton Avenue on ramp and the Russell Street off ramp would be widened to two lanes. The Russell Street off ramp would also be widened to two lanes until it overpasses MD 295, at which point the two lanes would split. One lane would continue along the existing ramp alignment to Russell Street NB. The second would continue east, over the Middle Branch, as a new ramp spur parallel to the existing ramps adjacent to I-95 NB, and merge with the new spur ramp from I-395 SB, connecting to McComas Street at an at-grade intersection on the western side of Port Covington.
  - **Spur from I-395 SB Ramp** – A new ramp spur, splitting off from the existing I-395 SB Ramp to I-95 NB where it overpasses I-95, is proposed. It would run southeast, merge with the new spur ramp from Russell Street, and connect to McComas Street at an at-grade intersection on the western side of Port Covington.
- **I-95 NB to Hanover Street SB Ramp** – The existing ramp would be removed. Vehicles traveling from I-395 SB to MD 2 SB would be accommodated by a new ramp spur from I-395 SB.
- **I-95 NB to McComas Street Ramp** – The existing ramp would remain in a similar location, but would be realigned to accommodate the new I-95 NB on ramp (Element B), modifications to McComas Street (Element F), and the removal of the existing Hanover Street ramp from I-95 NB. The realigned ramp would extend the existing auxiliary lane that terminates at the Hanover Street exit to a two lane exit gore located approximately 1,600 feet from the existing I-395 SB on ramp gore. The new two-lane exit ramp would run under I-95 NB, braid through the existing piers, and daylight perpendicular to an at-grade signalized intersection with McComas Street near the existing intersection of McComas and Cromwell Streets.

Element B: I-95 Northbound On Ramps

- **Key Highway to I-95 NB Ramp** – No modifications to the existing ramp are proposed.

- **McComas Street to I-95 NB Ramp** – A new ramp is proposed from McComas Street at a location approximately 700 feet east of its intersection with Hanover Street. The new ramp would braid with the realigned I-95 NB to McComas Street Ramp (Element A) and modifications to the realigned one-way section of McComas Street WB (Element F).

<u>Element C: I-95 Southbound Off Ramps</u>

- **I-95 SB to Key Highway Ramp –** No modifications to the existing ramp are proposed.

- **I-95 SB to McComas Street WB Ramp –** A new ramp, with a gore located approximately 400 feet west of the Key Highway overpass is proposed. It would provide access to the one-way section of McComas Street WB located directly beneath I-95 SB. The new ramp would braid with the realigned McComas Street WB to I-95 SB Ramp (Element D). The improvements would require the relocation of two CSX storage tracks.

<u>Element D: I-95 Southbound On Ramps</u>

- **McComas Street WB to I-95 SB** – The existing ramp would continue to provide access from the one-way section of McComas Street WB to I-95 SB, but would be realigned to minimize construction cost and duration. It would braid with the new ramp from I-95 SB to McComas Street WB (Element C).

- **Hanover Street NB to I-95 SB** – No modifications to the existing ramp are proposed.

<u>Element E: Hanover Street</u>

- **From Wells Street to McComas Street** – No modifications to this section of Hanover Street are proposed.

<u>Element F: McComas Street & Key Highway</u>

- **McComas Street west of Key Highway** – The existing two-way section of McComas Street and the one-way section of McComas Street EB would be converted to a two-way boulevard from the western side of the Port Covington peninsula to Key Highway. The boulevard would accommodate vehicular and multi-modal connections between South Baltimore, I-95, and the Port Covington development. The median would be designed to accommodate a future light rail spur from Westport anticipated to terminate prior to the existing intersection of McComas and Cromwell Streets. The existing one-way section of McComas Street WB beneath I-95 SB would remain in its current location, but be modified to accommodate the addition of an exclusive right-turn lane at the approach to the Key Highway intersection, the addition of the I-95 SB to McComas Street WB ramp (Element C), and the tie-in to the proposed two-way McComas Street Boulevard.

- **Key Highway –** The existing roadway would be widened from a 4-lane section (2 NB & 2 SB) to a 5-lane section (3 NB & 2 SB) between the McHenry Row and McComas Street intersections Additionally, a 450’ long southbound right-turn lane would be added at the McComas Street intersection. The CSX bridge over Key Highway, just north of the McComas Street intersection, would be reconstructed to accommodate the new width of Key Highway.

For purposes of the noise study, noise monitoring was performed at nine locations during peak traffic conditions. Major sources of acoustic shielding (e.g., terrain lines, and building rows, etc.) and primary land usage adjacent to the project corridor were documented by field reconnaissance. Noise modeling using the Federal Highway Administrations Traffic Noise Model (FHWA TNM 2.5), was conducted at additional locations to supplement the understanding of the existing noise environment and to determine how the proposed improvements would affect the noise levels throughout the project area.

For reporting purposes, the project was divided into eight Noise Sensitive Areas (NSAs). Noise modeling was completed for Existing (2016) and Future Build (2040) conditions. It was determined that existing worst-case noise levels exceed FHWA/MDOT SHA Noise Abatement Criteria (NAC) at many of the front-row receptors in the project area, which is primarily due to high existing traffic volumes along I-95. However, because the study assumes that the proposed Port Covington development would be built, many of these receivers would not exist in the 2040 Future Build year. For the Future Build year, 28 impacts were predicted at noise sensitive receptor locations. Of those locations, 18 would be representative of the northern edge of the proposed Port Covington redevelopment area. The receivers in the study area are comprised of residential and a few retail/commercial land uses, several parks (including Swann Park and Riverdale Park), and numerous industrial land uses. In total, only one residential land use area warranted noise abatement consideration. In addition, because the Future Build (2040) noise levels predicted for the Port Covington area do not meet the requirement for permitted land uses; they were not included in the abatement analyses. For the remainder of the assessed noise locations, an evaluation concluded that noise abatement would not be feasible or reasonable. A discussion of the noise abatement evaluation is described in this technical report.

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Baltimore City, Maryland

Type I
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March 2018

Section 1
INTRODUCTION

Prepared for:

Maryland Transportation Authority

DEPARTMENT OF TRANSPORTATION BALTIMORE CITY

and

U.S. Department of Transportation Federal Highway Administration

Introduction

The project involved the design and construction of several roadway and ramp improvements along the I-95 corridor in the vicinity of the Port Covington peninsula. In addition, several local roadway improvements were assessed for Hanover Street, McComas Street, and Key Highway. The study area is approximately seven miles long, and as shown on **Figure 1**, construction would primarily occur within the I-95 Right-of-Way between MD 295 and Andre Street along the northern boundary of the Port Covington peninsula. Along this section, I-95 is generally eight lanes wide – four each in the northbound and southbound directions. Exit 54 (Hanover Street) and Exit 55 (Key Highway) currently provide access between I-95 and the Port Covington peninsula.

Figure 1: Study Area

I-95 is part of the Interstate Highway System in the City of Baltimore, and is owned, operated and maintained by Maryland Department of Transportation State Highway Administration (MDOT SHA). The Baltimore City DOT is responsible for other arterial and collector roadways in the project area. The Federal Highway Administration (FHWA) has approval authority over any changes to access points on the Interstate Highway System. Approval of any proposed modification to interstate access constitutes a federal action subject to review under the National Environmental Policy Act (NEPA).

This technical report has been prepared to evaluate the potential noise impacts of the I-95 Access Improvements project in compliance with Maryland Transportation Authority (MDTA), Maryland Department of Transportation (MDOT), MDOT SHA Highway Noise Policy (August 2011), and FHWA's noise regulations (23 CFR 772). This technical report details the steps involved in the noise analysis, including noise monitoring/modeling methodologies, results, impact evaluation, and noise abatement optimization.

Noise Fundamentals Overview

Noise, otherwise known as unwanted sound, is a fluctuating disturbance of the air caused by the propagation of sound pressure waves. Noise within a community can come from man-made sources such as automobiles, trucks, buses, aircraft, rail and construction equipment, as well as industrial, commercial, transportation, and manufacturing facilities. In some instances, additional noise within the community environment can also include natural sources such as animals, insects, and wind.

Noise levels, which are measured using a logarithmic unit called a decibel (dB), simply relate the magnitude of the sound pressure from a noise source to a standard reference value. While the noise values of extremely loud activities can approach 135 dB, normally encountered sounds lie in the range of 40 to 120 dB. A sample of common noise sources expressed in A-weighted decibels is shown in **Figure 2** (see following paragraph for an explanation of A-weighting).

Noise of any kind contains sound energy that occurs at several different frequencies. The frequency range of this sound energy depends on the nature of the individual noise activity or source. For example, train noise can contain both the low frequency rumbling of the freight train engine and the high frequency characteristics of wheel squeal noise along tight radius curves. With respect to the way in which humans interpret noise, this is important because the human ear does not register the sound levels of all noise frequencies equally, automatically reducing the impression of high and low-pitched sounds. Over the normal range of hearing, humans are most sensitive to sounds produced with frequencies in the range of 200 Hz to 10,000 Hz. To quantitatively replicate this response of the human ear to noise, the noise levels at different frequencies must be adjusted using a process referred to as A-weighting. Under such a process, the resulting noise level commonly expressed as an A-weighted decibel (dBA) will automatically compensate for the non-flat frequency response of human hearing.

Figure 2: Common Indoor and Outdoor Noise Levels

Table 1.A Common Outdoor and Indoor Noise Levels

Common Outdoor Noise Example	Noise Level (decibels)	Common Indoor Noise Example
	110	Rock Band
Jet Flyover at 1,000 feet	100	Inside Subway Train
Gas Lawn Mower at 3 feet		
Diesel Truck at 50 feet	90	Food Blender at 3 feet
Noisy Urban Daytime	80	Garbage Disposal at 3 feet, Shouting at 3 feet
Gas Lawn Mower at 100 feet	70	Vacuum Cleaner at 10 feet
Commercial Area		Normal Speech at 3 feet
	60	
		Large Business Office
Quiet Urban Daytime	50	Dishwasher, Next Room
Quiet Urban Nighttime	40	Small Theater, Large Conference Room (background)
Quiet Suburban Nighttime		Library
	30	
Quiet Rural Nighttime		Bedroom at Night, Concert Hall (background)
	20	
		Broadcast and Recording Studio
	10	Threshold of Hearing
	0	

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

Noise levels from environmental and man-made activities also vary widely over time. As a result, distinctive noise descriptors are used so that that these variations can be represented within a proper context. For example, the equivalent noise level, represented by the L_{eq} descriptor, characterizes a time-varying noise level produced over a random period of time, as a single number represented over a specified period of time. This represents the equivalent steady noise level, which, over a given period, contains the same energy as the time-varying noise during the same period.

A common time period used in environmental noise studies is one hour, represented as L_{eq} (h). This descriptor is used to express the results of noise monitoring, predictions, and impact assessments at sensitive receptors where people sleeping is not an issue.

Noise Criteria for Impact Assessment

With respect to NEPA Type 1 noise analyses, MDTA follows MDOT SHA's policy and guidance. In light of the wide range of land uses and sensitivities of the exposed population, the MDOT SHA/FHWA has set design goals and regulations of acceptable noise levels as they relate to highway projects. These regulations appear in Title 23 CFR Part 772 (Highway Traffic Noise and Construction Noise). They require that a noise analysis be conducted for all highway projects that meet the guidance criteria.

In addition, noise sensitive land uses must be identified and future design year noise levels due to the project must be predicted for these land uses. These levels must then be compared to the Noise Abatement Criteria (NAC) (See **Table 1**) and MDOT SHA's definition of a substantial increase in order to assess noise impacts. If the Future Build noise levels approach or exceed (are within one decibel of) the NAC, or if the projected noise increase is "substantial" (at least 10 to 15 dBA, depending upon the existing noise level), then noise abatement measures must be considered and, if reasonable and feasible, implemented.

Where required, 23 CFR 772 designates noise abatement measures that must be considered for reasonableness and feasibility. Reasonableness and feasibility requirements are defined in the MDOT SHA - Highway Noise Policy (2011).

Table 1: MDOT SHA/FHWA Noise Abatement Criteria (Hourly A-Weighted Sound Level (dBA)

Activity Category	Activity Criteria[1] $L_{eq}(h)$[2]	Maryland SHA Approach Criteria	Description of Activity Category
A	57 (Exterior)	56 (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 [3]	67 (Exterior)	66 (Exterior)	Residential
C [3]	67 (Exterior)	66 (Exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare 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	51 (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 [3]	72 (Exterior)	71 (Exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F
F	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	--	--	Undeveloped lands that are not permitted

[1] The $L_{eq}(h)$ Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.
[2] The equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period, with $L_{eq}(h)$ being the hourly value of Leq.
[3] Includes undeveloped lands permitted for this activity category.

I-95 Access Improvements from Caton Avenue to Fort McHenry Tunnel – Environmental Assessment (EA)
Baltimore City, Maryland

Type I Technical Noise Report

March 2018

Section 2

Noise Measurements and TNM Model Validation

Prepared for:

Maryland Transportation Authority

dot
DEPARTMENT OF TRANSPORTATION
BALTIMORE CITY

and

U.S. Department of Transportation
Federal Highway Administration

Existing Noise Environment

The study area consists of the Port Covington peninsula, areas north of I-95, and a small portion of the Westport community. The majority of land usage to the north of the I-95 viaduct consists of the existing CSX Rail Tracks and Yard. North of the rail tracks and yard are several single- and multi-family residential buildings along with active parkland and a few industrial uses just west of Hanover Street. South of the I-95 viaduct, land usage primarily consists of industrial uses with a few residences and a baseball field (Swann Park) located along McComas Street, just west of Hanover Street. Several rowhouses also exist along Annapolis Street in the northeast section of Westport.

