NORTH SPLIT
UPGRADES
DRIVING PROGRESS

ENVIRONMENTAL ASSESSMENT

APPENDIX I: TRAFFIC NOISE ANALYSIS

I-65/I-70 North Split Project
Indianapolis, Indiana

Des. Nos. 1592385 and 1600808

FINAL TRAFFIC NOISE TECHNICAL REPORT

6/4/2020

INDIANA DEPARTMENT OF TRANSPORTATION
INDOT

NORTH SPLIT
UPGRADES
DRIVING PROGRESS

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EXECUTIVE SUMMARY

This report evaluates the potential noise impacts of the proposed improvements within the I-65/I-70 North Split Interchange (North Split) in Indianapolis, Indiana in conformance with corresponding federal regulations and guidance and the National Environmental Policy Act (NEPA). The noise analysis presents the existing and future acoustical environment at various receptors located along I-65 and I-70 within the study area.

The determination of noise abatement measures and locations is in compliance with the Federal Highway Administration (FHWA) Procedures for Abatement of Highway Traffic Noise and Construction Noise as presented in the Code of Federal Regulations, Title 23 Part 772 (23 CFR 772) and the Indiana Department of Transportation (INDOT) Traffic Noise Analysis Procedure, last updated in 2017.

Existing noise level measurements were taken at eight representative locations. A 20-minute measurement was taken at each site. The measurements were made in accordance with FHWA and INDOT guidelines using an integrating sound level analyzer meeting American National Standard Institute and International Electro Technical Commission Type 1 specifications. Traffic counts and vehicle classification were collected concurrently with the noise measurement.

The latest version of the INDOT traffic noise model (TNM) was used to model existing (2017) and design year (2041) worst hourly traffic noise levels within the study area. A total of 396 TNM noise receivers representing 1083 noise-sensitive receptors, numbered R1 through R455, were modeled for the existing and proposed condition. These receivers were selected to model representative noise impacts at 957 Activity Category B receptors, 34 Category C receptors, 34 Category C/D receptors, 47 Category D receptors, and 11 Category E receptors. The location of each receiver is shown on the maps in **Appendix A** of this report.

Based on the studies completed to date, INDOT has identified those noise receptors that would be exposed to 2041 design year noise levels approaching or exceeding the FHWA Noise Abatement Criteria (NAC) of 67 dB(A) Leq(h). Predicted future design year (2041) noise levels adjacent to the proposed project would approach or exceed the NAC at 92 receiver locations representing 259 receptors. The noise levels at these 259 receptors would range from 66.3 to 73.8 dB(A) Leq(h). Substantial noise level increases, defined by the INDOT Traffic Noise Analysis Procedure as 15.0 dB(A) or greater, are not projected to occur within the study area.

Eight noise barrier locations (most with multiple acoustical designs) were modeled in the study area. The noise barrier designs ranged from 600 to 4,734 feet in length with average heights ranging from 11 to 20 feet and ranged in cost from $204,060 to $2,711,670. The cost per benefited receptor for the analyzed barriers ranged from $7,024 to $288,653. Noise abatement at these locations is based upon preliminary estimated costs and design criteria.

Based on the studies completed to date, INDOT has identified 259 impacted receptors and has determined that noise abatement is likely, but not guaranteed, at two locations. Noise abatement at these locations is based upon preliminary design costs, design criteria, and public input. Noise abatement in these locations at this time has been estimated to cost $690,930 and $1,201,080, and will reduce the noise level by a minimum of 7 dB(A) at a majority of the identified impacted receptors. A re-evaluation of the noise analysis will occur during final design. If during final design it has been determined that conditions have changed such that noise abatement is not feasible and reasonable, the abatement measures might not be provided.

The viewpoints of the benefited residents and property owners were sought and were considered in determining the reasonableness of highway traffic noise abatement measures for proposed highway construction projects. INDOT will incorporate highway traffic noise consideration in on-going activities for public involvement in the highway program. The final decision on the installation of any abatement measure(s) will be made upon the completion of the project's final design.

1 INTRODUCTION

The Indiana Department of Transportation (INDOT) is developing a project involving the I-65/I-70 North Split Interchange (North Split) in Indianapolis, Indiana, in partnership with the Federal Highway Administration (FHWA). I-65 and I-70 are nationally significant corridors, serving the Midwest and United States in four directions. The North Split is the second-most heavily-traveled interchange in Indiana, accommodating about 214,000 vehicles per day.[1] The purpose of the North Split Project is to rehabilitate and improve existing interstate facilities in the project area. The location of the North Split interchange in the downtown Indianapolis interstate system is shown in **Figure 1**.

2 LEGISLATION AND NOISE FUNDAMENTALS

2.1 Regulatory Requirements

Effective control of undesirable traffic noise focuses upon three types of action. These are the control of land uses adjacent to a highway, regulation of vehicle noise emission levels, and mitigation of noise impacts resulting from certain types of highway improvement projects.

The authority to implement planning and land use control in the State of Indiana is under the jurisdiction of local governments. Both FHWA and INDOT encourage local governments to regulate land uses in such a manner that noise sensitive developments are either prohibited from being located adjacent to major transportation facilities, or are planned, designed, and built in such a manner that potential noise impacts can be avoided or minimized.

The *Noise Control Act of 1972* gave the U.S. Environmental Protection Agency (USEPA) the authority to establish noise regulations to control major noise sources, including motor vehicles and construction equipment. Furthermore, the USEPA was required to set noise emission standards for motor vehicles used for interstate commerce and FHWA was required to enforce the USEPA noise emission standards through the Office of Motor Carrier Safety.

The National Environmental Policy Act (NEPA) gave broad authority and responsibility to Federal agencies to evaluate and mitigate adverse environmental impacts caused by Federal actions. FHWA is required to comply with NEPA including mitigating adverse highway traffic noise effects. The *Federal-Aid Highway Act of 1970* mandates FHWA to develop standards for mitigating highway traffic noise. It also requires FHWA to establish traffic noise level criteria for various types of land uses. The Act prohibits FHWA approval of federal-aid highway projects unless adequate consideration has been made for noise abatement measures to comply with the standards.

FHWA regulations for highway traffic noise for federal-aid highway projects are contained in 23 CFR Part 772. The regulations contain noise abatement criteria, which represent the maximum acceptable level of highway traffic noise for specific types of land uses. The regulations do not mandate that the abatement criteria be met in all situations, but rather require that reasonable and feasible efforts be made to provide noise mitigation when the abatement criteria are approached or exceeded.

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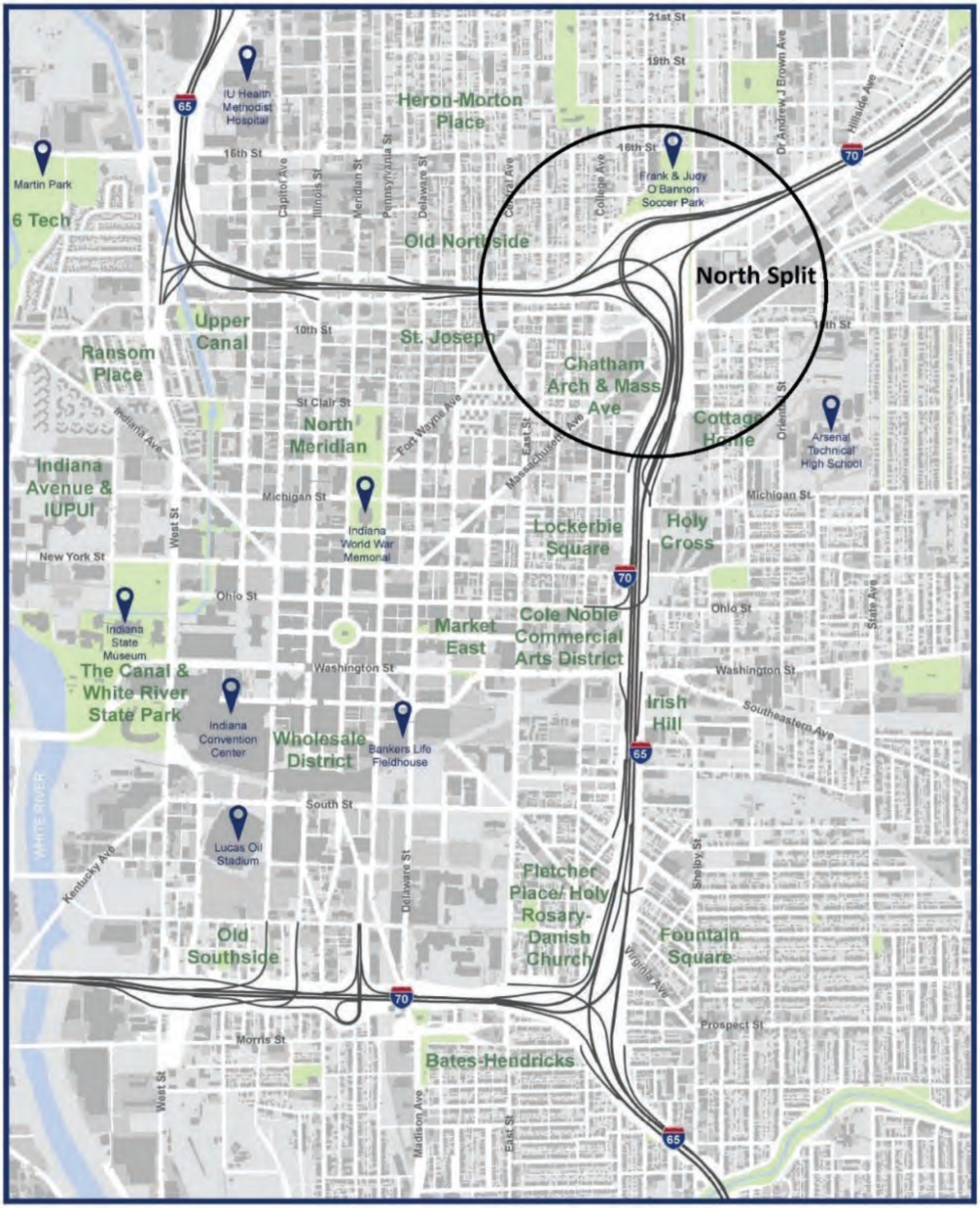
[1] *INDOT, 'North Split Reconstruction Project.' Retrieved from* https://northsplit.com/ *5/30/2019.*

Figure 1: North Split Location



The traffic noise standards and the description of highway traffic noise prediction requirements, noise analyses, noise abatement criteria, and requirements for informing local officials are found in 23 CFR Part 772. (Procedures for Abatement of Highway Traffic Noise and Construction Noise). Also, FHWA policy requires each state Department of Transportation to adopt a state-specific noise policy, approved by FHWA, which defines specific terms and describes how the state implements the noise standard.

The effective date of the most recent FHWA-approved *INDOT Traffic Noise Analysis Procedure* is July 1, 2017. This policy is applicable to Type I federal-aid highway projects which involve the construction of a highway on a new location or the physical alteration of an existing highway that significantly changes either its horizontal or vertical alignment or increases the number of through traffic lanes. The structure of the policy focuses on the following principal elements:

- Identification of Noise-Sensitive Land Uses.
- Determination of Existing Noise Levels.
- Prediction of Future Noise Levels.
- Identification of Traffic Noise Impacts.
- Identification and Consideration of Abatement.
- Consideration of Construction Noise.
- Coordination with Local Government Officials.

2.2 Traffic Noise

Noise is generally defined as unwanted sound. Airborne sound occurs by a rapid fluctuation of air pressure above and below atmospheric pressure. Sound pressure levels are usually measured and expressed in decibels (dB). The decibel scale is logarithmic and expresses the ratio of the sound pressure unit being measured to a standard reference level.

Most sounds occurring in the environment do not consist of a single frequency, but rather a broad band of differing frequencies. Because the human ear does not respond to all frequencies equally, the method commonly used to quantify environmental noise is to apply an adjustment, or weighting, to define the relative loudness of different frequencies. The A-weighted scale is widely used because it best approximates the frequency response of the human ear. The A-weighted sound level in decibels is identified as dB(A).

Although the dB(A) may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources, creating a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of traffic noise, a statistical noise descriptor called the equivalent hourly sound level, or Leq(h), is commonly used. Leq(h) describes a noise sensitive receptor's cumulative exposure from all noise-producing events over a one-hour period.

Because decibels are logarithmic units, sound levels cannot be added by ordinary arithmetic means. The following general relationships provide a basic understanding of sound generation and propagation:

- An increase, or decrease, of 10 dB will be perceived by the human ear to be a doubling, or halving (respectively), of the sound level.
- Doubling the traffic volumes, keeping vehicle mix and speeds the same, and not changing the distance between the source and a receiver will increase the traffic noise level by 3 dB, which will be perceived as a barely noticeable change in outdoor settings.

3 IMPACT CRITERIA

3.1 Noise Abatement Criteria

The *INDOT Traffic Noise Analysis Procedure* has adopted the noise abatement criteria (NAC) that have been established by FHWA (23 CFR Part 772)[2] for determining noise impacts for a variety of land uses. The land-use Activity Categories along with the criteria are presented in **Table 1**. The NAC sound levels are only to be used to determine a roadway noise impact. These are the absolute values where abatement must be considered.

3.2 INDOT Definition of Noise Impacts

Traffic noise impacts occur if either of the following two conditions is met:

- The predicted traffic noise levels approach or exceed the NAC, as shown in **Table 1**. The *INDOT Traffic Noise Analysis Procedure* defines "approach or exceed" as meaning that future levels are higher than 1 dB(A) below the appropriate NAC activity category. For example, for a category B receptor, 66 dB(A) is approaching 67 dB(A) and would be considered an impact.
- The predicted traffic noise levels substantially exceed the existing noise level. The *INDOT Traffic Noise Analysis Procedure* defines "substantially exceed" as meaning when predicted traffic noise levels exceed existing noise levels by 15 dB(A) or more. For example, if a receptor's existing noise level is 50 dB(A), and if the future noise level is 65 dB(A), then it would be considered an impact.

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[2] *23 C.F.R. § 772 (2010). "Procedures for Abatement of Highway Traffic noise and Construction Noise." Accessed June, 3, 2019.*

Table 1: FHWA Noise Abatement Criteria

Hourly A-Weighted Sound Level - Decibels (dB(A))			
Category	**Criteria[1] Leq(h)**	**Evaluation Location**	**Description of Activity**
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	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	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A-D or F.
F	-	-	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	-	-	Undeveloped lands that are not permitted.

1. Leq(h) Activity Criteria ***are only for impact determination*** *and are not design standards for noise abatement measures.*
2. Includes undeveloped lands permitted for this activity category.
Source: Federal Highway Administration (23 CFR Part 772, Table 1).

4 NOISE STUDY METHODOLOGY

4.1 Identification of Land Uses

The project is located in downtown Indianapolis which consists primarily of single and multifamily residences (NAC Category B), schools, places of worship, and recreational facilities (NAC Category C and Category C/D), offices, motels, and restaurants (NAC Category E); and retail, and industrial properties (NAC Category F), as well as non-sensitive industrial and commercial land uses (NAC Category F). All receivers are within 500 feet from the preferred alternative (edge of the outside travel lane). The entire area is fully developed with very few vacant, undeveloped properties.

The study area contains several National Register of Historic Places (National Register)-listed and National Register-eligible historic districts and properties. Historic properties within 800 feet of the proposed edge of pavement were included in the TNM model for only informational purposes to support the Section 106 process. Since the TNM model does not accurately predict noise levels beyond 800 feet from the noise source, 800 feet was the limit of this evaluation. These historic districts include the Old Northside, Chatham-Arch, the Saint Joseph Neighborhood, Lockerbie Square, Holy Cross/Westminster, and the Windsor Park Neighborhood Historic District. Historic properties include the Bals-Wocher House, the Wyndham building, the Pierson-Griffiths House, the Calvin I. Fletcher House, the Cole Motor Car Company building, the Gasteria Inc. building, the Manchester Apartments, the Sheffield Inn , the Delaware Court Apartments, the William Buschman Block building, the Morris-Butler House, the Pearson Terrace building, the Benjamin Harrison Home/Presidential Site, John Hope School # 26, and Saints

Peter and Paul Cathedral. Based on the noise abatement criteria set in 23 Code of Federal Regulations (CFR) 772[3], 11 of these properties have exterior areas of frequent human use and are therefore considered noise sensitive (see Table 1). Additional discussion on these properties is included in **Section 7** of this report.

Within the study area, the Monon Trail parallels Lewis Street before stopping at 10th Street. The Monon Trail crosses under the North Split interchange extending more than 20 miles north with direct access to many parks and recreational facilities. The O'Bannon soccer fields, connecting directly to the Monon Trail, are located on the north edge of the interchange. The property encompasses approximately 17 acres of open space. Land use along the south leg of the interchange is predominantly industrial and residential.

The northern terminus of the Indianapolis Cultural Trail is within the study area at 10th street. The Cultural Trail provides direct access to arts and cultural districts as well as parks and recreational facilities downtown.

4.2 Common Noise Environments (CNE) Descriptions

Land uses in the project area have been grouped into a series of numbered Common Noise Environments (CNE) that are identified on maps in **Appendix A**.

- **CNE 1** is located on the east side of I-65/I-70 on the south leg of the interchange between the CSX railroad at the southern end of the project and approximately North Street. This area consists of industrial, commercial, and residential land uses. The residential land use includes the Holy Cross/Westminster neighborhood. This area is generally flat. No sound barrier or topographical shielding occurs between the highway and the residential areas.

- **CNE 2** is located on the east side of I-65/I-70 on the south leg of the interchange between North Street and 13th Street. Residential land uses (Activity Category B) include the Cottage Home neighborhood. The Monon Trail and the Legacy Learning Center are also located in this area. This area is generally flat. No areas of frequent human outdoor use were identified for the commercial land uses. There are no topographical shielding factors between the residences and the highway.

- **CNE 3** is located south of I-70 on the east leg of the interchange between approximately Columbia Street and the eastern limits of the study area. This area consists primarily of industrial land use with a small residential area centered on Dr. Andrew J. Brown Avenue and a small portion of the Windsor Park neighborhood. This area is generally flat. No areas of frequent human outdoor use were identified for the commercial land uses. There are no topographical shielding factors between the residences and the highway.

- **CNE 4** is located north of I-70 on the east leg of the interchange from the eastern limits of the study area to Lewis Street. This area consists of a few commercial/industrial properties and residential land uses, one apartment complex under construction, several churches and the Oaks Academy School. No areas of frequent outdoor human use were identified for the commercial properties. Residential land uses include the Martindale Brightwood neighborhood. There are no topographical shielding factors between the highway and sensitive land uses. This area contains several building rows providing shielding to sensitive land uses further from the roadway.

- **CNE 5** is located north of the interchange and on the northbound side of I-65 west of the interchange. This area consists of a commercial, residential, and recreational properties. Residential land uses include the Old Northside neighborhood. Recreational properties include the Monon Trail and the O'Bannon soccer fields. There are no topographical shielding factors between the highway sensitive land uses. This area contains several building rows providing shielding to sensitive land uses further from the roadway.

- **CNE 6** is located in the southwest quadrant of the interchange and on the southbound side of I-65 from the western extent of the study area to approximately 10th Street. This area consists of a few commercial properties and residences. Residential land uses include the Chatham Arch neighborhood. There are no topographical shielding factors between the highway sensitive land uses. This area contains several building rows providing shielding to sensitive land uses further from the roadway.

- **CNE 7** is located on the southbound/westbound side of I-65/I-70 west of the south leg of the interchange from 10th Street south to St. Clair Street. This area consists of a few commercial properties and a large multi-story apartment building. There are no topographical shielding factors between the highway sensitive land uses. This area contains several building rows providing shielding to sensitive land uses further from the roadway.

- **CNE 8** is located on the southbound/westbound side of I-65/I-70 west of the south leg of the interchange from St. Clair Street to Vermont Street. This area consists of a few commercial properties and residences. Residential land uses include several large multi-story apartment complexes and individual homes. There are no topographical shielding factors between the highway sensitive land uses. This area contains several building rows providing shielding to sensitive land uses further from the roadway.

- **CNE 9** is located on the southbound/westbound side of I-65/I-70 west of the south leg on the interchange from Vermont Street to the Ohio Street exit ramp and the southern extent of the study area. This area consists of a few commercial and institutional properties and residences. Residential land uses include a group of residences south of New York Street and west of Davidson Street. There are no topographical shielding factors between the highway sensitive land uses. This area contains several building rows providing shielding to sensitive land uses further from the roadway.