<u>Noise Sensitive Areas Descriptions</u>

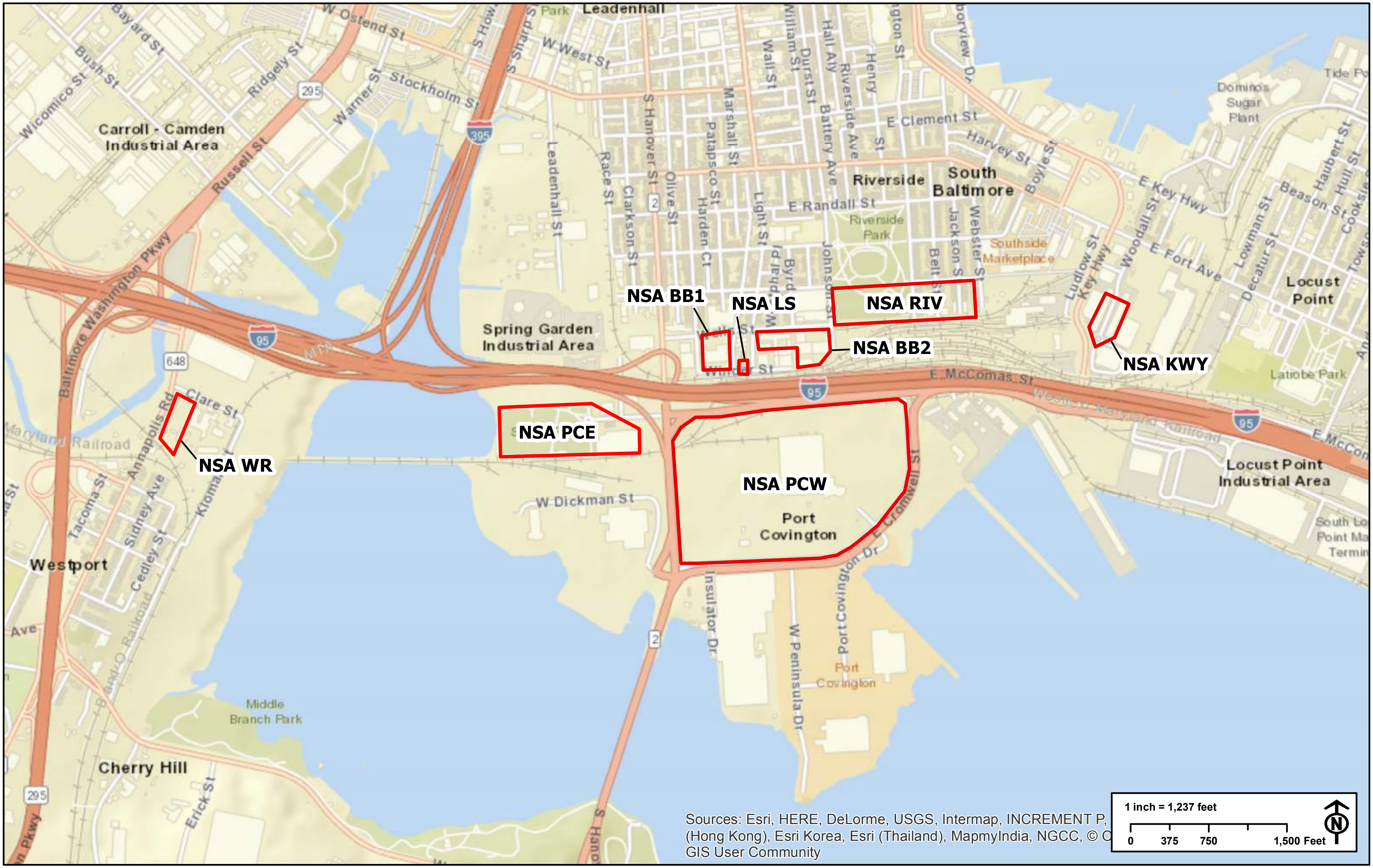
As shown in Table 1, the study of traffic noise considers different categories of impact depending upon the land usage. As a result, NSAs for common land usage and impact criteria are defined for specific and common geographic areas. Due to the length of this study area, this analysis was separated into eight sections common to an individual NSA. The locations of these NSAs are shown on **Figure 3.** The following is a brief description of each NSA.

<u>NSA WR</u>

NSA WR, which is associated with Activity Category "B", represents a row of residential homes in the Westport section of Baltimore. The receptors are located along the east side of Annapolis Road just south of Clare Street and are comprised of one-family homes. The highway improvement (Element A) is closest to this NSA and it includes the widening of the I-95 auxiliary off ramp as well as the new NB off ramp to McComas Street. However, traffic traveling along Annapolis Street represents the dominant noise source as I-95 is located over 500 feet from this NSA.

<u>NSA PCW</u>

NSA PCW, which is associated with Activity Category "B" and "C", represents the existing homes on McComas Street and baseball fields (Swann Park) just south of the I-95 off ramp to Hanover Street. However, in the Future Build (2040) conditions, both of these receptor locations would no longer exist. They would be replaced by mixed-use (residential/commercial buildings) at the northern limits of the proposed Port Covington Redevelopment. These new buildings would be located directly south of the newly created and realigned McComas Street (Element F) which would extend towards the new I-95 NB off ramp. The proposed development would be associated with Activity Category "B".



Noise Sensitive Areas

I-95 ACCESS IMPROVEMENTS
FIGURE 3

NOISE SENSITIVE AREAS

MARYLAND TRANSPORTATION AUTHORITY

CITY OF BALTIMORE

May 2017

NSA PCE

For NSA PCE, there are no existing sensitive receptor locations. However, it is assumed that for the Future Build (2040) conditions, residential buildings associated with the Port Covington Redevelopment would be located just south of the realigned McComas Street (Element F), the new I-95 off ramp to Key Highway (Element A) and the new I-95 NB on ramp (Element B). The proposed development would be associated with Activity Category "B".

NSA BB1

NSA BB1 represents the 1901 South Charles residential apartments. These buildings do not contain an exterior recreational area outside of the building boundaries. As a result, these receptors were not considered for noise impact.

NSA LS

NSA LS, which is associated with Activity Category "B", represents a row of one-family residential homes located along Light Street, just north of I-95 and the CSX rail line. The closest highway improvement would be the realigned McComas Street (Element F) and the new I-95 off ramp to Key Highway (Element A), both on the south side of I-95 viaduct.

NSA BB2

NSA BB, which is associated with Activity Category "B", represents the 101 Wells residential apartments. These buildings do not contain an exterior recreational area outside of the building boundaries. As a result, these receptors were not considered for potential noise impacts.

NSA RIV

NSA RIV, which is associated with Activity Category "B" and "C", is represented by Riverside Park and a series of rowhouses which are north of I-95 and the CSX Rail Yard. The row house receptors are located along Covington, Jackson, and Webster Streets. These receptor sites could be potentially affected by the realigned I-95 SB on ramp from McComas Street (Element D) and the new I-95 SB off ramp (Element C).

NSA KWY

NSA KWY, which is associated with Activity Category "B", is represented by the McHenry Row residential buildings along the newly realigned Key Highway (Element G). In this area, the McHenry Row residential buildings contain ground floor commercial spaces with upper floor residential apartments with balconies. In total, there are five floors of residential apartments that face Key Highway. Due to the proximity of Key Highway to this NSA and the high traffic volumes that exist, and are projected to increase, Key Highway represents the dominant noise source for this NSA. However, upper floor noise receptor could also be affected by traffic along the elevated I-95 corridor to the south.

Ambient Noise Level Measurements

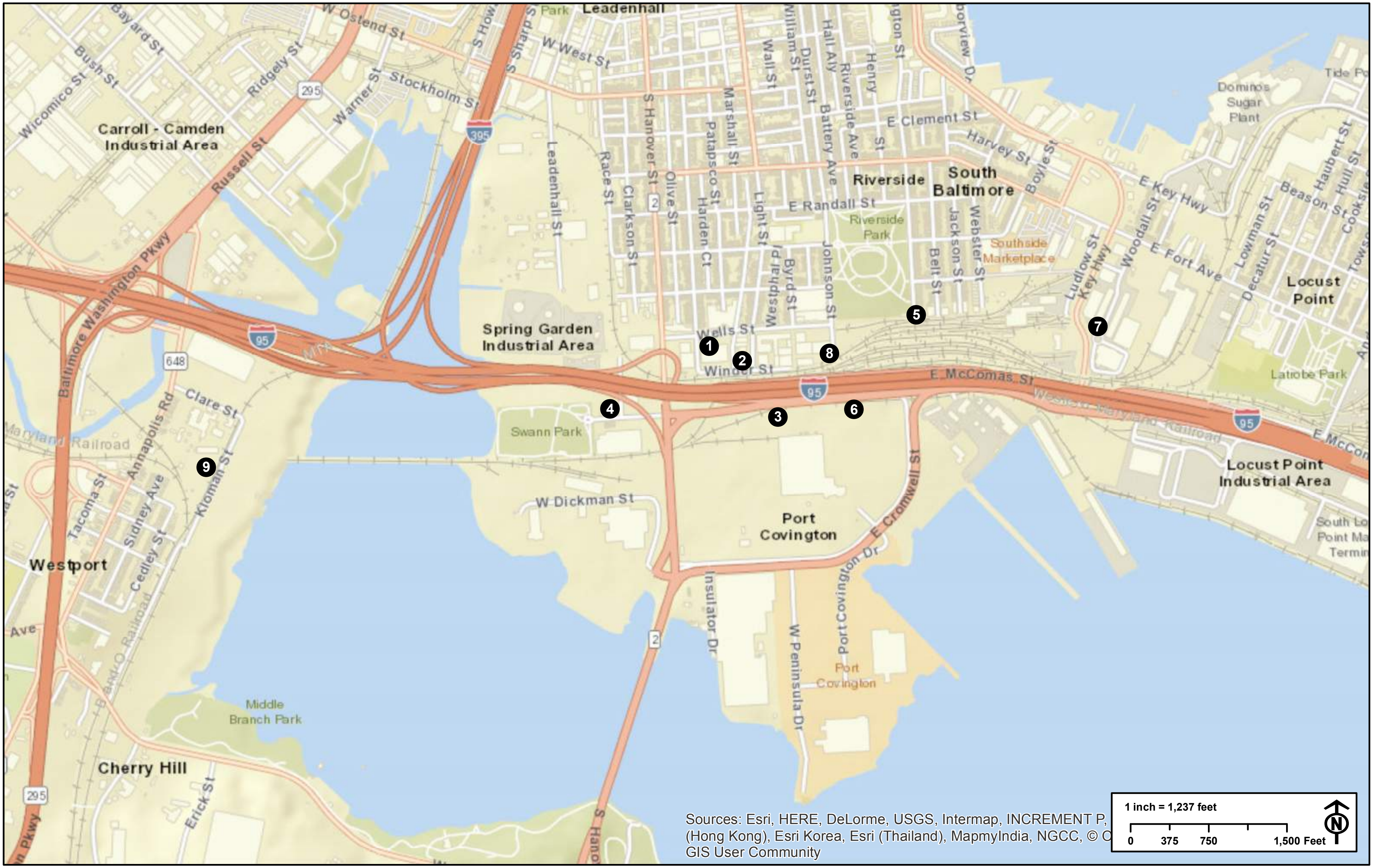
The object of measuring existing noise is threefold. First, the measurements provide the baseline information required in establishing the noise environment to which the various communities are being exposed. These levels may exceed noise levels recommended by various Federal, State and local agencies. Second, existing noise level measurements are required by FHWA as a baseline against which future noise levels are assessed. Third, the model used to assess the impacts of future conditions must be validated with the use of existing measured data.

Noise Monitoring Results

Nine noise sensitive locations were identified for monitoring. All of the locations are residential in nature. These locations, which are shown in **Figure 4**, include:

1. 1901 S. Charles Street
2. 1946 Light Street
3. Baltimore Sun North Property Line #1
4. 220 W. McComas Street
5. 1880 Covington Street

6. Baltimore Sun North Property Line #2
7. 1724 Whetstone Way (near Key Hwy)
8. 101 Wells Street - Apartments
9. Annapolis Street @ Clare Street



Noise Monitoring Location

Maryland Transportation Authority

I-95 ACCESS IMPROVEMENTS
FIGURE 4

NOISE MONITORING LOCATIONS

MARYLAND TRANSPORTATION AUTHORITY

CITY OF BALTIMORE

May 2017

Short-term noise monitoring was performed at these locations in 2016 between the 14th and 15th of June and in 2017 on June 1st during the weekday AM and PM time periods. All measurements were taken with an ANSI Type I compliant Larson & Davis Model LXT and Model 831 sound level meters. Each meter was properly calibrated before and after all measurements using a Larson & Davis Model Cal200 calibrator. There were no variances between the beginning and ending calibration measurements. While monitoring was conducted, simultaneous traffic counts were taken along local streets that could influence noise levels. Per FHWA guidelines, traffic counts and noise monitoring should be performed simultaneously for noise model validation. Individual readings were taken over a 15 to 30 minute time period.