4.3 Receptors for Non-Residential Land Uses

As stated in **Section 4.1**, non-residential land uses in the study area with noise sensitive land uses consist of schools, non-profit institutions, and recreational facilities. Under most situations, a single structure is considered a single receptor. Structures that contain multiple residential units (e.g. hotels, apartments) are considered to have one receptor per residential unit. For certain land uses (parks, trails, etc.), a separate algorithm (shown below) is used to translate usage data into an appropriate number of receptors, based on converting total usage to equivalent residential units. To determine the number of receptors appropriate for the Monon Trail/Indianapolis Cultural Trail, O'Bannon soccer fields, Benjamin Harrison Home/Presidential Site, the Legacy Learning Center, and the Oaks Academy, a slightly modified version of the algorithm provided in the *INDOT Traffic Noise Analysis Procedure* was used. This algorithm converts total usage to equivalent receptors. An explanation of how the number of receptors was determined for each property is provided below.

Monon Trail/Indianapolis Cultural Trail

The Monon Trail and Indianapolis Cultural Trail (Cultural Trail) are multi-use trails that run roughly north/south through the study area. The southern terminus of the Monon Trail is just east of the I-65/I-70 overpass over 10th Street. For the purposes of this evaluation the segment of the Cultural Trail from 10th Street to approximately Carrollton Avenue was considered an extension of the Monon Trail and assumed to have approximately the same number of users. Approximately 3,500 feet of the Monon Trail/Cultural Trail is within a 500-foot buffer of the proposed edge of pavement for the North Split Project. A total of six receivers, R455, R120-1, R120-2, R120-3, R120-5, and R120-6 were placed at equal distances along the trails.

The total length of the trail segment for which counts were provided is approximately 5.7 miles (30,000 feet). This segment extended from Northview Drive to 10th Street. The annual usage of this trail segment is 99,764.[4] The number of annual users (99,764) was divided by 365 (days per year) to get 273 average daily users. The following algorithm was used to calculate the appropriate number of receptors per receiver.

> (273 users per day/2.52 people on average per family) X (3,500 feet of trail within the study area/30,000 feet of trail within the segment) = 13 receptors.

The 13 receptors calculated above were divided between the six receiver locations (two receptors per receiver) within the study area with the extra receptor being assigned to the trail segment representing the Cultural Trail.

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[4] *City of Indianapolis Greenways Development Committee Files, 2016 via e-mail "Re: indy Greenways Trail Counts" from Ron Taylor, Chair of the Indianapolis Greenways Development Committee*

O’Bannon Soccer Fields

The O’Bannon Soccer Fields include approximately 17 acres of soccer fields bordered by 16th Street to the north, the North Split Interchange to the south, the Monon Trail to the east and Bundy Place to the west. These fields host soccer leagues from Spring to Fall and serve as a trailhead and parking for the Monon Trail. These fields are represented in the model by receivers R121 and R122. An estimate of average daily number of users, based on the number of fields, assumed number of users per field, and assumed number of users of the Monon Trail access, was determined to be 200. Based on the usage of the fields, approximately 10 hours per day and 7 days per week for 9 months of the year a usage factor of 0.24 was calculated for this facility. Multiplying the usage factor (0.24) by the estimated daily number of users (200) gives an average daily number of users of 48. The following algorithm was used to calculate the appropriate number of receptors per receiver.

(48 visitors per day/2.52 average people per household) X (61% of the property within the study area) =12 receptors.

These 12 receptors were divided evenly between R121 and R122.

Benjamin Harrison Home/Presidential Site

The Benjamin Harrison Home/Presidential Site is a National Historic Landmark consisting of a museum, manicured grounds, and gardens in the lawn south of the home. This site is represented in the model by receiver R206. It was determined that this site receives approximately 30,000 annual visitors.[5] The following algorithm was used to calculate the appropriate number of receptors per receiver.

> (82 visitors per day/2.52 average people per household) X (100% of the property within the study area) =33 receptors.

These 33 receptors were applied to R206 in the model.

Legacy Learning Center

The Legacy Learning Center is a school located in CNE 2 in the southeast quadrant of the North Split interchange. This site is represented in the model by receiver R113. It was determined that this school has a combined 270 staff and students on an average day.[6] Based on the occupation of this building approximately 10 hours per day and 5 days per week for 9 months of the year a usage factor of 0.22 was calculated for this facility. Multiplying the usage factor (0.22) by the total faculty, staff and students (270) gives an average daily number of users of 59. The following algorithm was used to calculate the appropriate number of receptors per receiver.

> (59 visitors per day/2.52 average people per household) X (50% of the property within the study area) =12 receptors.

These 12 receptors were applied to R113 in the model.

The Oaks Academy

The Oaks Academy is a school located in CNE 4 at the intersection of 16th Street and Columbia Avenue. This site is represented in the model by receiver R106A. It was determined that this school has a combined 265 staff and students on an average day.[7] Based on the occupation of this building approximately 10 hours per day and 5 days per week for 9 months of the year a usage factor of 0.22 was calculated for this facility. Multiplying the usage factor (0.22) by the total faculty, staff and students (265) gives an average daily number of users of 58. The following algorithm was used to calculate the appropriate number of receptors per receiver.

> (58 visitors per day/2.52 average people per household) X (100% of the property within the study area)X(50% of faculty and staff using the outdoor areas) =12 receptors.

These 12 receptors were applied to R106A in the model.

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[5] *Hyde, Charles (2019, July 12) Phone call.*

[6] *Representative from the Legacy Learning Center (2019, August 7) Phone call.*

[7] *Representative from the Oaks Academy (2019, August 1) Phone call.*

Foundation of Truth Worship Center

The Foundation of Truth Worship Center is in CNE 3 north of Michigan Street between I-65 and the railroad. This site is represented in the model by receiver R49. It was estimated based on usage number from other worship centers in the area that Foundation of Truth Worship Center has approximately 150 regular attendees on an average Sunday. Based on the occupation of this building approximately 6 hours per day and 2 days per week for 12 months of the year a usage factor of 0.07 was calculated for this facility. Multiplying the usage factor (0.07) by the total visitors, staff and students (150) gives an average daily number of users of 11. The following algorithm was used to calculate the appropriate number of receptors per receiver.

> (11 visitors per day/2.52 average people per household) X (100% of the property within the study area) =4 receptors.

These 4 receptors were applied to R49 in the model.

Goodwill Missionary Baptist Church

The Goodwill Missionary Baptist Church is located at 1302 Columbia Avenue in CNE 2 in the northwest quadrant of the intersection of Columbia Avenue and 13th Street. This site is represented in the model by receiver R50. It was estimated based on usage number from other worship centers in the area and the size of the building that Goodwill Missionary Baptist Church has approximately 100 regular attendees on an average Sunday. Based on the occupation of this building approximately 6 hours per day and 2 days per week for 12 months of the year a usage factor of 0.07 was calculated for this facility. Multiplying the usage factor (0.07) by the total assumed visitors (100) gives an average daily number of users of 7. The following algorithm was used to calculate the appropriate number of receptors per receiver.

> (7 visitors per day/2.52 average people per household) X (100% of the property within the study area) =3 receptors.

These 3 receptors were applied to R50 in the model.

Hillside Christian Church

The Hillside Christian Church is located at 1737 Ingram Street in CNE 3 in the southwest quadrant of the intersection of Ingram Street and 18th Street. This site is represented in the model by receiver R86. It was estimated based on usage number from other worship centers in the area and the size of the building that Hillside Christian Church has approximately 150 regular attendees on an average Sunday. Based on the occupation of this building approximately 6 hours per day and 2 days per week for 12 months of the year a usage factor of 0.07 was calculated for this facility. Multiplying the usage factor (0.07) by the total assumed visitors (150) gives an average daily number of users of 11. The following algorithm was used to calculate the appropriate number of receptors per receiver.

> (11 visitors per day/2.52 average people per household) X (100% of the property within the study area) =4 receptors.

These 4 receptors were applied to R86 in the model.

New Bethel Missionary Baptist Church

The New Bethel Missionary Baptist Church is located at 1535 Dr. Andrew Brown Drive in CNE 3 in the southeast quadrant of the intersection of Dr. Andrew Brown Drive and 16th Street. This site is represented in the model by receiver R106. It was determined from a phone call with a representative of the church that New Bethel Missionary Baptist Church has approximately 150 regular attendees on an average Sunday. Based on the occupation of this building approximately 6 hours per day and 2 days per week for 12 months of the year a usage factor of 0.07 was calculated for this facility. Multiplying the usage factor (0.07) by the total assumed visitors (150) gives an average daily number of users of 11. The following algorithm was used to calculate the appropriate number of receptors per receiver.

> (11 visitors per day/2.52 average people per household) X (100% of the property within the study area) =4 receptors.

These 4 receptors were applied to R106 in the model.

Greater Bethlehem Missional Baptist Church

The Greater Bethlehem Missional Baptist Church is located in the southeast corner of Yandes Street and 15th Street within CNE 3. This site is represented in the model by receiver R111. It was estimated based on usage number from other worship centers in the area and the size of the building that Greater Bethlehem Missional Baptist Church has approximately 100 regular attendees on an average Sunday. Based on the occupation of this building approximately 6 hours per day and 2 days per week for 12 months of the year a usage factor of 0.07 was calculated for this facility. Multiplying the usage factor (0.07) by the total assumed visitors (100) gives an average daily number of users of 7. The following algorithm was used to calculate the appropriate number of receptors per receiver.

> (7 visitors per day/2.52 average people per household) X (100% of the property within the study area) =3 receptors.

These 3 receptors were applied to R111 in the model.

Eastside New Hope Missionary Baptist Church

The Eastside New Hope Missionary Baptist Church is located at 1601 Sheldon Street within CNE 3 in the northeast corner of Sheldon Street and 16th Street. This site is represented in the model by receiver R112. It was estimated based on usage number from other worship centers in the area and the size of the building that Eastside New Hope Missionary Baptist Church has approximately 150 regular attendees on an average Sunday. Based on the occupation of this building approximately 6 hours per day and 2 days per week for 12 months of the year a usage factor of 0.07 was calculated for this facility. Multiplying the usage factor (0.07) by the total assumed visitors (150) gives an average daily number of users of 11. The following algorithm was used to calculate the appropriate number of receptors per receiver.

> (11 visitors per day/2.52 average people per household) X (100% of the property within the study area) =4 receptors.

These 4 receptors were applied to R112 in the model.

Traders Point Christian Church

The Traders Point Christian Church is located at 1201 N. Delaware Street CNE 5. This site is represented in the model by receiver R205 and R 205-1. It was determined in a phone call from a representative from the church that Traders Point Christian Church has approximately 1,100 regular attendees on an average Sunday. Based on the occupation of this building approximately 6 hours per day and 2 days per week for 12 months of the year a usage factor of 0.07 was calculated for this facility. Multiplying the usage factor (0.07) by the total assumed visitors (1,100) gives an average daily number of users of 77. The following algorithm was used to calculate the appropriate number of receptors per receiver.

> (77 visitors per day/2.52 average people per household) X (100% of the property within the study area) =31 receptors.

These 31 receptors were divided and applied between R205 (15) and R205-1 (16) in the model.

Allen Chapel AME Church

The Allen Chapel AME Church is located at 637 11th Street within CNE 6 in the southeast corner of 11th Street and Broadway Avenue. This site is represented in the model by receiver R392. It was estimated based on usage number from other worship centers in the area and the size of the building that Allen Chapel AME Church has approximately 150 regular attendees on an average Sunday. Based on the occupation of this building approximately 6 hours per day and 2 days per week for 12 months of the year a usage factor of 0.07 was calculated for this facility. Multiplying the usage factor (0.07) by the total assumed visitors (150) gives an average daily number of users of 11. The following algorithm was used to calculate the appropriate number of receptors per receiver.

> (11 visitors per day/2.52 average people per household) X (100% of the property within the study area) =4 receptors.

These 4 receptors were applied to R392 in the model.

Upper Room Apostolic Church

The Upper Room Apostolic Church is located at 1601 Sheldon Street within CNE 6 in the northeast corner of Sheldon Street and 16th Street. This site is represented in the model by receiver R393. It was estimated based on usage number from other worship centers in the area and the size of the building that Upper Room Apostolic Church has approximately 100 regular attendees on an average Sunday. Based on the occupation of this building approximately 6 hours per day and 2 days per week for 12 months of the year a usage factor of 0.07 was calculated for this facility. Multiplying the usage factor (0.07) by the total assumed visitors (100) gives an average daily number of users of 11. The following algorithm was used to calculate the appropriate number of receptors per receiver.

> (7 visitors per day/2.52 average people per household) X (100% of the property within the study area) =3 receptors.

These 3 receptors were applied to R393 in the model.

4.4 Determination of Existing Noise Levels

Existing noise levels are defined in 23 CFR Part 772 as the noise resulting from the natural and mechanical sources and human activity considered to be present in an area during the period of the noise analysis. Existing noise level measurements were collected at eight representative sites within the study area on October 29 and 30, 2018, and November 2 and 5, 2018. **Table 2** lists these sites and identifies the time of data collection and the traffic mix and speed at each location. Measurement sites were selected in residential areas (Activity Category B). The locations were selected to cover various distances, common noise areas, and variations in topography.

These short-term measurements were conducted using a Larson-Davis Model Lxt1 sound level meter (serial number 5625). Measurements were taken over a 20-minute period. Calibration on the meter was checked before and after field work using a Larson-Davis Model Cal 200 (serial number 12852). During the measurements the temperature varied around 48-72 degrees Fahrenheit, and winds were light, having little effect of sound propagation over moderate distances. Temperature, humidity, and winds speeds were within the manufacture's recommended guidelines for operation of the sound level meter.

The noise field measurement sites (FM), FM-01 through FM-08, are presented in **Appendix B** of this report. The measured noise levels at sites FM-01 through FM-08 ranged from 61.6 to 70.4 dB(A) Leq. The field data sheets are presented in **Appendix B** of this report and the sound level analyzer laboratory calibration certificates are presented in **Appendix C** of this report.

Results were used to validate the noise model used in this analysis, the TNM, Version 2.5.

Table 2: Measured Existing Noise Levels

Field Site	Site Description	Date	Start Time	Duration	Traffic 1)						Speed (mph)	Noise Level, dBA l_{eq}(1h)
					Roadway	A^a	MT^b	HT^c	MC^d	$Buses^e$		
FM 01	Harrison House Lawn	10/30/18	13:24	20 min	I-65 NB	1,022	41	83	2	9	59	68.4
					I-65 SB	1,024	35	86	1	10	59	
FM 02	Sidewalk near Morris-Butler House	10/30/18	14:17	20 min	I-65 NB	1,377	26	107	0	15	57	68.7
					I-65 SB	2,194	51	95	0	2	57	
FM 03	O'Bannon Soccer Fields	11/2/18	10:29	20 min	I-70 EB	788	96	124	4	0	62	60.9
					I-70 WB	810	6	54	0	0	61	
FM 04	Arsenal Ave	11/2/18	15:02	20 min	I-70 EB	2,214	62	140	0	6	61	69.3
					I-70 WB	1,982	110	158	0	10	60	
FM 05	1102 St. Clair Street	11/2/18	11:38	20 min	I-65 NB	622	20	62	0	0	60	66.3
					I-65 SB	1,266	58	114	0	0	60	
FM 06	1010 East Market	11/2/18	16:35	20 min	I-65/I-70 NB	1,836	36	158	0	0	56	62.1
					I-65/I-70 SB	1,568	48	160	0	0	56	
FM 07	420 Fulton Ave	11/5/18	10:57	20 min	I-65 NB	1,081	45	106	0	85	58	66.2
					I-65 SB	723	22	112	0	1	58	
FM 08	East 11th Street Unit 323	10/30/18	14:58	20 min	I-65 NB	1,121	21	120	1	29	60	60.4
					I-65 SB	1,209	40	100	0	22	60	

1) Vehicle counts classified as follows:
   a. Autos (A) defined as vehicles with 2 axles and 4 tires.
   b. Medium trucks (MT) defined as vehicles with 2 axles and 6 tires.
   c. Heavy trucks (HT) defined as vehicles with 3 or more axles.
   d. Motorcycle (MC) defined as vehicles with 2 or 3 wheels.
   e. Buses defined as vehicles carrying more than 9 passengers.

4.5 Traffic Noise Model

The traffic noise analysis was performed using the INDOT traffic noise model (TNM). The TNM was first released in March 1998. Version 2.5 of the model was released in April 2004 and is the latest approved version.

The TNM estimates vehicle noise emissions based on mean (average) noise emission levels for three classes of vehicles used for this analysis: automobiles, medium trucks, and heavy trucks. The predicted noise levels for the existing and design year build alternative conditions were based on peak hour volumes and vehicular fleet mixes for the years 2017 and 2041.

Terrain and other roadway features were input in to TNM. These inputs include roadway widths (including inner and outer shoulders) and elevations, receptor elevations, intervening terrain, and ground cover (tree zones). In accordance with the procedure in *INDOT Traffic Noise Analysis Procedure*, all receptors located within 500 feet of the edge of pavement of all reasonable build alternatives were assessed for traffic noise impacts. Additional receptors located at distances up to 600 feet were included in the model as a conservative measure so that sensitive land uses bordering the 500-foot study area would be captured in the evaluation. Receivers representing historic properties and districts were included in the model to support the analysis of the project's effects on historic properties.

Based on this input data, the TNM uses its acoustic algorithms to predict noise levels at receptor locations by considering sound propagation divergence, intervening ground, barriers, building rows, and vegetation.

4.6 Model Validation

Existing noise level measurements were taken at eight representative locations. The measurements were made in accordance with FHWA and INDOT guidelines using an integrating sound level analyzer meeting American National Standard Institute and International Electro Technical Commission Type 1 specifications. Traffic counts and vehicle classification were collected concurrently with the noise measurement. Vehicle classifications include passenger vehicles, medium trucks, heavy trucks, buses, and motorcycles.

Table 3 summarizes the results of the measured and modeled noise levels at the field measurement sites. Since the TNM modeled field data were within ± 3 dB of the measured noise levels, the model is assumed to be valid for this study. The field measurements and the modeled noise levels, using traffic counts taken during the field noise measurements, are used to validate the noise model. These values do not represent the existing worst (noisiest) hour traffic noise levels used throughout the remainder of the noise analysis. These traffic values were only used for model validation.

Table 3: Measured and Modeled Noise

Field Measurement Site ID	Noise Level, dB(A) Leq(1h)		Difference
	Measured Level	Modeled Level	
FM 01	68.4	66.0	2.4
FM 02	68.7	70.4	-1.7
FM 03	60.9	63.1	-2.2
FM 04	69.3	67.6	1.7
FM 05	66.3	63.4	2.9
FM 06	62.1	63.4	-1.3
FM 07	66.2	63.8	2.4
FM 08	60.4	61.6	-1.2

5 NOISE MODELING

Based on a combination of land use, traffic volumes, location of cross streets and residential density, the study area was divided into nine common noise environments (CNEs). Traffic data from the traffic simulation model were used as input into TNM to model 2017 (referred to as existing) and 2041 (design year) noise levels throughout the North Split Project study area. Topographic shielding due to due to the anticipated location of a berm northwest and southwest of the interchange were included in the 2041 design year model.

The predicted noise levels for the existing and design year build alternative conditions were based on the worst (noisiest) traffic hour in the years 2017 and 2041. The Design Hourly Volume (DHV) for all existing and proposed roadways was projected above a Level of Service (LOS) D, therefore an equivalent traffic volume that would produce a LOS C was used. Receptors are defined as discrete or representative locations in a noise sensitive area(s). Receivers are defined as points where the noise model calculates the noise level. A receiver in the noise model may represent multiple receptors.

The latest version of the TNM was used to model existing (2017) and design year (2041) worst hourly traffic noise levels within the North Split study area. A total of 396 TNM noise receivers representing 1083 receptors, numbered R1 through R455, were modeled for the existing and proposed condition. These receivers were selected to model representative noise impacts at 957 Activity Category B receptors, 34 Category C receptors, 34 Category C/D receptors, 47 Category D receptors, and 11 Category E receptors. The location of each receiver is shown in **Appendix A** of this report. The receivers were modeled five feet above ground for ground level receivers and an additional ten feet was added to each receiver above the second story based on floor (e.g. 25 feet for third story receivers). The modeled noise levels are presented in **Appendix D** of this report.