The monitoring results shown in **Table 2** indicate daytime hourly noise levels ranging from a low of 61.5 dBA at 1901 S. Charles Street to a high of 72.2 dBA at the Baltimore Sun North Property Line #1 receptor. Of the nine monitoring locations, noise levels at six locations either approached (within 1db) or exceeded the 66 dBA L_{eq} (h) NAC. In all cases, the noise generated by traffic was both predominant and consistent during the monitoring time periods. However, at receptor locations 2, 5 and 8 to the north of both the I-95 viaduct and the CSX Rail Tracks and Yard, receptors would have a direct and unobstructed line-of-sight to the CSX Rail Tracks and Yard. Consequently at these locations, occasional rail movement and activity resulted in increased baseline noise levels readings.

Table 2: Noise Monitoring Results (dBA L_{eq} (h))

NSA	Receptor	Address	Period	Date	Duration	Noise Level
NSA BB1	1	1901 S. Charles Street	AM	06/14/16	15 min	61.5
			PM	06/14/16	15 min	63.4
NSA LS	2	1946 Light Street	AM	06/14/16	15 min	64.5
			PM	06/14/16	15 min	63.6
NSA PCE	3	Baltimore Sun North Property Line #1	AM	06/14/16	15 min	72.2
			PM	06/14/16	15 min	71.3
NSA PCW	4	220 W. McComas Street	AM	06/15/16	15 min	63
			PM	06/15/16	15 min	64.1
NSA RIV	5	1880 Covington Street	AM	06/15/16	15 min	67
			PM	06/15/16	15 min	65.3
NSA PCE	6	Baltimore Sun North Property Line #2	AM	06/14/16	15 min	71.3
			PM	06/14/16	15 min	69.9
NSA KWY	7	1724 Whetstone Way (elevated above Key Hwy)	AM	06/14/16	15 min	66.3
			PM	06/14/16	15 min	66.3
NSA BB2	8	101 Wells Street - Apartments	AM	06/15/16	15 min	66.7
			PM	06/15/16	15 min	68
NSA WR	9	Annapolis Street @ Clare Street	AM	06/01/17	30 Min	71.2
			PM	06/01/17	30 Min	63.5

Noise Model Validation

This section describes the validation of the FHWA Traffic Noise Model Version 2.5 (TNM) used in the assessment of traffic noise for the proposed project. The goal of the validation process is to define the relationship between measured and modeled L_{eq} noise levels and to ensure that the model can accurately predict future noise levels. Comparisons are made between the predicted and measured sound levels. If the levels are within ± 3 dB of one another, this is considered an indication that the model is within an acceptable level of accuracy. If the difference is greater than ± 3 dB, further investigation into the problem is required. Information applied to the modeling effort includes highway design files, traffic data counts (where applicable), roadway elevations, and surveying of terrain. Field reconnaissance and aerial mapping were used to identify any terrain features that may affect roadway noise. Simultaneous traffic counts used in the validation were collected along streets closest to its associated noise location. At all other locations, existing traffic volumes were used. A summary of the results of the model validation is shown in **Table 3**.

Table 3: TNM Model Validation Results (dBA L_{eq} (h))

NSA	Receptor	Address	Monitored L_{eq}	Calculated L_{eq}	Delta
NSA BB1	1	1901 S. Charles Street	61.5	58.8	-2.7
NSA LS	2	1946 Light Street	64.5	60.2	**-4.3**
NSA PCE	3	Baltimore Sun North Property Line #1	72.2	71.3	-0.9
NSA PCW	4	220 W. McComas Street	63	61.0	-2.0
NSA RIV	5	1880 Covington Street	67	63.4	**-3.6**
NSA PCE	6	Baltimore Sun North Property Line #2	71.3	71.2	-0.1
NSA KWY	7	1724 Whetstone Way (elevated above Key Hwy)	66.3	66.5	0.2
NSA BB2	8	101 Wells Street - Apartments	66.7	62.8	**-3.9**
NSA WR	9	Annapolis Street @ Clare Street	71.2	68.3	-2.9

Since the TNM model only considers noise produced from traffic, it is essential that existing noise levels are measured in the field so that any non-traffic related noise is accounted for in a noise measurement. Differences in noise levels of less than 3 dBA are the limit of what is normally perceptible to the human ear. As shown in **Table 3**, differences between the measured and model validation results were generally within the acceptable limits of ± 3 dB. However, at receptor sites 2, 5, and 8, the model did not validate the noise levels so a careful review of the monitoring data was performed, as well as a review of the existing topographic files. In addition, all applicable shielding terrain features were incorporated into the noise model for these locations. The review concluded that non-roadway noise sources present during the noise monitoring phase at this location were responsible for the discrepancy in noise levels. Specifically, these three sites are all adjacent to the existing CSX Rail Tracks and Yard and all have a direct and unobstructed line-of-sight to portions of the existing CSX Rail Tracks and Yard. As a result, these receptor locations were influenced by rail movement and activities that occur on the tracks and within the yard. The 5-minute noise monitoring increments conducted for the project indicated elevated noise levels correlating to rail movements. For receptor site 5, the influence on the noise level was greater than for receptor sites 2 and 8, since receptor site 5 is exposed to noise from the entire CSX yard which stretches from Johnson Street to Webster Street, as shown on **Figure 1**, above. With the exception of receptors on the north side of I-95 that are substantially influenced by the CSX Rail Tracks and Yard, most of the analyzed receptors show a difference of 3 dB or less between the monitored and modeled noise levels. As a result, the model can be considered an accurate representation of existing traffic conditions throughout the project area.

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I-95 Access Improvements from Caton Avenue to Fort McHenry Tunnel – Environmental Assessment (EA)
Baltimore City, Maryland

Type I
Technical
Noise Report

March 2018

Section 3
Future Noise Prediction
Methodology and Results

Prepared for:

Maryland Transportation Authority

DEPARTMENT OF TRANSPORTATION BALTIMORE CITY

and

U.S. Department of Transportation Federal Highway Administration

Future Noise Impact Assessment

Prediction Methodology

Impact analyses were performed in conformance with FHWA guidelines as established by 23 CFR 772 and MdSHA's Highway Noise Policy (August 2011). Traffic noise was predicted for the Existing (2016) condition and Future Build (2040) conditions at selected sensitive receptor locations using the most recent and accepted noise model, FHWA's Traffic Noise Model (TNM) version 2.5. TNM enables the user to more accurately model complex environmental and traffic conditions such as surface terrain, ground elevations, residential barriers, temperature and vehicle acceleration and deceleration.

According to MdSHA Highway Noise Policy, a project is defined as having a traffic noise impact if either of the following conditions occur:

- Future year noise levels approach or exceed the FHWA Noise Abatement Criteria (NAC), as defined in the Federal regulation, 23 CFR 772. MdSHA defines "approach" to be one decibel less than the NAC.
- Future noise levels must increase 10 dB(A) over existing levels as a result of the proposed project.

Traffic Parameter Summary

Existing and Future Build (2040) traffic volumes, vehicle composition, and speeds were assigned to the existing and proposed roadways. Traffic data used in the model was generated from existing traffic data using conservative assumptions for the future usage of the proposed facility and the general growth within the region. TNM allows the use of five separate vehicle input categories including Autos, Medium Trucks, Heavy Trucks, Buses and Motorcycles. Because the vehicle mix is not expected to change over time, the vehicle mix data collected from existing counts were also used for the Build scenarios. The traffic data used in the noise analyses were derived from traffic engineering studies for the project. A summary of traffic data can be found in the traffic technical report for the I-95 Access Improvements project.

Determination of the Loudest Noise Hour

Both AM and PM mainline traffic volumes and associated predicted speeds developed by the project traffic engineer were input into the TNM model to help determine the loudest noise hour for study. Traffic data was input only for the representative mainline section between Hanover Street and the Fort McHenry Tunnel entrance. While the overall speeds for some segments of the entire traffic study area would be significantly affected in the future, the segment selected to determine the loudest noise hour would not be significantly affected by future reductions in travel speed. Information also considered includes the fact that the majority of highway/roadway improvements related to the project would be located on the south side of the I-95 viaduct, which include major improvements along East McComas Street. Furthermore, the Port Covington Redevelopment is projected to generate more than 5,600 vehicular trips during the AM peak hour and more than 8,100 vehicular trips during the PM peak hour to and from the proposed site. Finally, the peak period for the northbound I-95 traffic would occur during the PM traffic period. As a result, the PM peak hour was utilized to analyze noise impacts.

Noise Impact Determination

Using the validated model parameters and corrections, potential impacts at affected study area receptors for both Existing conditions and Future Build (2040) conditions were assessed using the TNM model. For future conditions, the model also accounted for proposed project improvements and application of Design Year (2040) traffic data. Existing and Future Build (2040) noise levels were then predicted throughout the project corridor with the improvements in place and in use.

Structural and ground terrain features were input into TNM in the same manner as for the model validation assessment. **Table 4** shows the predicted worse case noise levels for the Existing and Future Build conditions.

Table 4: Noise Assessment Summary [1, 2]

Receptor	Existing Noise Level	2040 Build Noise Level	Change Over Existing	Consider Noise Abatement?
NSA WR1	65.6	65.2	-0.4	N
NSA WR2	57.4	58.7	1.3	N
NSA WR3	55.4	56.4	1	N
NSA WR4	55.4	56.4	1	N
NSA WR5	64.8	64.4	-0.4	N
NSA WR6	65.7	65.2	-0.5	N
NSA LS1	56	57.2	1.2	N
NSA LS2	55.7	57	1.3	N
NSA LS3	55.7	56.9	1.2	N
NSA LS4	56.9	59	2.1	N
NSA LS5	55.1	57.3	2.2	N
NSA LS6	53.6	55.8	2.2	N
NSA RIV1	61.3	63.6	2.3	N
NSA RIV2	58.7	61	2.3	N
NSA RIV3	61.2	63.4	2.2	N
NSA RIV4	56.9	59	2.1	N
NSA RIV5	56.8	58.5	1.7	N
NSA RIV6	61.2	63.5	2.3	N
NSA RIV7	57.5	59.3	1.8	N
NSA RIV8	60.9	63.3	2.4	N
NSA RIV9	60.4	62.9	2.5	N
NSA RIV10	60.6	63.1	2.5	N
NSA RIV11	60.7	63.3	2.6	N
NSA KWY3	68.8	70.3	1.5	Y
NSA KWY4	68.4	69.6	1.2	Y
NSA KWY5	68.8	70.5	1.7	Y
NSA KWY6	68.5	69.7	1.2	Y
NSA KWY7	68.8	70.7	1.9	Y
NSA KWY8	68.5	70.1	1.6	Y
NSA KWY9	68.9	70.7	1.8	Y
NSA KWY10	68.5	70.1	1.6	Y

Receptor	Existing Noise Level	2040 Build Noise Level	Change Over Existing	Consider Noise Abatement?
NSA KWY11	68.9	70.8	1.9	Y
NSA KWY12	68.5	70.1	1.6	Y
NSA PCW1	----	80.4	NA	NA
NSA PCW2	----	78.6	NA	NA
NSA PCW3	----	78.6	NA	NA
NSA PCW4	----	78.5	NA	NA
NSA PCW5	----	65	NA	NA
NSA PCW6	----	72.4	NA	NA
NSA PCE1	----	75.4	NA	NA
NSA PCE2	----	73.2	NA	NA
NSA PCE3	----	73.1	NA	NA
NSA PCE4	----	73	NA	NA
NSA PCE5	----	72.2	NA	NA
NSA PCE6	----	74	NA	NA
NSA PCE7	----	74.2	NA	NA
NSA PCE8	----	74.6	NA	NA
NSA PCE9	----	74.2	NA	NA
NSA PCE10	----	73.8	NA	NA
NSA PCE11	----	75.2	NA	NA
NSA PCE12	----	74.9	NA	NA

[1] All noise levels were based on the validated TNM model, which only considers noise due to traffic.
[2] "---- or NA" represents receptor locations that do not exist in the existing condition or would not exist in the future condition.

I-95 Access Improvements from Caton Avenue to Fort McHenry Tunnel – Environmental Assessment (EA)
Baltimore City, Maryland

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Section 4

Mitigation Assessment and Barrier Analyses

Prepared for:

Maryland Transportation Authority

Department of Transportation Baltimore City

and

U.S. Department of Transportation Federal Highway Administration

Mitigation Assessment

The evaluation of whether or not noise abatement would be considered for a community requires that three questions be considered:

- Does a noise impact currently exist, or is it projected to exist?
- Is the design of noise abatement feasible?
- Is the construction of noise abatement reasonable?

Based on the noise assessment summary results contained in **Table 4** above, noise abatement was considered at the NSAs indicated. These noise study areas were evaluated to determine if the construction of abatement would be both feasible and reasonable.

FEASIBILITY CRITERIA

Feasibility of noise abatement is defined as the engineering and acoustical ability to safely provide effective noise reduction. Noise abatement measures, such as noise barriers, earth berms, berm and noise barrier combinations, or soundproofing of publicly owned public buildings to mitigate interior noise impacts, will be analyzed for all impacted sites. The following criteria will be used in determining if noise abatement is feasible:

Acoustic Considerations

A modeled reduction of projected noise levels by at least 5 dBA at 50% of impacted sites, in any given noise sensitive area.

Safety & Access Considerations

Driveway or local street access would be restricted. In addition to the creation of adverse safety conditions, such as limiting sight distance or reduction of a vehicle recovery area.

Site Constraint Assessment

With respect to noise walls, site constraints may exist when additional engineered elements, besides a typical noise wall system, are required. These include, requirements for extensive fill or excavation material, significant utility relocations, major drainage systems, and major structural elements beyond the noise walls themselves. If any of these issues are anticipated a site constraint assessment may be warranted.