Activity Category C land uses that do not have an exterior area of frequent human use are categorized as Activity Category D land uses, which are evaluated for interior impacts. Activity Category C land uses that also have an interior use were categorized as category C/D.

6 NOISE IMPACTS AND ABATEMENT

6.1 Noise Impact Assessment

Existing (2017) worst (noisiest) traffic hour noise levels range from 37.6 to 73.5 dB(A) Leq(h). Worst traffic hour noise levels in the design year (2041) range from 37.6 to 73.8 dB(A) Leq(h). Existing and design year traffic worst hour noise levels are found in **Appendix D** of this report. The locations of the receivers are shown on the traffic analysis noise maps in **Appendix A** of this report.

Predicted future design year (2041) noise levels adjacent to the proposed project would approach or exceed the Noise Abatement Criteria (NAC) at 92 receiver locations representing 259 receptors. The noise levels at these 259 receptors would range from 66.3 to 73.8 dB(A) L_{eq}(h).

Predicted future noise level changes range from a 7 dB(A) decrease to a 3.7 dB(A) increase. Substantial noise level increases, 15.0 dB(A) as defined in **Section 3.2**, are not projected to occur. To evaluate interior noise levels the exterior level was modeled and a reduction factor is applied[8]. A summary of Category D land uses is provided in Table 4 below.

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[8] *U.S. Department of Transportation. (1995). Highway Traffic Noise Analysis and Abatement Policy and Guidance. Washington DC: Federal Highway Administration Office of Environmental Planning Noise and Air Quality Branch*

Table 4: Category D Noise Levels

Receiver ID	Category D Description	Exterior Noise Level (dBA)	Noise Reduction due to Structural Criteria (dBA)	Interior Noise (dBA)	Interior Criteria (dBA)	Impact
R49	Church	67.5	25	42.5	51	N
R50	Church	67.1	25	42.1	51	N
R86	Church	74.1	25	49.1	51	N
R106	Church	66.6	25	41.6	51	N
R111	Church	67.8	25	42.8	51	N
R112	Church	65.3	20	45.3	51	N
R161	Non-profit Institutional	66.7	25	41.7	51	N
R162-1	Non-profit Institutional	65.9	25	40.9	51	N
R205-1	Church	67.4	25	42.4	51	N
R206	Non-profit Institutional	63.6	25	38.6	51	N
R392	Church	62.0	25	37.0	51	N
R393	Church	57.3	20	37.3	51	N
R447	Non-profit Institutional	59.3	25	34.3	51	N

6.2 Noise Abatement Measures

Based on the requirements of 23 CFR 772 and within the framework of the *INDOT Traffic Noise Analysis Procedure*, various methods were reviewed to mitigate the noise impact of the preferred alternative. Among those mitigation options considered were those listed below.

- Restricting truck traffic to specific times of the day.
- Prohibiting truck traffic.
- Altering horizontal and vertical alignments.
- Acquiring property for construction of noise barriers or berms.
- Acquiring property to create buffer zones to prevent development that could be adversely impacted.
- Soundproofing public use or nonprofit institutional buildings in land use Activity Category D only.
- Constructing berms (linear earthen mounds).
- Installing noise barriers (a wall located between the highway and receptors).

Restricting or prohibiting trucks is beyond the scope of this project and would require changes in legislation. Design criteria and recommended termini for the proposed project do not allow for sufficient changes in alignment to provide a noticeable change in the traffic noise levels at the abutting properties. A 15-foot tall earthen noise berm would have a footprint ranging in width from 35 to 95 feet. Therefore, it is neither feasible nor reasonable to construct noise berms within the study area without acquiring substantial amounts of right-of-way. The construction of noise barriers appears to be the most feasible and reasonable method to mitigate noise impact for this project. Abatement is recommended for consideration where it is feasible and reasonable to construct a noise barrier. Soundproofing will be reviewed during final design for Activity Category D land uses that remain above the NAC after the potential feasible and reasonable noise mitigation measures have been finalized.

A noise analysis identifies “where noise abatement is feasible and reasonable, and locations with impacts that have no feasible or reasonable noise abatement alternatives.” The most efficient location for a noise barrier is as close to the source or the receiver as possible. Therefore, in the areas of the projected noise impacts noise barriers were modeled five feet inside the right-of-way, at edge of shoulder on top of retaining walls or just outside the clear zone in areas where the mainline or ramps were at a higher elevation than the adjacent receivers.

Noise barriers were modeled at eight locations with TNM for the preferred alternative. These analyzed barriers are described below:

NB1 –– Northbound (NB) I-65/Eastbound (EB) I-70 along the edge of shoulder in the southeast quadrant of the interchange. This noise barrier examines abatement of future noise levels at receivers R35 through R113 in CNE 2 (see **Appendix A**, pages 3 and 4).

NB2 –– EB I-70 along the edge of the shoulder roughly between Columbia Avenue and North Arsenal Avenue. This noise barrier examines abatement of future noise levels at residential receivers R50 through R55 within CNE 3 (see **Appendix A**, pages 3 and 4).

NB3E –– Westbound (WB) I-70 along the edge of shoulder between Commerce Avenue and Valley Avenue. This noise barrier examines abatement of future noise levels at residential receivers R70 through R112 within CNE 4 (see **Appendix A**, pages 4 and 5).

NB3W — Westbound (WB) I-70 along the north edge of shoulder from approximately 240 feet west of Lewis Street to Commerce Avenue. This noise barrier examines abatement of future noise levels at residential receivers R100 through R119-3 within CNE 4 (see Appendix A, Traffic Noise Analysis Maps, pages 2-4).

NB4 –– NB I-65 north of the interchange along the edge of shoulder between College Avenue and Alabama Street. This noise barrier examines abatement of future noise levels at residential receivers R143 through R178 within CNE 5 (see **Appendix A**, page 2).

NB5 –– Southbound (SB) I-65 south of the interchange along the edge of shoulder between College Avenue and Alabama Street. This noise barrier examines abatement of future noise levels at residential receivers R324 through R398 within CNE 6 (see **Appendix A**, page 2).

NB6 –– SB I-65 south of the interchange along the edge of shoulder between Alabama Street to Meridian Street. This noise barrier examines abatement of future noise levels at residential receivers R220 through R342 within CNE 6 (see **Appendix A**, page 2).

NB7 –– SB I-65/WB I-70 along edge of shoulder on the west side of the southern leg of the interchange between 10th Street and Ohio Street. This noise barrier examines abatement of future noise levels within CNEs 8 and 9 (see **Appendix A**, pages 6-8).

Factors to be considered in determining noise abatement feasibility, as defined in the *INDOT Traffic Noise Analysis Procedure*, are listed below.

- Acoustic Feasibility: INDOT requires that noise barriers achieve a 5 dB(A) reduction at a majority (greater than 50%) of the impacted receptors.
- Engineering Feasibility: INDOT requires noise abatement measures to be based on sound engineering practices and standards and requires that any measures be evaluated at the optimum location.

Factors to be considered in determining reasonableness, as defined in the *INDOT Traffic Noise Analysis Procedure,* are listed below.

- Cost Effectiveness: To determine cost effectiveness, the estimated cost of constructing a noise barrier will be divided by the number of benefited receptors (those who would receive a reduction of at least 5 dB(A)). A base material and design cost of $25,000 to $30,000 or less per benefited receiver is currently considered to be cost-effective. Development in which a majority (more than 50%) of the receptors was in place prior to the initial construction of the roadway in its current state (functional classification) will receive additional consideration for noise abatement. The cost-effectiveness criteria used for these cases will be 20% greater (currently $30,000 per benefited receptor).
- Noise Reduction Design Goal: INDOT's goal for substantial noise reduction is to provide at least a 7.0 dB(A) reduction for impacted first row receptors in the design year.
- Views of Residents and Property Owners: A survey was mailed to each benefited resident to consider the views of residents and property owners. The concerns and opinions of the property owner and the unit occupants were balanced with other considerations in determining whether a barrier is appropriate for a given location.

Noise barriers were modeled at eight locations within the study area. The results of the noise barrier analysis are summarized in **Table 5**. The table presents the proposed barrier location or identification number, the CNE area, barrier length, average height, number benefited receptors adjacent to the proposed noise barrier, and a yes or no statement as to whether or not a noise barrier meets INDOT's feasibility criteria, design goal, and cost reasonable criteria as previously defined. The table also presents the estimated cost of the noise barrier based on the TNM calculated area of the noise barrier times a cost of $30.00/square foot. The cost per benefited receptor is the cost of the noise barrier divided by the number of benefited receptors. Of the eight barriers analyzed five met INDOT's reasonable and feasible criteria. Additional barrier configurations evaluated during the barrier design are shown in **Appendix F**.

Maps showing noise receptors and potential feasible and reasonable noise barrier locations are shown in **Appendix A**. There are five feasible and cost-effective noise barrier locations for the preferred alternative, NB3E, NB3W, NB4, NB5, and NB7. A structural evaluation of the bridge structure starting at Alabama Street and extending beyond the western limits of the project concluded that it could not safely support the additional load required from installation of a noise barrier. Therefore, NB4 and NB5 were terminated at the Alabama Street overpass, and NB6 was determined to be structurally infeasible.

If pertinent parameters change substantially during the continuing project design, the noise abatement decision may be changed or eliminated from the final project design.

Table 5: Noise Barrier Summary

Proposed Barrier Location	CNE Area	Length (feet)	Average Height (feet)	Benefit Recep-tors	Feasibility Criteria Met	Design Goal Met?	Cost of Barrier (@$30/sq ft)	Cost per Benefited Receptor	Cost-Effective Threshold	Cost-Reasonable Criteria Met
NB1	2	1,925	20	4	Yes	Yes	$1,154,610	$288,653	$25,000	No
NB2	3	600	11	5	Yes	No	$204,060	$40,812	$30,000	No
NB3E	4	1,615	14	35	Yes	Yes	$690,930	$19,741	$30,000	Yes
NB3W	4	2,463	16	171	Yes	Yes	$1,201,080	$7,024	$25,000	Yes
NB4	5	2,325	19	58	Yes	Yes	$1,273,470	$21,956	$30,000	Yes
NB5	6	2,001	15	104	Yes	Yes	$1,006,860	$9,681	$25,000	Yes

NB6	6	1,804	13	10	No*	No	$731,100	$73,110	$30,000	No
NB7	7,8,9	4,734	19	166	Yes	Yes	$2,711,670	$16,335	$25,000	Yes

*NB6 was determined to not meet the engineering feasibility criteria as a noise wall could not be safely constructed on the structure.

7 RESULTS FOR HISTORIC PROPERTIES

A total of 23 receivers were modeled in the TNM to support the evaluation of the project's effects on aboveground National Register-listed or National Register-eligible properties within the study area. Of these 23 receivers, 11 were within 500 feet of the edge of pavement and, due to their land use, were assigned receptors in accordance with the FHWA guideline. The remaining 12 were either further than 500 feet from the edge of pavement or were not assigned receivers due to their current land use. Three of these properties would experience a reduction in noise levels as a result of barriers likely to be constructed. Results of this analysis are included in **Table 6.**

Table 6: Historic Resource Noise Results

Receiver ID	Historic Resource	Existing dB(A) (2017)	Build dB(A) (2041)	Change	Noise Level w/ Barrier
R2	Holy Cross\Westminster Historic District	65.9	65.0	-0.9	N/A
R24	Cottage Home Historic District	60.2	60.5	0.3	N/A
R106 A	John Hope School No. 26	67.1	66.8	-0.3	N/A
R161 (HP3)	Old Northside Historic District	70.4	66.7	-3.7	60.4
R161 (HP3)	Morris-Butler House	70.4	66.7	-3.7	60.4
R206 (HP4)	Benjamin Harrison Home/ Presidential Site	65.1	63.6	-1.5	N/A
R221 (HP5)	Manchester Apartments	63.1	62.2	-0.9	N/A
R221 (HP5)	Sheffield Inn	63.1	62.2	-0.9	N/A
R222 (HP6)	Calvin I. Fletcher House	69.3	67.7	-1.6	N/A
R223 (HP8)	Wyndham	70.8	68.6	-2.2	N/A
R224 (HP7)	Pierson-Griffiths House	66.3	64.8	-1.5	N/A
R227	Saint Joseph Neighborhood Historic District	71.7	69.3	-2.4	N/A
R305 (HP 12)	Delaware Court Apartments	61.4	60.5	-0.9	N/A
R314 (HP13)	Bals-Wocher House	58.3	57.9	-0.4	56.4
R315 (HP14)	Pearson Terrace	58.2	58.0	-0.2	56.3
R344 (HP9)	William Buschman Block	59.9	59.5	-0.4	55.3
R394	Chatham Arch Historic District	66.3	64.1	-2.2	61.7
R401	Massachusetts Avenue Commercial Historic District	69.4	69.4	0.0	62.6

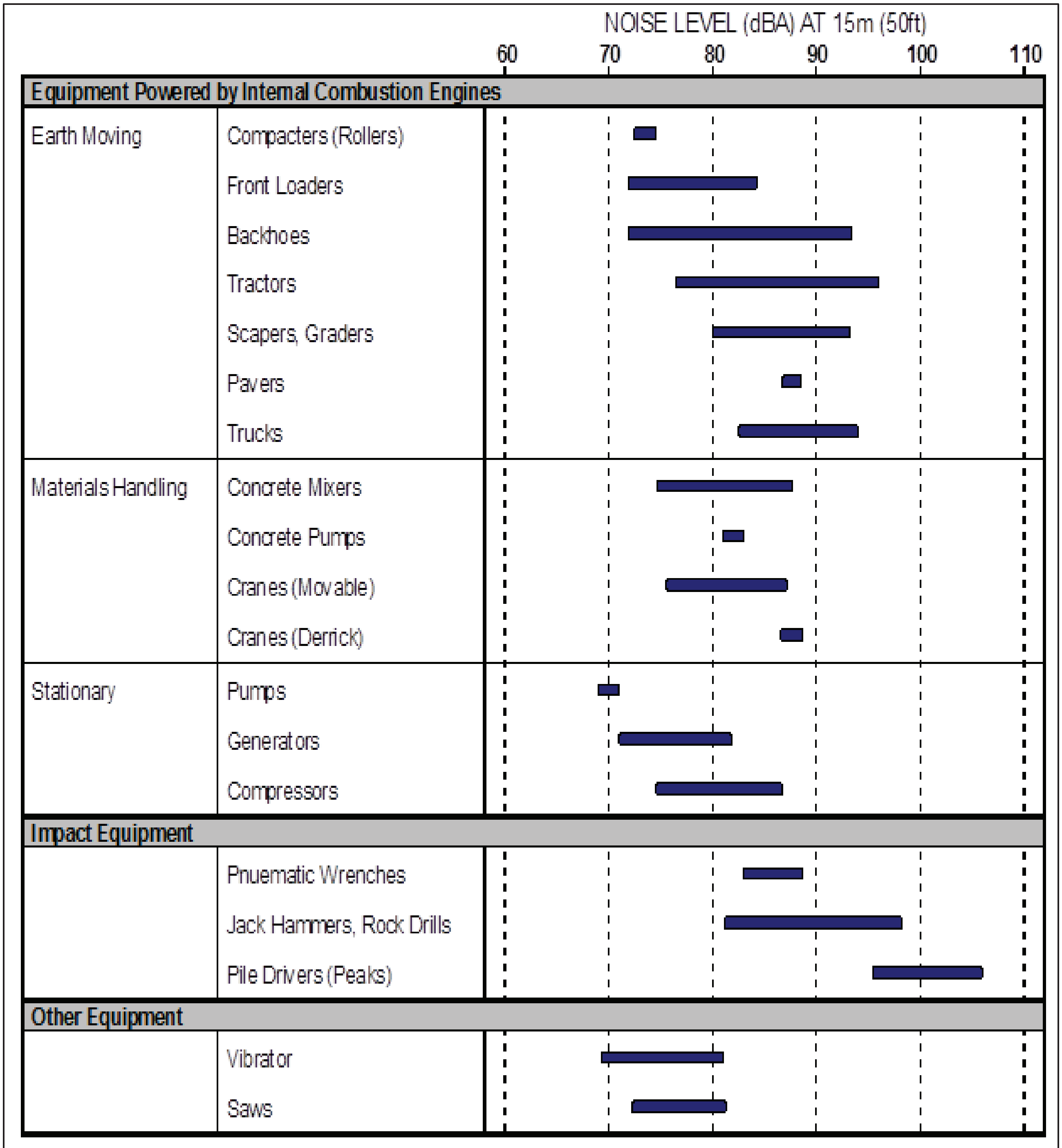
R425	Lockerbie Square Historic District	67.3	67.2	-0.1	59.1
HP1	Gasteria, Inc.	59.9	59.5	-0.4	N/A
HP10	Windsor Park Neighborhood Historic District	66.6	67.6	1.0	N/A
HP11	Saints Peter and Paul Cathedral Parish Historic District	57.4	56.8	-0.6	N/A
HP15	Cole Motor Car Company	65.5	64.8	-0.7	N/A

8 CONSTRUCTION NOISE

Construction of the proposed improvements will result in a temporary increase in the ambient noise level along I-65 and I-70. The major construction elements of this project are expected to be demolition, hauling, grading, paving, and bridge construction. General construction noise impacts for passerby and those individuals living or working near the project can be expected from demolition, earth moving, pile driving, and paving operations. Equipment associated with construction generally includes backhoes, graders, pavers, concrete trucks, compressors, and other miscellaneous heavy equipment.

Figure 2 shows some typical peak operating noise levels for equipment at 50 feet, grouping construction equipment according to mobility and operating characteristics. Considering the temporary nature of specific construction stages, and thus construction noise, impacts are not expected to be substantial. The typical outdoor to indoor noise reduction qualities of the homes, places of worship, schools, and businesses are believed to be sufficient to moderate the effects of intrusive construction noise. INDOT will be sensitive to local needs and may make adjustments to work practices in order to reduce inconvenience to the public.

Table 7: Construction Noise Levels



SOURCE: U.S. Report to the President and Congress on Noise, February, 1972.

9 PUBLIC INVOLVEMENT

As described in the *INDOT Traffic Noise Analysis Procedure*, INDOT is required to seek the input of owners and residents of all benefited property. The concerns and opinions of the property owners and the unit occupants will be balanced with other considerations in determining whether a barrier is appropriate for a given location.

The noise analysis identified five potential noise barrier locations as being feasible and potentially reasonable. Based on the results of the analysis and considering the viewpoints of benefited receptors and other considerations, INDOT is planning a series of noise reduction design features for the full project and has recommended noise barriers at selected locations, as described below.

9.1 Noise Reduction Design Features

The TNM used in the North Split noise analysis predicts a reduction in noise at most locations even if no noise barriers are installed. This modeled reduction in noise levels is primarily the result of the elevation and realignment of proposed roadways and replacement of guardrail with concrete safety barriers. Although predicted noise levels will generally be lower, they will still exceed current thresholds for consideration of noise barriers in some areas. To reduce noise levels further, INDOT is incorporating additional design features that are not recognized in the Traffic Noise Model. These features include the following:

a. “Next Generation” Pavement. This new paving technique is designed specifically to reduce tire noise through the use of longitudinal grooves. Although results vary based on tire manufacturer, existing pavement type and condition, and other factors, recent studies have shown that next generation pavement can reduce tire noise levels by 3 to 5 decibels or more.

b. Continuous Reinforced Concrete Pavement. This paving technique eliminates the need for transverse joints, which are the cause of rhythmic sound patterns of tires passing over traditional concrete roadways.

c. Jointless Concrete Bridges. This design eliminates the open joints at the end of bridges, which are the cause of the “banging” sounds typically heard at older bridges such as those currently existing in the project area.

9.2 Noise Barriers Recommended for Implementation

The following potential noise barriers are recommended for implementation:

- NB3E: Westbound I-70, along the edge of the north shoulder from Valley Avenue to Commerce Avenue, near the Martindale-Brightwood neighborhood.
- NB3W: Westbound I-70, along the edge of the north shoulder from Commerce Avenue to Lewis Street, near the Martindale-Brightwood neighborhood.