REASONABLE CRITERIA

A reasonable decision is based upon a combination of social, economic and environmental factors. These factors include the viewpoints of benefited property owners and residents, the number of benefited residences, the proposed acoustical effectiveness of the abatement, and the cost effectiveness of the proposed abatement, as detailed in the MDOT SHA Highway Noise Policy 2011.

Viewpoints of Benefited Receptors

During the evaluation of public comments, if more than 25% of benefited residencies are opposed to the abatement measures, a subsequent vote will be administered by MDOT SHA where if more than 50% of affected residents oppose the abatement measure it will be deemed not reasonable.

Benefited Residences and Design Goal

At least 50% of all benefited residences should receive at least a 7 dBA reduction from the proposed abatement measures in order for the abatement to be considered reasonable.

Cost Effectiveness

In order to determine whether the cost of abatement is reasonable, the following measures must be adhered to:

- A barrier system will be considered reasonable if the area of wall provided per benefited residence is equal to, or less than, 2,700 square feet.
- Equivalent residences will be determined based on the linear frontage of other land use types. The square footage of the barrier system will be compared with respect to the equivalent residences.
- Engineering constraints for noise barrier systems can dictate the reasonableness determination depending upon the extent of costs related to additional engineered elements. If the allowable costs of a barrier with these additional engineering requirements is less than the highway estimate (based on the allowable square feet of wall per residence) of allowable costs, the barrier system would then be considered reasonable.

NSA KWY

The only NSA studied that warranted abatement consideration was NSA KWY. The impacted receptors for NSA KWY include upper floor outdoor balconies that face directly towards Key Highway. In general, abatement for upper floor windows in a large residential building is typically not feasible. Utilizing simple line-of-sight geometric principles, the required barrier height for upper floor windows are typically found to be prohibitive as heights would have to be unacceptably tall to block the line-of-sight for a significant number of properties. However, for completeness, an abatement assessment was conducted for the receptors along Key Highway. The proposed barrier would be located along the edge of the paved access roadway atop the existing retaining wall adjacent to Key Highway. As shown in Table 5, the results indicate that abatement would not be feasible for this NSA as the proposed noise barrier would not reduce noise levels at any of the receptors by at least 5 dBA.

Table 5: Noise Abatement Summary (NSA KWY)[1]

Receptor	Existing Noise Level	2040 Build Noise Level	Change Over Existing	Consider Noise Abatement?	With Barrier	Insertion Loss
NSA KWY3	68.8	70.3	1.5	Y	66.9	3.4
NSA KWY4	68.4	69.6	1.2	Y	66.7	2.9
NSA KWY5	68.8	70.5	1.7	Y	67.9	2.6
NSA KWY6	68.5	69.7	1.2	Y	67.2	2.5
NSA KWY7	68.8	70.7	1.9	Y	69.2	1.5
NSA KWY8	68.5	70.1	1.6	Y	68.2	1.9
NSA KWY9	68.9	70.7	1.8	Y	69.8	0.9
NSA KWY10	68.5	70.1	1.6	Y	68.8	1.3
NSA KWY11	68.9	70.8	1.9	Y	70.2	0.6
NSA KWY12	68.5	70.1	1.6	Y	69.2	0.9

[1] Abatements results shown for a 30 foot noise barrier. The initial noise barrier height considered was 20 feet.

NSA PCE and NSA PCW

While predicted noise levels for NSA's PCE and PCW would include locations that would exceed the FHWA noise criteria, because specific design plans for the Port Covington Redevelopment project have not yet been advanced, an assessment of abatement measures for specific buildings cannot be properly considered at this time. As a result, 2040 noise levels were only and specifically projected at the site boundaries of the Port Covington Redevelopment area to help inform future design plans.

I-95 Access Improvements from Caton Avenue to Fort McHenry Tunnel – Environmental Assessment (EA)
Baltimore City, Maryland

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March 2018

Section 5

Construction Noise

Prepared for:

Maryland Transportation Authority

DEPARTMENT OF TRANSPORTATION BALTIMORE CITY

and

U.S. Department of Transportation Federal Highway Administration

Coordination with Local Officials

The lack of consideration of highway traffic noise in land use planning at the local level has added to the highway traffic noise problem which will continue to grow as development continues adjacent to major highway long after these highways were proposed and/or constructed. As a result, the MDOT SHA will encourage local officials and developers to consider highway traffic noise in the planning, zoning and development of property neat existing and proposed highway corridors. Local coordination will be specifically accomplished through the distribution of highway project environmental documents and noise study reports.

Construction Noise

Construction noise is intermittent and responsible for a variety of discontinuous noise sources. As with any construction project, areas around the construction site could experience some periods where they are affected by noise from construction. With regard to the proposed project, construction and construction-related activities are expected to have a short-term effect on noise levels in the local community. For highway projects, the types of construction equipment utilized typically include, but are not limited to, the following:

- Bulldozers
- Trucks
- Graders
- Compressors

While specifics of the construction schedule are not yet available, equipment associated with highway construction typically operates intermittently and produces noise in the range of 70 – 98 dBA at a distance of approximately 50 feet. While short-term, this noise can be extremely loud at receptors close by construction activities. However, with the exception of construction activities along Key Highway, the overwhelming majority of construction would not occur within close proximity to sensitive receptors. However, to reduce the significance of any temporary increases in noise levels due to construction, the following could be utilized to help minimize construction noise:

- Carefully route construction equipment and vehicles carrying rock, concrete or other materials over streets that would cause the least disturbance to residents in the vicinity of the work.
- Limit unnecessary idling times on diesel powered engines. Also, move any processing equipment as far as practicable from receptor locations during operation.
- Proper planning of construction schedules to minimize traffic disruption and limit any short-term increase in noise.
- Consider temporary noise barriers.
- Set up a community liaison and complaint hot line.
- Use of noise enclosures or noise insulation fabric on compressors, generators, etc.

Although construction-related increases in local noise would occur, any increase would be temporary and short-term. Adherence to standard construction noise minimization measures would help reduce noise potentially experienced at sensitive receptor locations.

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Appendix A
Traffic Data

Prepared for:

Maryland Transportation Authority

and

U.S. Department of Transportation Federal Highway Administration

APPENDICES

Alt 5 Freeway Segments (VISSIM)

Segment No.	Freeway Segment	Freeway/Ramp Segment	Alt 5 AM				Alt 5 PM			
			Speed (mph)	Density or v/c (pc/mi/ln)	Demand (VPH)	Output Volumes (VPH)	Speed (mph)	Density or v/c (pc/mi/ln)	Demand (VPH)	Output Volumes (VPH)
Interstate 95 NB										
F1	I-95	I-695 EB Off Ramp to I-695 WB Off Ramp	46	38	8,166	7,233	40	47	7,029	6,782
F2	I-95	I-695 WB Off Ramp to I-695 On Ramps	36	44	6,356	5,525	58	23	5,217	5,059
F3	I-95	Caton Ave Off Ramp to Washington Blvd Off Ramp	28	62	8,707	6,814	57	30	7,277	6,763
F4	I-95	Washington Blvd Off Ramp to Caton Ave On Ramp	22	70	7,814	5,955	57	29	6,964	6,474
F5	I-95	MD 295 Off Ramp to I-395 Off Ramp	18	72	7,039	5,242	54	30	6,657	6,231
F6	I-95	I-395 Off Ramp to MD 295 On Ramp	57	14	3,046	2,275	58	23	4,176	3,911
F7	I-95	MD 295 On Ramp to I-395 On Ramp	61	12	3,653	2,853	58	24	5,689	5,372
F8	I-95	Hanover Street Off Ramp to Key Highway Off Ramp	60	14	4,004	3,191	57	27	6,825	6,129
F33	I-95	Key Highway Off Ramp to NEW Key Highway On Ramp	62	10	2,609	2,215	58	22	5,239	4,968
F9	I-95	NEW Key Highway On Ramp to Key Highway On Ramp	62	10	2,945	2,483	56	25	6,224	5,611
F10	I-95	Key Highway On Ramp to Tunnel	58	13	3,430	2,933	52	33	7,350	6,546
Interstate 95 SB										
F11	I-95	Tunnel to Key Highway Off Ramp	56	24	8,454	6,664	57	16	4,411	4,351
F34	I-95	Key Highway Off Ramp to NEW Key Highway Off Ramp	54	31	7,850	6,509	58	19	3,993	4,172
F12	I-95	Key Highway Off Ramp to Key Highway On Ramp	49	30	6,729	5,525	58	15	3,217	3,236
F13	I-95	Key Highway On Ramp to Hanover Street On Ramp	34	46	8,094	6,560	48	23	4,960	4,512
F14	I-95	I-395 Off Ramp to MD 295 Off Ramp	37	41	7,241	5,753	29	41	5,093	4,251
F15	I-95	MD 295 Off Ramp to I-395 On Ramp	32	49	5,479	4,319	21	58	4,367	3,557
F16	I-95	I-395 On Ramp to MD 295 On Ramp	33	58	8,202	6,840	23	68	8,179	6,091
F17	I-95	MD 295 On Ramp to Washington Boulevard On Ramp	39	44	8,687	7,260	23	74	9,312	7,028
F18	I-95	Caton Ave Off Ramp to Caton Ave On Ramp	40	47	7,953	6,399	22	75	9,095	6,641
F19	I-95	I-695 WB Off Ramp to I-695 EB Off Ramp	51	24	6,700	5,266	49	28	8,117	5,915
F20	I-95	I-695 WB On Ramp to I-695 EB On Ramp	56	23	6,674	5,471	55	24	7,765	5,868
MD 295 SB										
F21	MD 295	Bush Street to Monroe Street Off Ramp	34	22	2,664	2,234	15	63	3,469	2,835
F22	MD 295	Monroe Street Off Ramp to I-95 SB Off Ramp	41	21	2,550	2,417	16	71	3,379	3,109
F23	MD 295	I-95 SB Off Ramp to I-95 SB/Monroe On Ramp	53	13	2,065	2,066	50	15	2,246	2,189
F24	MD 295	Westport Off Ramp to Westport On Ramp	50	26	4,124	3,755	50	24	3,736	3,550
F25	MD 295	Westport On Ramp to Annapolis Road Off Ramp	46	25	4,176	3,791	39	31	3,762	3,557
F26	MD 295	Annapolis Road Off Ramp to Annapolis Road On Ramp	50	23	3,707	3,397	50	22	3,263	3,107
F27	MD 295	Annapolis Road On Ramp to County Line	54	23	3,893	3,579	54	21	3,457	3,289
MD 295 NB										
F28	MD 295	County Line to Waterview Avenue Off Ramp	43	38	4,336	4,317	46	35	4,368	4,366
F29	MD 295	Waterview Avenue Off Ramp to Waterview Avenue On Ramp	28	58	4,085	3,993	41	39	4,116	4,097
F30	MD 295	Westport Off Ramp to Westport On Ramp	22	66	4,227	4,042	28	58	4,486	4,329
F31	MD 295	I-95 NB Off Ramp to Monroe Street Off Ramp	15	87	4,000	3,779	33	33	3,215	3,072
F32	MD 295	Monroe Street Off Ramp to Bush Street	18	87	4,377	3,017	19	82	3,354	2,278