Factors considered in recommending these noise barriers are as follows:

a. Survey of Benefited Receptors. In accordance with the INDOT Noise Policy, surveys were sent to obtain the views of benefited receptors (property owners and residents) and a public meeting was held in the adjacent neighborhood to describe the results of the noise analysis and encourage survey response. Forty-five percent (45%) of NB3E benefited receptors responded, with 93% expressing support. Seventy-eight percent (78%) of NB3W benefited receptors responded, with 100% expressing support.

b. Other Considerations. According to the INDOT Noise Policy, a re-evaluation of the noise analysis will occur during final design. If it is determined that conditions have changed such that noise abatement is not feasible and reasonable, the abatement measures might not be provided.

9.3 Noise Barriers Not Recommended for Implementation

The following potential noise barriers are not recommended for implementation:

- NB4: Northbound I-65, along the edge of the north shoulder between College Avenue and Alabama Street, near the Old Northside neighborhood.
- NB5: Southbound I-65, along the edge of the south shoulder between College Avenue and Alabama Street, near the Chatham Arch and Saint Joseph neighborhoods.
- NB7:[9] Southbound I-65/westbound I-70, along the edge of the west shoulder between 10th Street and Ohio Street near Massachusetts Avenue and the Lockerbie Square neighborhood.

Factors considered in recommending these noise barriers not be constructed are as follows:

a. Survey of Benefited Receptors. In accordance with the INDOT Noise Policy, surveys were sent to obtain the views of benefited receptors (property owners and residents) and public meetings were held in the adjacent neighborhood of each potential noise barrier to describe the results of the noise analysis and encourage survey response. Social media posts and listserv emails were sent, and door hangers were hung on doors of benefited receptors to encourage completion of the surveys and attendance at the public meetings. Surveys were sent a second time for these three barriers because the percent response rates were under 50%. The responses for each barrier are shown below:

    i. NB4: Surveys were sent in mid-October 2019. The response rate was below 50%, so a second survey was sent to non-responders early in November 2019. After the second survey, a majority (55%) of benefited receptors had responded, with 59% expressing opposition to this barrier.

    ii. NB5: Surveys were sent in mid-October 2019. The response rate was below 50%, so a second survey was sent to non-responders early in November 2019. After the second survey, along with four public meetings, social media posts, emails, and door hangers, fewer than half (38%) of benefited receptors had responded, with 74% expressing support for this barrier.

    iii. NB7: Surveys were sent in mid-October 2019. The response rate was below 50%, so a second survey was sent to non-responders early in November 2019. After the second survey, along with four public meetings, social media posts, emails, and door hangers, fewer than one-quarter (23%) of benefited receptors had responded, with 62% expressing support for this barrier.

b. Other Considerations. In accordance with the INDOT Noise Policy, which states “the concerns of opinions of the property owner and the unit occupants will be balanced with other considerations in determining whether a barrier is appropriate for a given location,” INDOT considered other reasonableness factors related to changes between existing and future build conditions in evaluating these barriers. These considerations are described below:

    i. Effects to Historic Properties: Six historic districts listed on the National Register of Historic Places (NRHP) are located immediately adjacent or near the North Split Project area. INDOT, acting on behalf of FHWA, is required to comply with Section 106 of the National Historic Preservation Act of 1966 as amended (Section 106), and its implementing federal regulation, 36 CFR 800. Section 106 and 36 CFR 800 outline a process that requires FHWA and INDOT to evaluate the effects of undertakings on properties that are listed on or eligible for listing on the NRHP.

    As a part of the Section 106 process, INDOT has conducted a series of meetings and reviews with consulting parties, including the State Historic Preservation Officer (SHPO), representatives from many of the adjacent historic neighborhoods, and other local historic organizations/agencies. A primary outcome of the Section 106 process is a Memorandum of Agreement (MOA) identifying commitments to mitigate adverse effects on historic properties and districts. The MOA must be signed

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[9] *NB7 in the Traffic Noise Technical Report was shown as NB7A and NB7B in October 2019 public meetings since an opening would be provided at the Ohio Street exit. NB7A is north of the exit; NB7B is south of the exit.*

by INDOT, FHWA, the SHPO, and the Advisory Council on Historic Preservation. Consulting parties may sign the MOA as concurring parties if they wish.

Following the consulting party meeting to review potential noise barriers, the SHPO provided a letter to INDOT and FHWA, dated November 1, 2019, making the following comments related to the effect of proposed noise barriers:

> "While we appreciate the benefit of noise reduction to the adjacent sound receptors, we remain deeply concerned about the visual effect of noise walls on the setting of historic resources, particularly within the St. Joseph Neighborhood, Chatham-Arch, and Old Northside historic districts. We also note the potential for additional adverse effects if noise barriers are constructed adjacent to the Massachusetts Avenue Commercial Historic District and Lockerbie Square Historic District.
>
> We believe that the inclusion of noise barriers up to 19 feet above the freeway would introduce an additional and severe adverse effect to the character and setting of these resources, and greatly amplify the visual impact of the existing interstate highway intrusion within the historic districts. Construction of tall noise barriers would serve to further isolate historic districts and adjacent structures, and strengthen the perceived and actual separation between neighborhoods on either side of the highway."

Another letter from a consulting party, provided by the Administrator for the Indianapolis Historic Preservation Commission on November 8, 2019, included the following comments:

> "Specifically, the construction of the following proposed noise barriers, which will be up to 19 feet above the freeway, creates a severe visual adverse effect by diminishing the above-mentioned historic areas feeling, setting and character and the properties/historic resources within them: NB4, NB5, NB7A, NB7B.
>
> While I appreciate the mitigation efforts suggested by the consulting parties, exclusion of the barriers entirely is also a possibility."

Several of the historic neighborhoods are also represented directly as consulting parties in the Section 106 process. The following additional Section 106 consulting parties submitted written comments in opposition to NB4, NB5, and NB7:

- Saint Joseph Historic Neighborhood Association
- Chatham Arch Neighborhood Association
- Holy Cross Neighborhood Association
- Old Northside Neighborhood Association
- Historic Urban Neighborhoods of Indianapolis

Not constructing NB4, NB5, and NB7 is considered an avoidance and minimization measure as part of the Section 106 consultation process

ii) Mixed-Use Developments: The INDOT Noise Policy recognizes the potential for conflicts in mixed-use developments, as barriers to protect residences may block line of sight to adjacent businesses. NB5 and NB7 are between the interstate highways and the Indianapolis central business district, which includes a concentration of mixed-use development.

Different views by residential and business receptors is most notable with NB7. Although the overall survey response rate along NB7 was only 23%, the survey response rate from businesses was near 50%. Of those businesses that responded, 90% were opposed to the installation of noise barriers. The responding businesses were scattered along the barrier location and not concentrated in one specific area.

Table 8: Noise Barrier Survey and Response Statistics

Noise Barrier	Benefited Receptors	Number of Surveys Mailed	Number of Surveys Returned	Percent of Benefited Receptors responding to survey	Number of Surveys in Favor of Barrier	Percent of Benefited Receivers in Favor of Barrier
NB3E	35	47	14	45%	14	93%
NB3W	161	26	1	78%	1	100%
NB4	58	62	32	55%	13	41%
NB5	104	116	39	38%	29	74%
NB7	166	173	39	23%	24	62%

10 STATEMENT OF LIKELIHOOD

Based on the studies completed to date, INDOT has identified 259 impacted receptors and has determined that noise abatement is likely, but not guaranteed, at two locations. Noise abatement at these locations is based upon preliminary design costs, and design criteria, and public input. Noise abatement in these locations at this time has been estimated to cost $690,930 and $1,201,080 and will reduce the noise level by a minimum of 7 dB(A) at a majority of the identified impacted receptors. A re-evaluation of the noise analysis will occur during final design. If during final design it has been determined that conditions have changed such that noise abatement is not feasible and reasonable, the abatement measures might not be provided.

The viewpoints of the benefited residents and property owners were sought and were considered in determining the reasonableness of highway traffic noise abatement measures for proposed highway construction projects. INDOT will incorporate highway traffic noise consideration in on-going activities for public involvement in the highway program. the final decision on the installation of any abatement measure(s) will be made upon the completion of the project’s final design. and the public involvement processes. The viewpoints of the benefited residents and property owners will be sought and considered in determining the reasonableness of highway traffic noise abatement measures for proposed highway construction projects. INDOT will incorporate highway traffic noise consideration in ongoing activities for public involvement in the highway program.

11 CONCLUSION

INDOT has identified those noise receptors that would be exposed to 2041 design year noise levels approaching or exceeding the FHWA noise abatement criteria of 67 dB(A) Leq(h). A total of 259 receptors within the North Split project study area have been found to meet this criterion.

Eight noise barrier locations (most with multiple acoustical designs) were modeled in the study area. The noise barrier designs ranged from 600 to 4,734 feet in length, 11 to 20 feet in average height, and ranged in cost from $204,060 to $2,711,670. The cost per benefited receptor for the analyzed barriers ranged from $7,024 to $288,653. Noise abatement at these locations is based upon preliminary estimated costs and design criteria. INDOT has determined that noise abatement is likely, but not guaranteed at two locations. Additional details regarding these barriers is provided in **Appendix E**. Changes to these barriers may be necessary due to conditions encountered during final design.

REFERENCES

American Concrete Pavement Association and International Grooving and Grinding Association, Development and Implementation of the Next Generation Concrete Surface, August 8, 2017, pp 36-37.

Anderson, G. S., C.S.Y. Lee, G.G. Fleming and C. Menge, “FHWA Traffic Noise Model®, Version 1.0 User’s Guide”, Federal Highway Administration, January 1998, p. 60.

Lau, Michael C., Cynthia S. Y. Lee, Gregg G. Judith L. Rochat, Eric R. Boeker, and Gregg C. Fleming. FHWA Traffic Noise Model® Users Guide (Version 2.5 Addendum). Federal Highway Administration, April 2004.

Taylor, Ron, City of Indianapolis Greenways Development Committee Files, email regarding “Re: Indy Greenway Trail Counts”, July 12, 2019.