Light to Moderate Traffic
Heavy Traffic
High Congestion
Severe Congestion

2040 No Build Freeway Segments (VISSIM)

Segment No.	Freeway Segment	Freeway/Ramp Segment	2040 No Build AM				2040 No Build PM			
			Speed (mph)	Density or v/c (pc/mi/ln)	Demand (VPH)	Output Volumes (VPH)	Speed (mph)	Density or v/c (pc/mi/ln)	Demand (VPH)	Output Volumes (VPH)
Interstate 95 NB										
F1	I-95	I-695 EB Off Ramp to I-695 WB Off Ramp	16	79	8,166	5,546	11	97	7,029	4,509
F2	I-95	I-695 WB Off Ramp to I-695 On Ramps	11	95	6,356	4,142	7	105	5,217	3,052
F3	I-95	Caton Ave Off Ramp to Washington Blvd Off Ramp	12	105	8,707	4,875	6	138	7,277	2,999
F4	I-95	Washington Blvd Off Ramp to Caton Ave On Ramp	9	114	7,814	4,095	4	155	6,964	2,290
F5	I-95	MD 295 Off Ramp to I-395 Off Ramp	9	112	8,007	4,128	3	157	7,331	2,003
F6	I-95	I-395 Off Ramp to MD 295 On Ramp	4	148	4,014	1,950	2	178	4,850	1,172
F7	I-95	MD 295 On Ramp to I-395 On Ramp	4	143	4,621	2,131	2	169	6,363	1,250
F8	I-95	Hanover Street Off Ramp to Key Highway Off Ramp	50	8	3,461	1,572	2	157	6,357	969
F9	I-95	Key Highway Off Ramp to Key Highway On Ramp	62	5	2,609	1,187	59	3	5,239	798
F10	I-95	Key Highway On Ramp to Tunnel	59	8	3,430	1,437	57	5	7,350	882
Interstate 95 SB										
F11	I-95	Tunnel to Key Highway Off Ramp	32	69	8,454	5,523	29	92	4,411	3,082
F12	I-95	Key Highway Off Ramp to Key Highway On Ramp	56	22	6,729	4,830	58	12	3,217	2,855
F13	I-95	Key Highway On Ramp to Hanover Street On Ramp	56	22	8,094	5,587	60	11	4,960	3,062
F14	I-95	I-395 Off Ramp to MD 295 Off Ramp	53	24	7,241	5,063	60	11	5,093	2,749
F15	I-95	MD 295 Off Ramp to I-395 On Ramp	55	23	5,479	3,817	59	13	4,367	2,353
F16	I-95	I-395 On Ramp to MD 295 On Ramp	55	23	8,202	5,486	59	12	8,179	3,137
F17	I-95	MD 295 On Ramp to Washington Boulevard On Ramp	59	23	8,687	5,999	59	16	9,312	4,302
F18	I-95	Caton Ave Off Ramp to Caton Ave On Ramp	59	24	7,953	5,509	59	19	9,095	4,453
F19	I-95	I-695 WB Off Ramp to I-695 EB Off Ramp	56	19	6,700	4,808	56	18	8,117	4,421
F20	I-95	I-695 WB On Ramp to I-695 EB On Ramp	57	20	6,674	5,067	58	17	7,765	4,556
MD 295 SB										
F21	MD 295	Bush Street to Monroe Street Off Ramp	28	26	2,664	2,232	15	62	3,469	2,851
F22	MD 295	Monroe Street Off Ramp to I-95 SB Off Ramp	34	24	2,550	2,417	16	70	3,379	3,125
F23	MD 295	I-95 SB Off Ramp to I-95 SB/Monroe On Ramp	52	13	2,065	2,068	50	15	2,246	2,204
F24	MD 295	Westport Off Ramp to Westport On Ramp	49	24	4,124	3,595	50	23	3,736	3,355
F25	MD 295	Westport On Ramp to Annapolis Road Off Ramp	48	22	4,176	3,630	43	25	3,762	3,359
F26	MD 295	Annapolis Road Off Ramp to Annapolis Road On Ramp	52	21	3,707	3,252	51	19	3,263	2,936
F27	MD 295	Annapolis Road On Ramp to County Line	54	21	3,893	3,430	54	19	3,457	3,101
MD 295 NB										
F28	MD 295	County Line to Waterview Avenue Off Ramp	8	119	4,336	2,922	3	155	4,368	1,440
F29	MD 295	Waterview Avenue Off Ramp to Waterview Avenue On Ramp	6	133	4,085	2,543	2	166	4,116	1,054
F30	MD 295	Westport Off Ramp to Westport On Ramp	7	133	4,227	2,637	2	176	4,486	949
F31	MD 295	I-95 NB Off Ramp to Monroe Street Off Ramp	13	70	4,000	2,718	42	5	3,215	639
F32	MD 295	Monroe Street Off Ramp to Bush Street	14	89	4,377	3,098	33	25	3,354	542

(green)	Light to Moderate Traffic
(yellow)	Heavy Traffic
(orange)	High Congestion
(red)	Severe Congestion

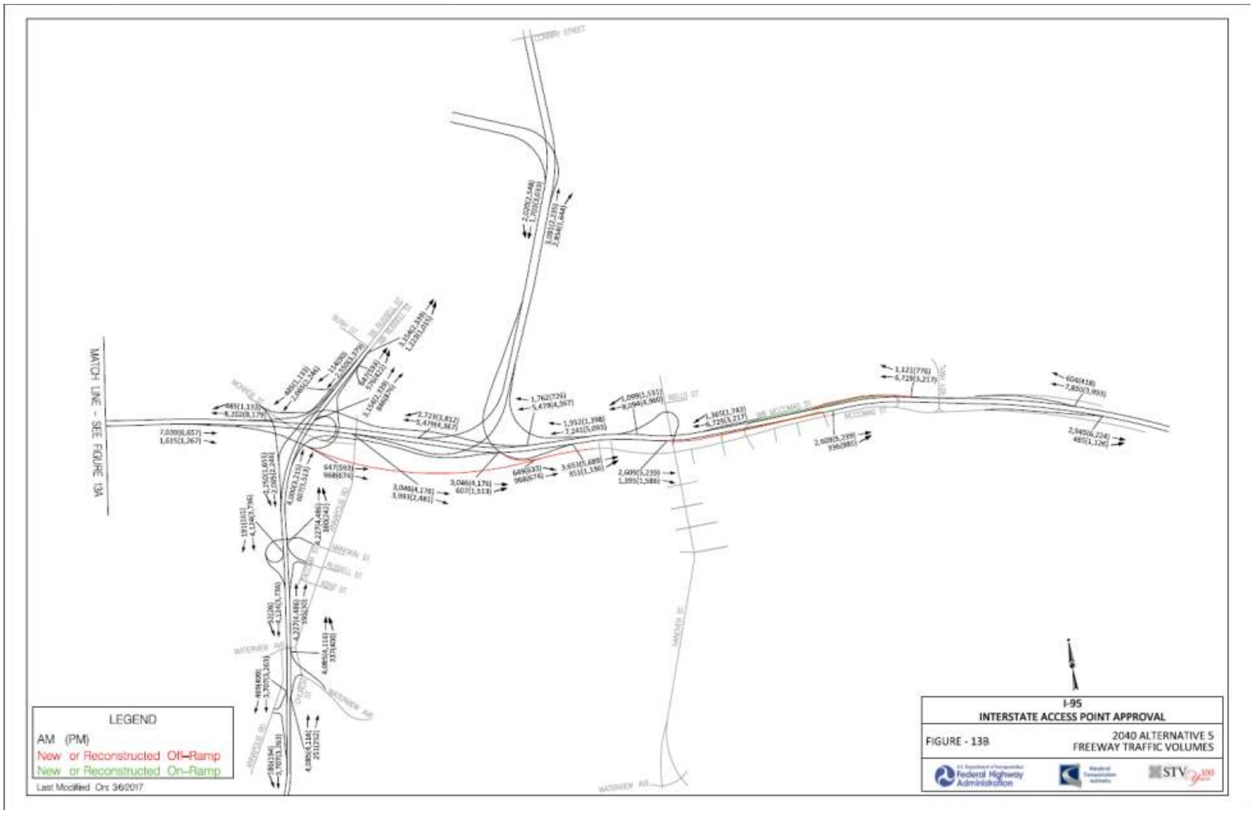
Segment No.	Freeway Segment	Freeway/Ramp Segment	Existing AM				Existing PM			
			Speed (mph)	Density or v/c (pc/mi/ln)	Demand (VPH)	Output Volumes (VPH)	Speed (mph)	Density or v/c (pc/mi/ln)	Demand (VPH)	Output Volumes (VPH)
Interstate 95 NB										
F1	I-95	I-695 EB Off Ramp to I-695 WB Off Ramp	57	23	5,959	5,947	52	28	5,969	6,061
F2	I-95	I-695 WB Off Ramp to I-695 On Ramps	61	18	4,354	4,356	60	18	4,362	4,422
F3	I-95	Caton Ave Off Ramp to Washington Blvd Off Ramp	53	29	6,250	5,919	53	32	6,250	6,152
F4	I-95	Washington Blvd Off Ramp to Caton Ave On Ramp	44	37	5,900	5,521	34	52	6,050	5,836
F5	I-95	MD 295 Off Ramp to I-395 Off Ramp	28	52	6,000	5,470	21	78	6,350	6,181
F6	I-95	I-395 Off Ramp to MD 295 On Ramp	58	14	2,700	2,459	52	27	4,300	4,185
F7	I-95	MD 295 On Ramp to I-395 On Ramp	61	12	3,200	2,955	49	29	5,550	5,438
F8	I-95	Hanover Street Off Ramp to Key Highway Off Ramp	56	14	3,250	3,045	23	69	6,300	6,057
F9	I-95	Key Highway Off Ramp to Key Highway On Ramp	62	9	2,450	2,129	30	53	5,250	4,872
F10	I-95	Key Highway On Ramp to Tunnel	59	11	2,800	2,854	23	76	6,000	5,340
Interstate 95 SB										
F11	I-95	Tunnel to Key Highway Off Ramp	51	33	6,900	6,711	61	15	3,600	3,594
F12	I-95	Key Highway Off Ramp to Key Highway On Ramp	57	27	6,150	5,974	61	13	3,150	3,112
F13	I-95	Key Highway On Ramp to Hanover Street On Ramp	37	43	7,100	6,867	59	14	3,900	3,756
F14	I-95	I-395 Off Ramp to MD 295 Off Ramp	44	35	6,200	6,024	59	15	3,550	3,434
F15	I-95	MD 295 Off Ramp to I-395 On Ramp	44	35	4,750	4,601	60	16	2,950	2,842
F16	I-95	I-395 On Ramp to MD 295 On Ramp	46	34	7,000	6,835	48	33	6,100	5,801
F17	I-95	MD 295 On Ramp to Washington Boulevard On Ramp	53	31	7,450	7,270	49	31	7,150	6,841
F18	I-95	Caton Ave Off Ramp to Caton Ave On Ramp	49	35	6,550	6,293	37	47	6,850	6,409
F19	I-95	I-695 WB Off Ramp to I-695 EB Off Ramp	52	21	5,379	5,052	51	23	5,918	5,265
F20	I-95	I-695 WB On Ramp to I-695 EB On Ramp	57	20	5,356	5,122	56	21	5,606	5,180
MD 295 SB										
F21	MD 295	Bush Street to Monroe Street Off Ramp	37	18	2,456	2,060	32	32	3,211	3,145
F22	MD 295	Monroe Street Off Ramp to I-95 SB Off Ramp	43	18	2,366	2,247	37	27	3,140	2,954
F23	MD 295	I-95 SB Off Ramp to I-95 SB/Monroe On Ramp	53	12	1,916	1,920	53	13	2,090	2,091
F24	MD 295	Westport Off Ramp to Westport On Ramp	50	24	3,720	3,644	51	21	3,266	3,222
F25	MD 295	Westport On Ramp to Annapolis Road Off Ramp	51	21	3,760	3,671	51	19	3,286	3,227
F26	MD 295	Annapolis Road Off Ramp to Annapolis Road On Ramp	52	21	3,399	3,349	53	18	2,902	2,874
F27	MD 295	Annapolis Road On Ramp to County Line	54	22	3,542	3,491	54	19	3,051	3,019
MD 295 NB										
F28	MD 295	County Line to Waterview Avenue Off Ramp	52	25	3,907	3,907	52	25	3,902	3,901
F29	MD 295	Waterview Avenue Off Ramp to Waterview Avenue On Ramp	53	23	3,714	3,704	53	23	3,708	3,696
F30	MD 295	Westport Off Ramp to Westport On Ramp	48	29	3,823	3,801	53	25	4,019	4,001
F31	MD 295	I-95 NB Off Ramp to Monroe Street Off Ramp	36	39	3,615	3,590	47	21	2,952	2,926
F32	MD 295	Monroe Street Off Ramp to Bush Street	26	66	4,000	3,862	22	64	3,139	3,102

Light to Moderate Traffic
Heavy Traffic
High Congestion
Severe Congestion

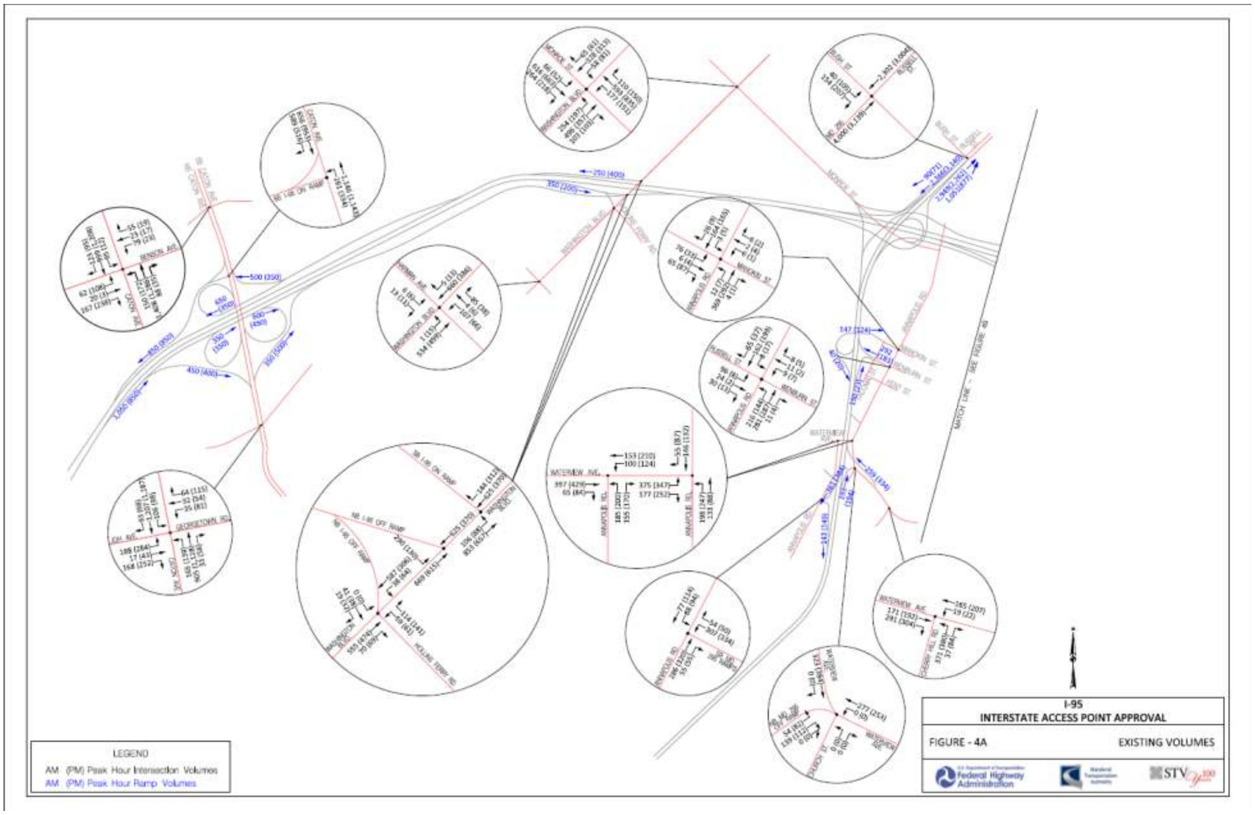
Network Average Speeds (mph)												
Segment	AM Peak Hour						PM Peak Hour					
	Existing Conditions	Alt. 1 (No Build)	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Existing Conditions	Alt. 1 (No Build)	Alt. 2	Alt. 3	Alt. 4	Alt. 5
	Average Speed	Average Speed	Average Speed	Average Speed	Average Speed	Average Speed	Average Speed	Average Speed	Average Speed	Average Speed	Average Speed	Average Speed
EB McComas Street	16	11	9	7	14	9	20	3	4	6	10	4
WB McComas Street	N/A	N/A	13	13	10	12	N/A	N/A	10	4	5	12
WB Old McComas Street	21	17	18	19	N/A	N/A	21	11	12	11	5	15
NB Hanover Street	18	8	5	5	3	6	17	8	4	6	4	5
SB Hanover Street	22	13	16	11	16	14	23	5	13	5	13	9

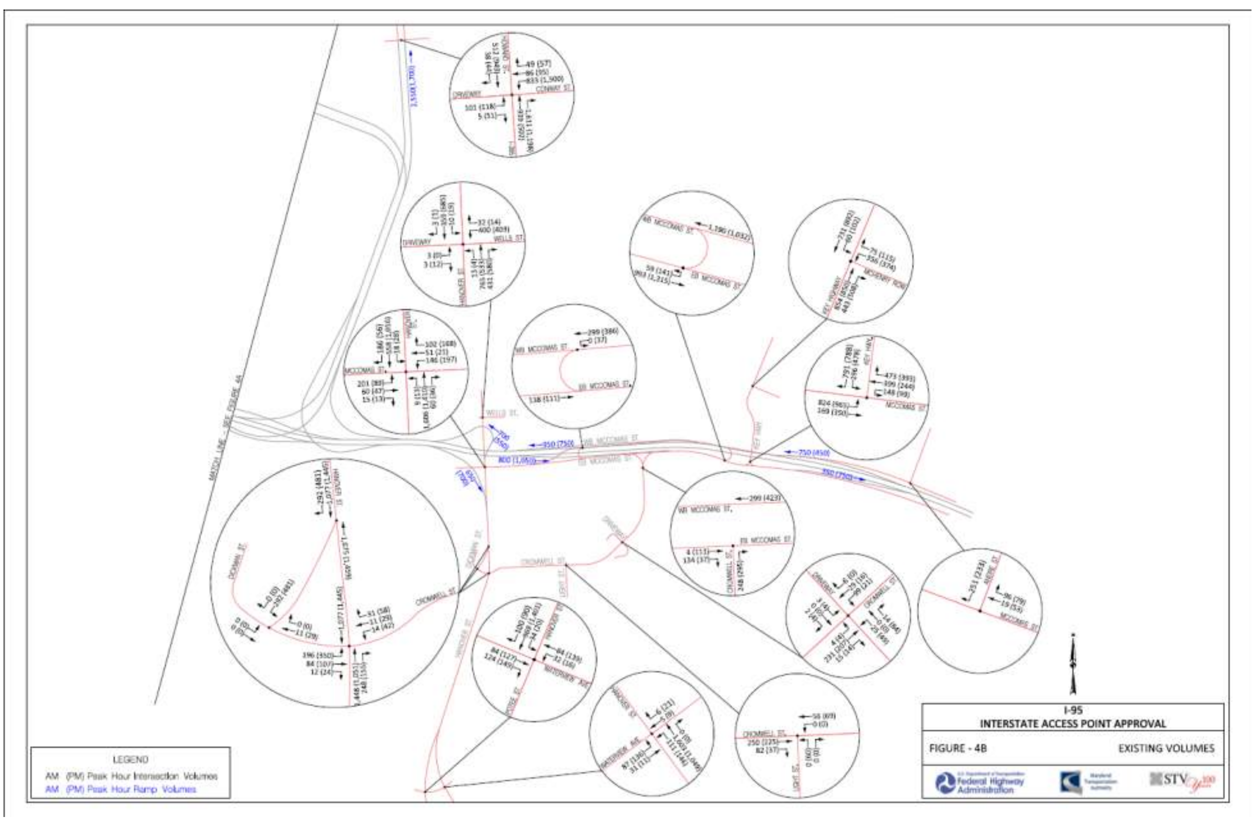
Network Run Speeds (mph)		
Segment	Existing Conditions	All Alternatives
	Run Speed	Run Speed
I-95	55	55
MD 295	55	55
EB McComas Street	30	30
WB McComas Street	30	30
WB Old McComas Street	30	30
NB Hanover Street	35	35
SB Hanover Street	35	35

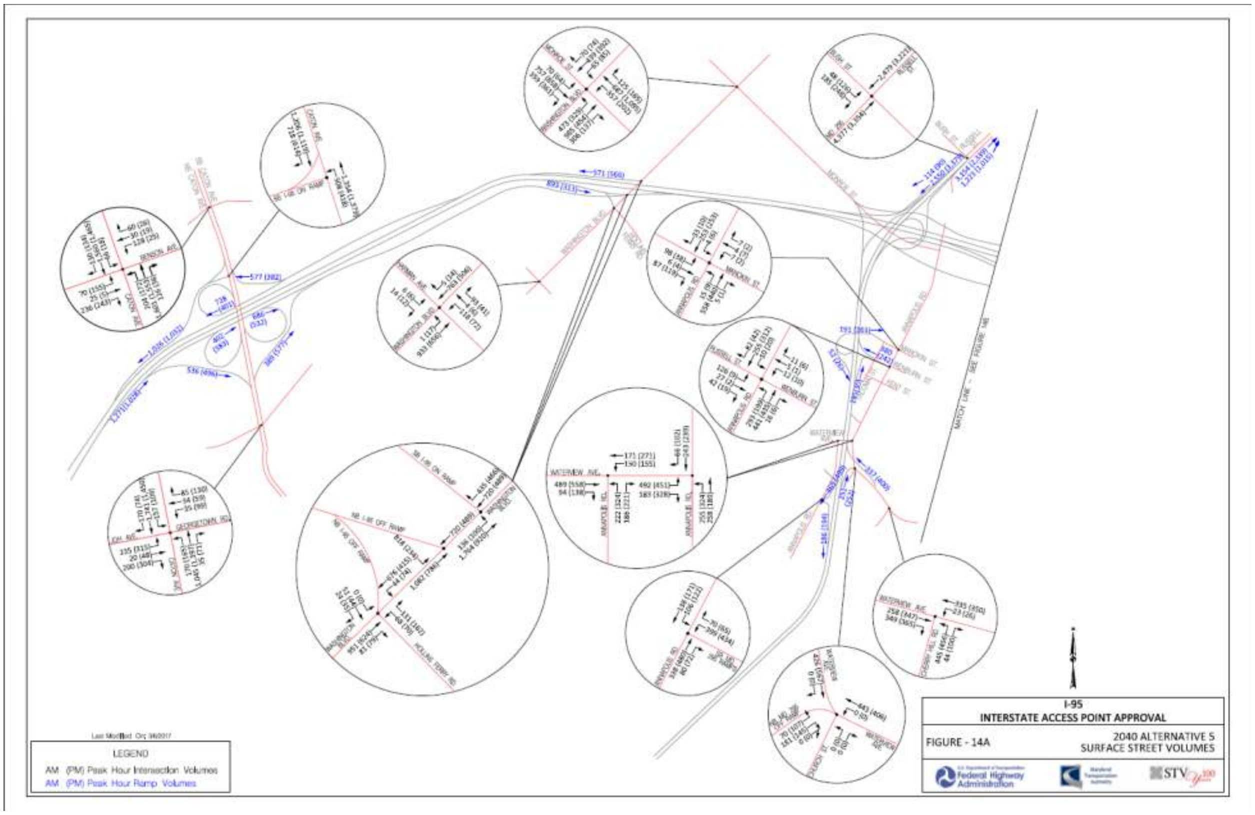
Vehicle Classifications (Freeway and Surface Streets)	
Cars	91.0%
Light Trucks	2.5%
Heavy Trucks	6.5%

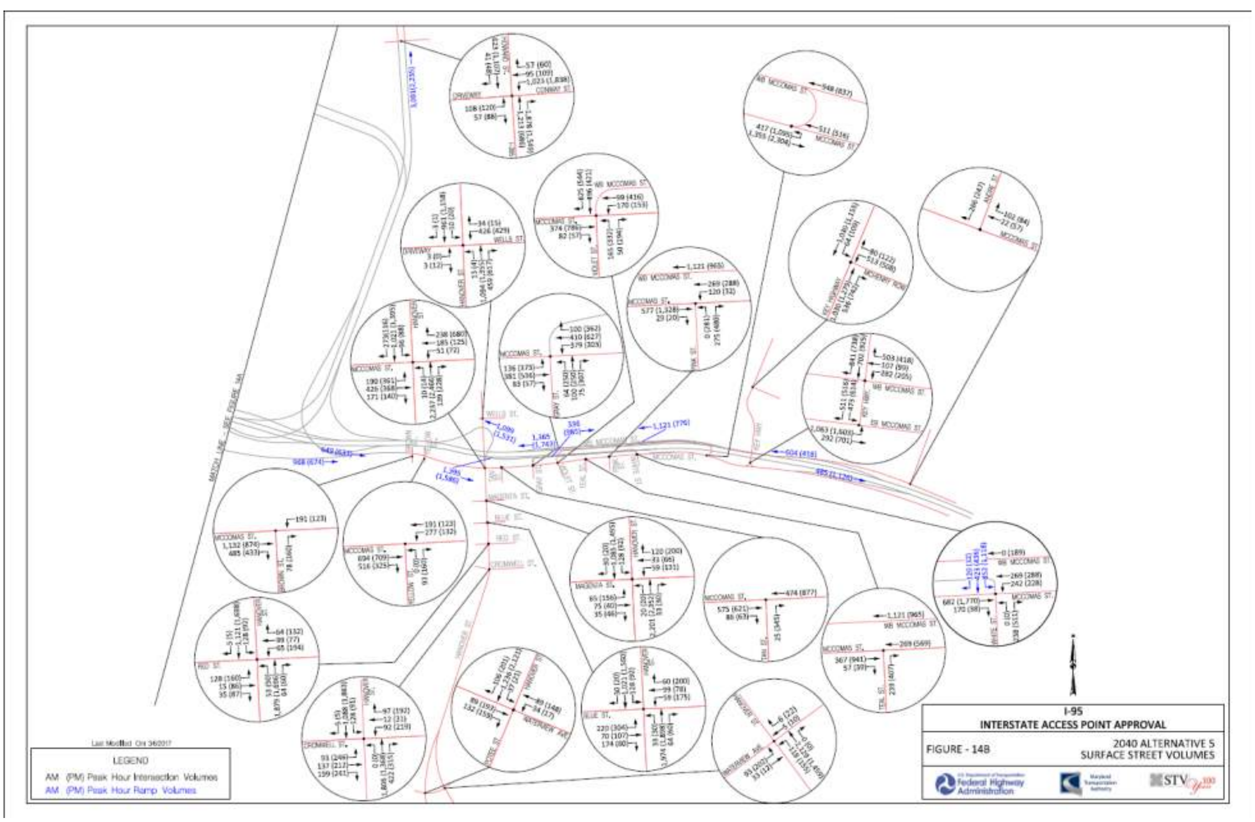

MATCH LINE - SEE FIGURE 13A
LEGEND
AM (PM)
New or Reconstructed Off-Ramp
New or Reconstructed On-Ramp
Last Modified On: 3/6/2017
I-95
INTERSTATE ACCESS POINT APPROVAL
FIGURE - 13B
2040 ALTERNATIVE 5 FREEWAY TRAFFIC VOLUMES
Federal Highway Administration


MATCH LINE - SEE FIGURE 1A
LEGEND
AM (PM)
I-95
INTERSTATE ACCESS POINT APPROVAL
FIGURE - 1B
EXISTING FREEWAY TRAFFIC VOLUMES
Federal Highway Administration


I-95
INTERSTATE ACCESS POINT APPROVAL
FIGURE - 4A
EXISTING VOLUMES
LEGEND
AM (PM) Peak Hour Intersection Volumes
AM (PM) Peak Hour Ramp Volumes


I-95
INTERSTATE ACCESS POINT APPROVAL
FIGURE - 4B
EXISTING VOLUMES
LEGEND
AM (PM) Peak Hour Intersection Volumes
AM (PM) Peak Hour Ramp Volumes


I-95
INTERSTATE ACCESS POINT APPROVAL
FIGURE - 14A
2040 ALTERNATIVE 5
SURFACE STREET VOLUMES
LEGEND
AM (PM) Peak Hour Intersection Volumes
AM (PM) Peak Hour Ramp Volumes


I-95
INTERSTATE ACCESS POINT APPROVAL
FIGURE - 14B
2040 ALTERNATIVE 5
SURFACE STREET VOLUMES
LEGEND
AM (PM) Peak Hour Intersection Volumes
AM (PM) Peak Hour Ramp Volumes

I-95 Access Improvements from Caton Avenue to Fort McHenry Tunnel – Environmental Assessment (EA)
Baltimore City, Maryland

Type I
Technical
Noise Report

March 2018

Appendix B
Noise Monitoring Data

Prepared for:

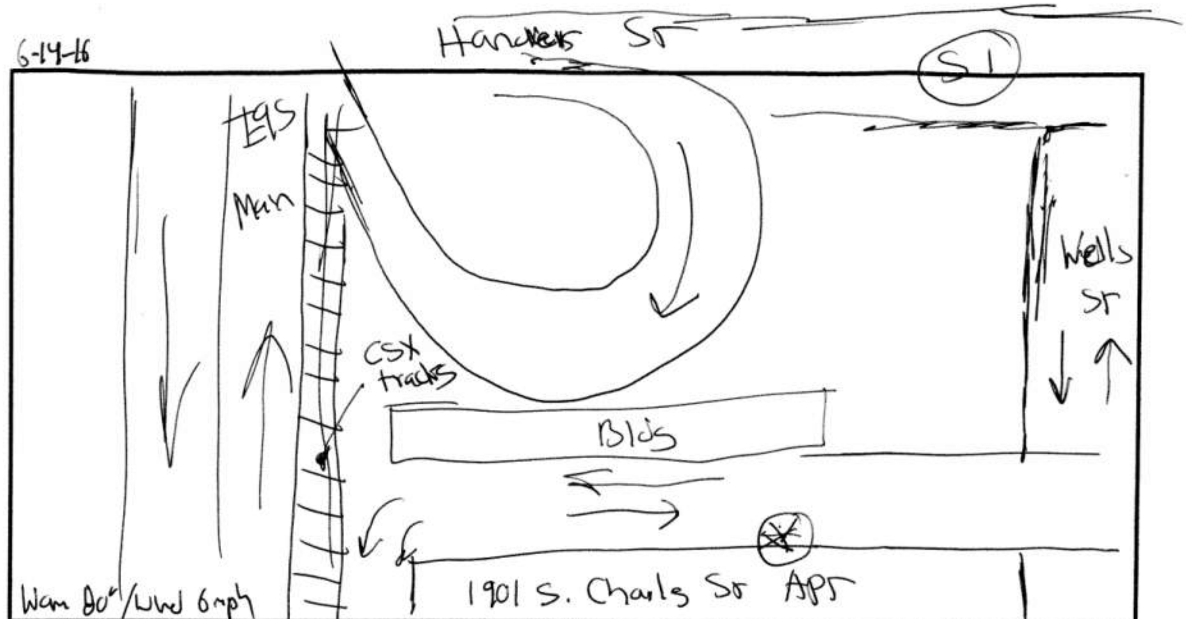
Maryland Transportation Authority

DEPARTMENT OF TRANSPORTATION BALTIMORE CITY

and

U.S. Department of Transportation Federal Highway Administration

6-14-16

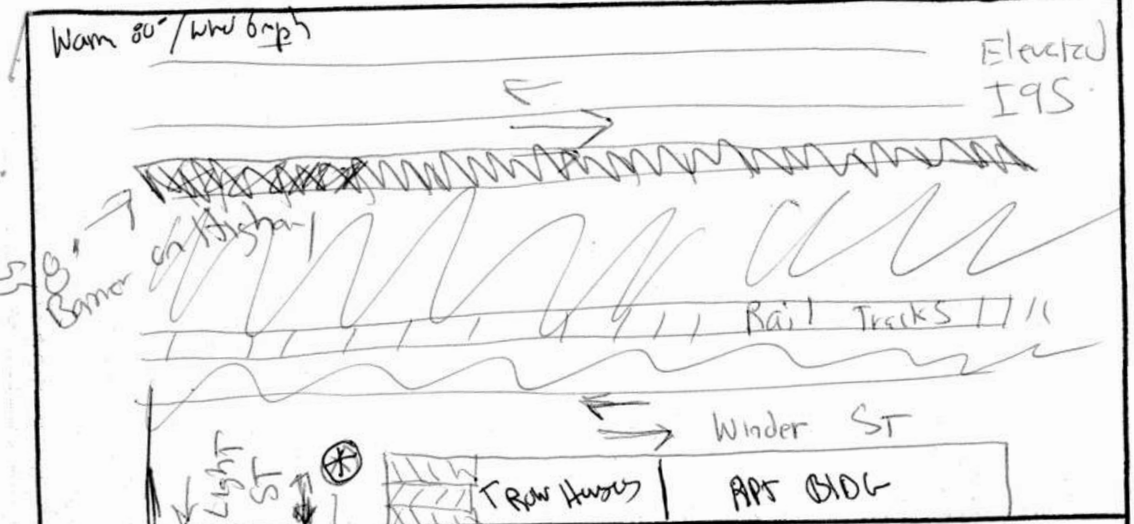


LOCATION: 1901 S. Charles St - SITE 1

NOTES: DS

TIME/ DATE	LENGTH	LEQ	L1	L10	L50	L90	Lmax	Lmin	Vehicles (S. Charles ST)	
6-14-16 7AM	15min	61.5		62.8	60.5	59.2	71.7	57.6	CARS	5
									BUS	–
									L. Truck	–
									Heavy	1
									MC	
6-14-16 5PM	15min	63.4		65.2	61.1	59.0	76.9	56.2	CARS	3
									BUS	4
									L. Truck	–
									Heavy	–
									MC	–
									CARS	
									BUS	
									L. Truck	
									Heavy	
									MC	
									CARS	
									BUS	
									L. Truck	
									Heavy	
									MC	
									CARS	
									BUS	
									L. Truck	
									Heavy	
									MC	
									CARS	
									BUS	
									L. Truck	
									Heavy	
									MC	

S2



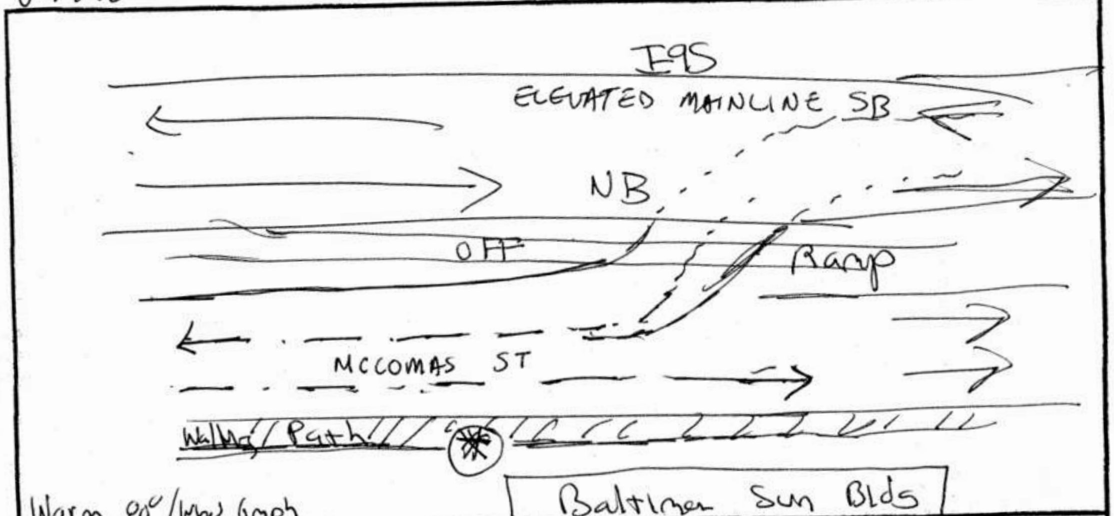
LOCATION: 1946 Light St

NOTES: Site 2 D.S.

	TIME/ DATE	LENGTH	LEQ	L1	L10	L50	L90	Lmax	Lmin	Vehicles Winder/Light ST	
0158	6-14-16 7:17A	15min	64.5		65.6	64.2	62.9	72.6	60.3	CARS	8
										BUS	–
										L. Truck	–
										Heavy	–
										MC	1
0161	6-14-16 8:23A	15min	64.0		65.1	63.7	62.4	74.3	59.9	CARS	2
										BUS	–
										L. Truck	–
										Heavy	–
										MC	–
0164	6-14-16 4:22P	15min	63.6		65.2	63.2	60.6	72.9	56.2	CARS	–
										BUS	–
										L. Truck	–
										Heavy	–
										MC	–
0167	6-14-16 5:19P	15min	64.8		66.7	64.4	62.6	76.2	60.8	CARS	–
										BUS	–
										L. Truck	–
										Heavy	–
										MC	–
										CARS	
										BUS	
										L. Truck	
										Heavy	
										MC	
										CARS	
										BUS	
										L. Truck	
										Heavy	
										MC	

S3

6-14-16



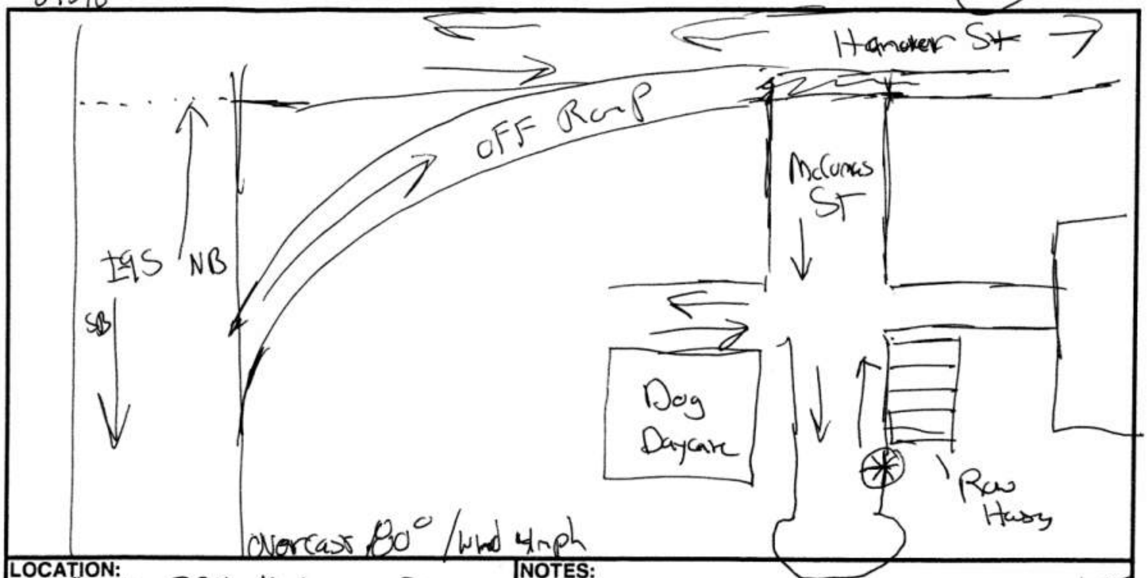
Warm 80° / Wind 6mph

LOCATION: Site 3

NOTES: 1st number E. McComas ST KT

TIME/DATE	LENGTH	LEQ	L1	L10	L50	L90	Lmax	Lmin	Vehicles McComas St	
6/14 7:30 File 003	15 min	72.2		74.1	70.0	68.0	85.0	65.1	CARS	47/10
									BUS	
									L. Truck	1/5
									Heavy	5/5
									MC	
6/14 8:45 007	15 min	72.1		74.3	70.0	68.1	84.9	65.7	CARS	52
									BUS	
									L. Truck	4
									Heavy	4
									MC	2
6/14 4:30 008	15 min	71.3		74.6	67.3	63.1	85.8	58.8	CARS	96
									BUS	
									L. Truck	2
									Heavy	6
									MC	
6/14 5:45 013	15 min	69.5		72.4	67.3	64.8	79.9	63.1	CARS	85
									BUS	1
									L. Truck	
									Heavy	2
									MC	
									CARS	
									BUS	
									L. Truck	
									Heavy	
									MC	
									CARS	
									BUS	
									L. Truck	
									Heavy	
									MC	

6-15-16 S4



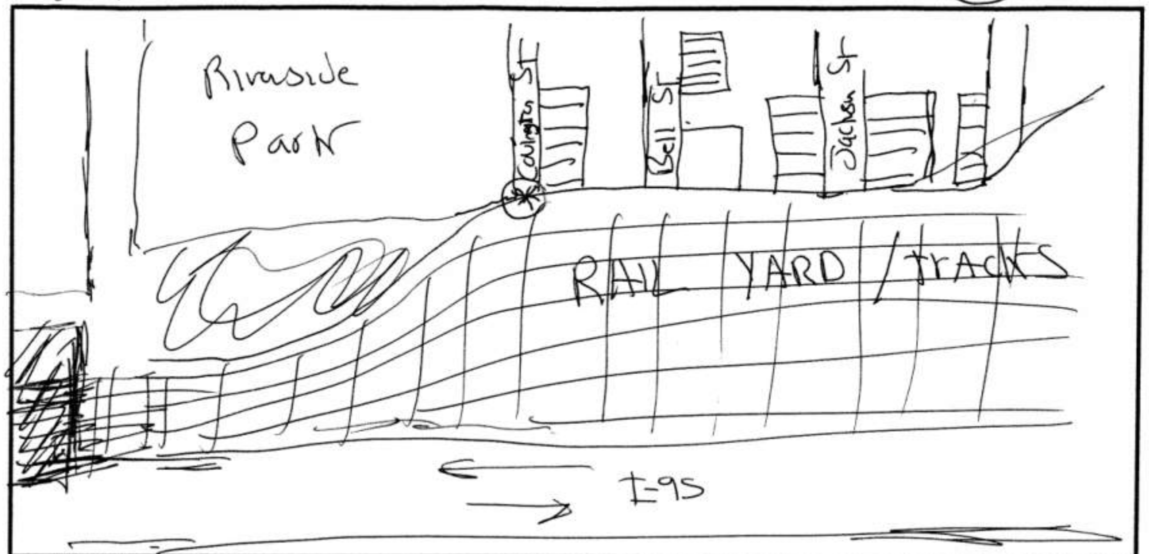
LOCATION: Site 4 220 McComas ST

NOTES: KT

TIME/ DATE	LENGTH	LEQ	L1	L10	L50	L90	Lmax	Lmin	Vehicles	
6-15-16 7:01A	15min	62,8		64,3	62,1	60.2	73,2	59,2	CARS	—
									BUS	—
									L. Truck	—
									Heavy	—
									MC	—
6-15-16 850A	"	63,0		64,5	62,2	60,9	71,9	59,4	CARS	—
									BUS	—
									L. Truck	—
									Heavy	—
									MC	—
6-15-16 4:00p	"	64,1		65,7	62,9	61,5	79,0	60,3	CARS	—
									BUS	—
									L. Truck	—
									Heavy	—
									MC	—
6-15-16	"	61,7		62,9	61.5	60.3	66,8	58,3	CARS	—
									BUS	—
									L. Truck	—
									Heavy	—
									MC	—
									CARS	
									BUS	
									L. Truck	
									Heavy	
									MC	
									CARS	
									BUS	
									L. Truck	
									Heavy	
									MC	

6-15-16

(S5)

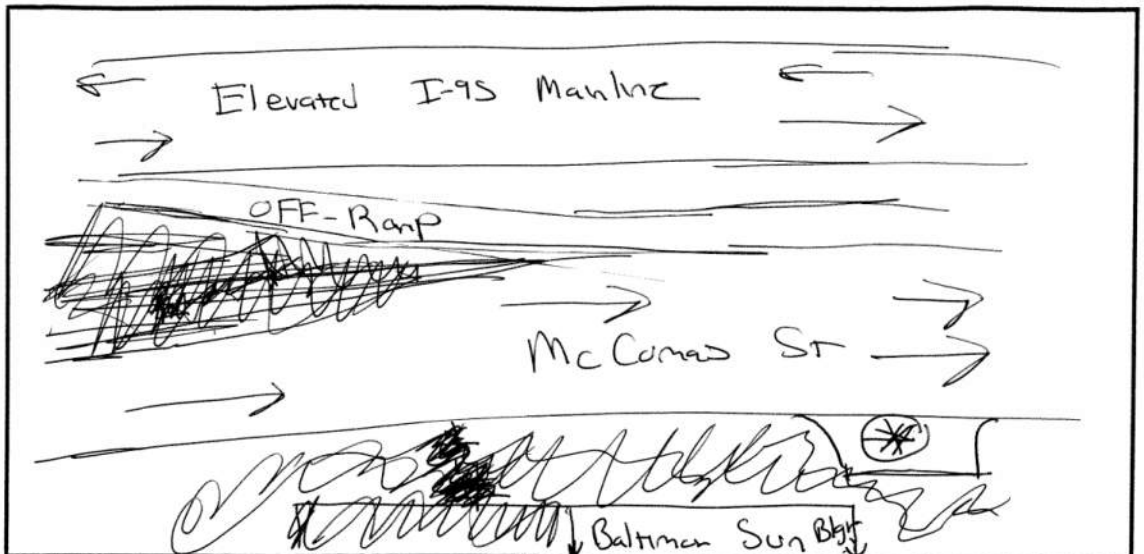


LOCATION: 1880 Covington St - Site 5

NOTES: Overcast / 80° / Wind 4mph

TIME/ DATE	LENGTH	LEQ	L1	L10	L50	L90	Lmax	Lmin	Vehicles
6-15-16 7:25A	15min	66.5		67.8	66.[illegible]	65.0	71.3	62.8	CARS – BUS – L. Truck – Heavy – MC –
6-15-16 8:21A	"	67.0		68.6	66.4	64.6	74.5	60.7	CARS – BUS – L. Truck – Heavy – MC –
6-15-16 4:24P	"	65.0		66.2	64.8	63.4	72.0	62.2	CARS – BUS – L. Truck – Heavy – MC –
6-15-16 5:22p	"	65.3		65.3	63.1	61.6	79.3	59.4	CARS – BUS – L. Truck – Heavy – MC –
									CARS BUS L. Truck Heavy MC
									CARS BUS L. Truck Heavy MC

6-14-16 (S6)

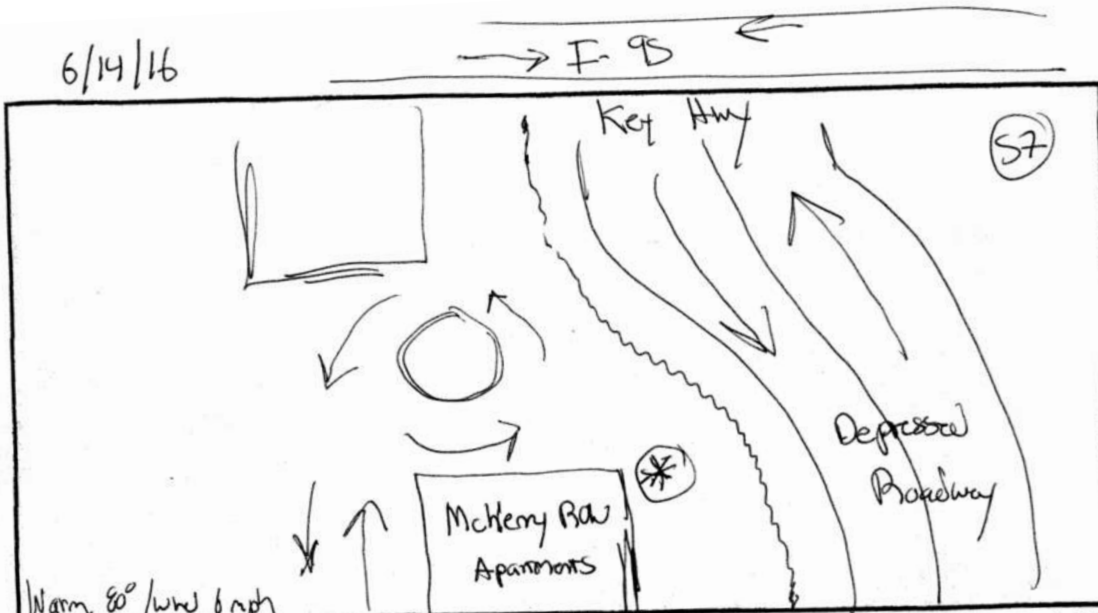


LOCATION: Site 6

NOTES: Warm 80° / Wind 6mph KT

TIME/ DATE	LENGTH	LEQ	L1	L10	L50	L90	Lmax	Lmin	Vehicles McComas St	
6/14/16 7:00A	15min	71.0		73.0	69.8	67.0	82.1	65.1	CARS	40
									BUS	2
									L. Truck	
									Heavy	6
									MC	2
6/14/16 8:30A	"	71.3		73.2	69.6	67.1	85.9	64.1	CARS	60
									BUS	
									L. Truck	2
									Heavy	3
									MC	1
6/14/16 4:00P	"	69.9		71.2	66.2	62.7	87.7	59.4	CARS	34
									BUS	2
									L. Truck	
									Heavy	2
									MC	
6/14/16 5:30P	15mn	68.6		70.8	66.9	63.4	83.2	59.6	CARS	42
									BUS	2
									L. Truck	
									Heavy	1
									MC	
									CARS	
									BUS	
									L. Truck	
									Heavy	
									MC	
									CARS	
									BUS	
									L. Truck	
									Heavy	
									MC	

6/14/16



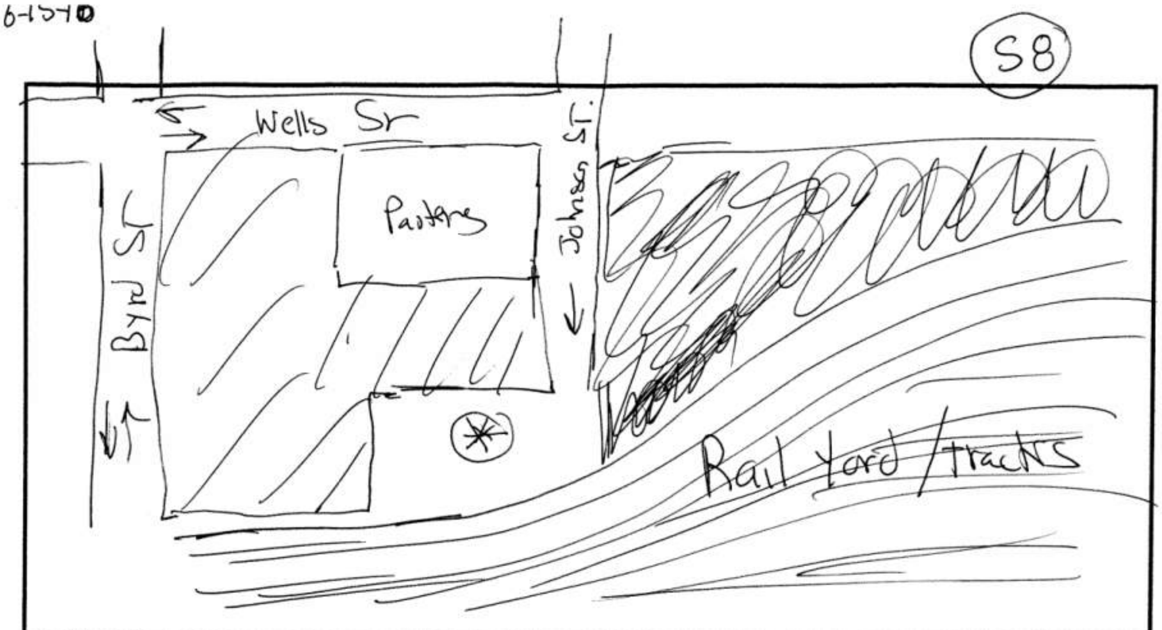
Warm 80° / wind 6 mph

LOCATION: Site 7

NOTES:

TIME/ DATE	LENGTH	LEQ	L1	L10	L50	L90	Lmax	Lmin	Vehicles (Key Hwy)	
6/14 7:45A File 004	15 min	64.6		66.4	64.2	62.3	70.4	59.5	CARS	596
									BUS	7
									L. Truck	8
									Heavy	7
									MC	1
6/14 8:05A File 005	15 min	66.3		68.1	65.3	63.1	76.9	58.6	CARS	606
									BUS	5
									L. Truck	5
									Heavy	19
									MC	2
6/14 4:46P File 010	15 min	64.3		66.1	63.5	61.5	79.6	58.7	CARS	449
									BUS	3
									L. Truck	4
									Heavy	8
									MC	1
6/14 5:00pm File 11	15	63.2		65.2	62.4	60.4	74.5	58.5	CARS	601
									BUS	5
									L. Truck	
									Heavy	7
									MC	2
									CARS	
									BUS	
									L. Truck	
									Heavy	
									MC	
									CARS	
									BUS	
									L. Truck	
									Heavy	
									MC	

6-1540



LOCATION: 101 Wells St Apts - Site 8

NOTES: Overcast Warm / 80° / Wind 4 mph KT

TIME/ DATE	LENGTH	LEQ	L1	L10	L50	L90	Lmax	Lmin	Vehicles	
6-14-16 7:44A	15min	66.7		68.1	66.4	64.7	75.4	61.7	CARS	—
									BUS	—
									L. Truck	—
									Heavy	—
									MC	—
6-14-16 8:00A	"	66.5		68.2	66.3	64.2	72.9	62.7	CARS	—
									BUS	—
									L. Truck	—
									Heavy	—
									MC	—
6-14-16 4:44p	"	68.0		69.7	67.7	65.1	81.0	59.7	CARS	—
									BUS	—
									L. Truck	—
									Heavy	—
									MC	—
6-14-16 5:00p	15min	68.9		70.5	68.4	66.8	77.3	63.7	CARS	—
									BUS	—
									L. Truck	—
									Heavy	—
									MC	—
									CARS	
									BUS	
									L. Truck	
									Heavy	
									MC	
									CARS	
									BUS	
									L. Truck	
									Heavy	
									MC	

6-1-17

59

WEATHER
AM: MIX OF SUN
& CLOUDS, 65°F

PM: SUNNY
84°F

LOCATION: INTERSECTION OF CLARE ST & ANNAPOLIS ROAD [Site 9]

NOTES:

DP

TIME/ DATE	LENGTH	LEQ	L1	L10	L50	L90	Lmax	Lmin	Vehicles		
D# 55 6/1/17 7:11AM	30MIN	71.2		73.7	67.1	61.6	88.0	59.	CARS	43	CLAR ST
									BUS		
									L. Truck	4	
									Heavy		
									MC		
									CARS	173	ANNAP. RD
									BUS	4	
									L. Truck	24	
									Heavy	4	
									MC		
58 6/1/17 4:42PM	30 MIN	69.9		72.5	68.2	65.5	84.7	63.7	CARS	28	CLARE
									BUS		
									L. Truck	1	
									Heavy		
									MC		
									CARS	131	ANNAPOL
									BUS	1	
									L. Truck	16	
									Heavy	2	
									MC		
									CARS		
									BUS		
									L. Truck		
									Heavy		
									MC		
									CARS		
									BUS		
									L. Truck		
									Heavy		
									MC		