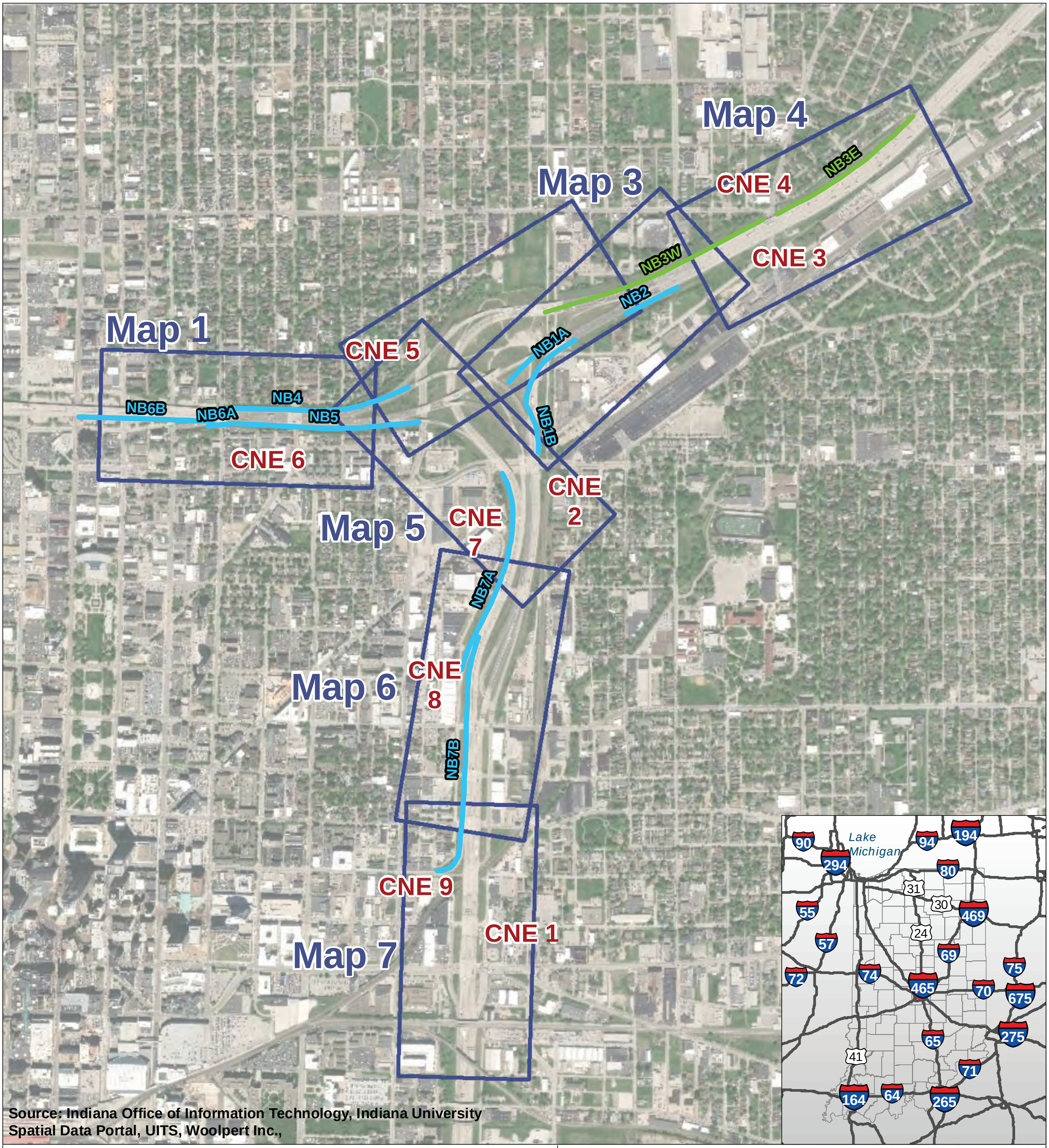
“Traffic Noise Analysis Procedure”, Indiana Department of Transportation, 2017.

23 C.F.R. § 772 (2010). “Procedures for Abatement of Highway Traffic Noise and Construction Noise.” Accessed June, 3, 2019.

U.S. Department of Transportation. (1995). Highway Traffic Noise Analysis and Abatement Policy and Guidance. Washington DC: Federal Highway Administration Office of Environmental Planning Noise and Air Quality Branch

http://www.in.gov/indot/files/2017%20INDOT%20Noise%20Policy.pdf

APPENDIX A: TRAFFIC NOISE ANALYSIS MAPS



Source: Indiana Office of Information Technology, Indiana University Spatial Data Portal, UITS, Woolpert Inc.,

Legend

- Map Extent
- Common Noise Environment (CNE)
- Noise Barrier Analyzed
- Feasible and Reasonable Noise Barrier

N

0 1,000 2,000
feet

Traffic Noise Analysis Overview Map

Des No. 1592385 and 1600808

Marion County, IN
Revised: 5/21/2020

Document Path: G:\69322 N Split Screening\NoiseUpdates_08_2019\MXD\Northsplit_TrafficNoise_Receivers_20190810_Overview.mxd

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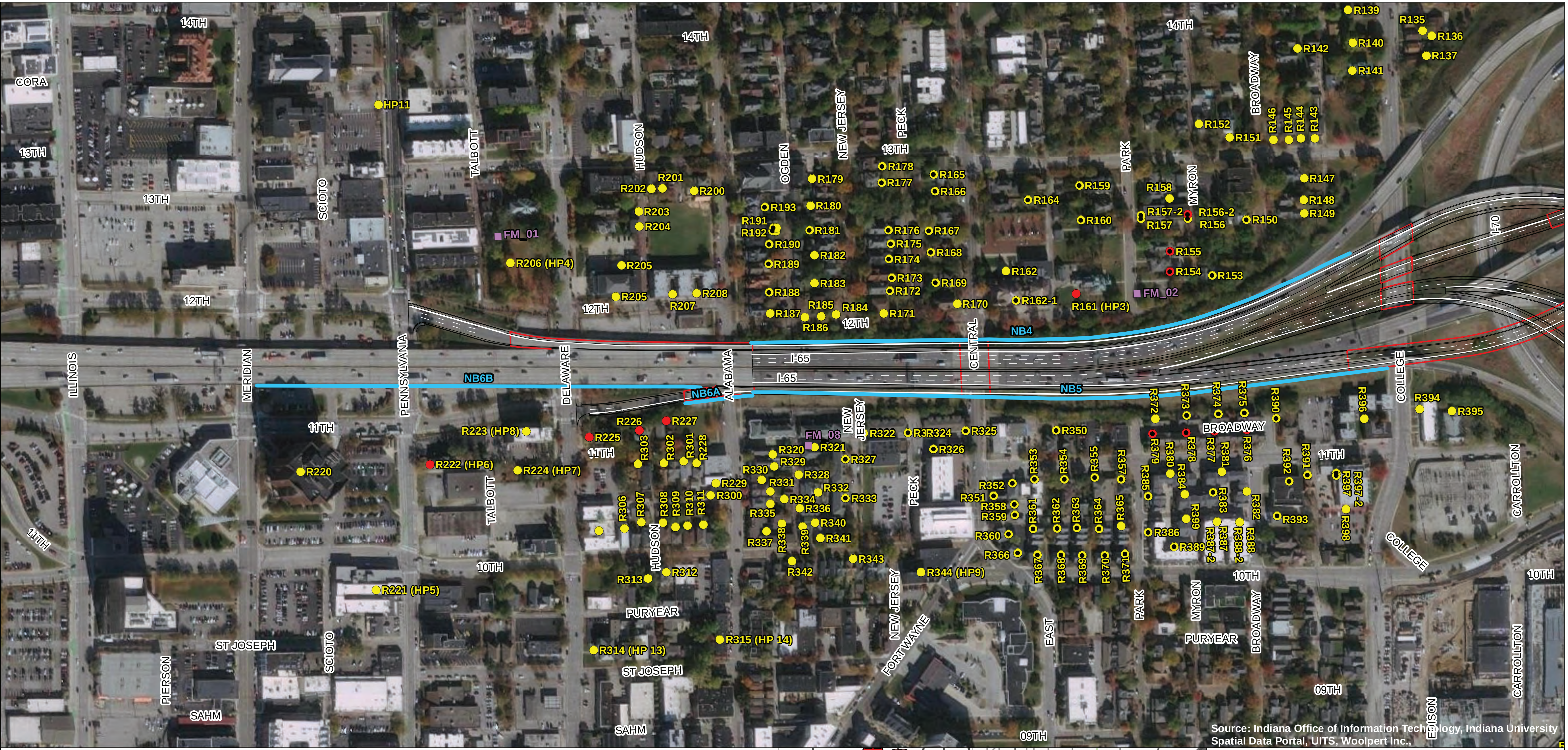


Source: Indiana Office of Information Technology, Indiana University Spatial Data Portal, UITS, Woolpert Inc.,

Legend

🟡 Not Impacted / Not Benefited

🔴 Impacted / Not Benefited

◉ Not Impacted / Benefited

◉ Impacted / Benefited

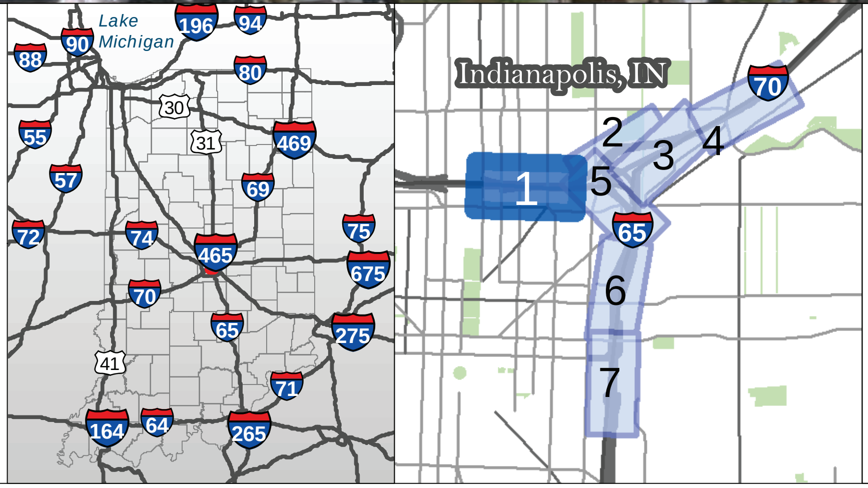
🟪 Field Measurement Sites

〰 Noise Barriers Analyzed

〰 Feasible and Reasonable Noise Barrier

N

0 250 500 feet

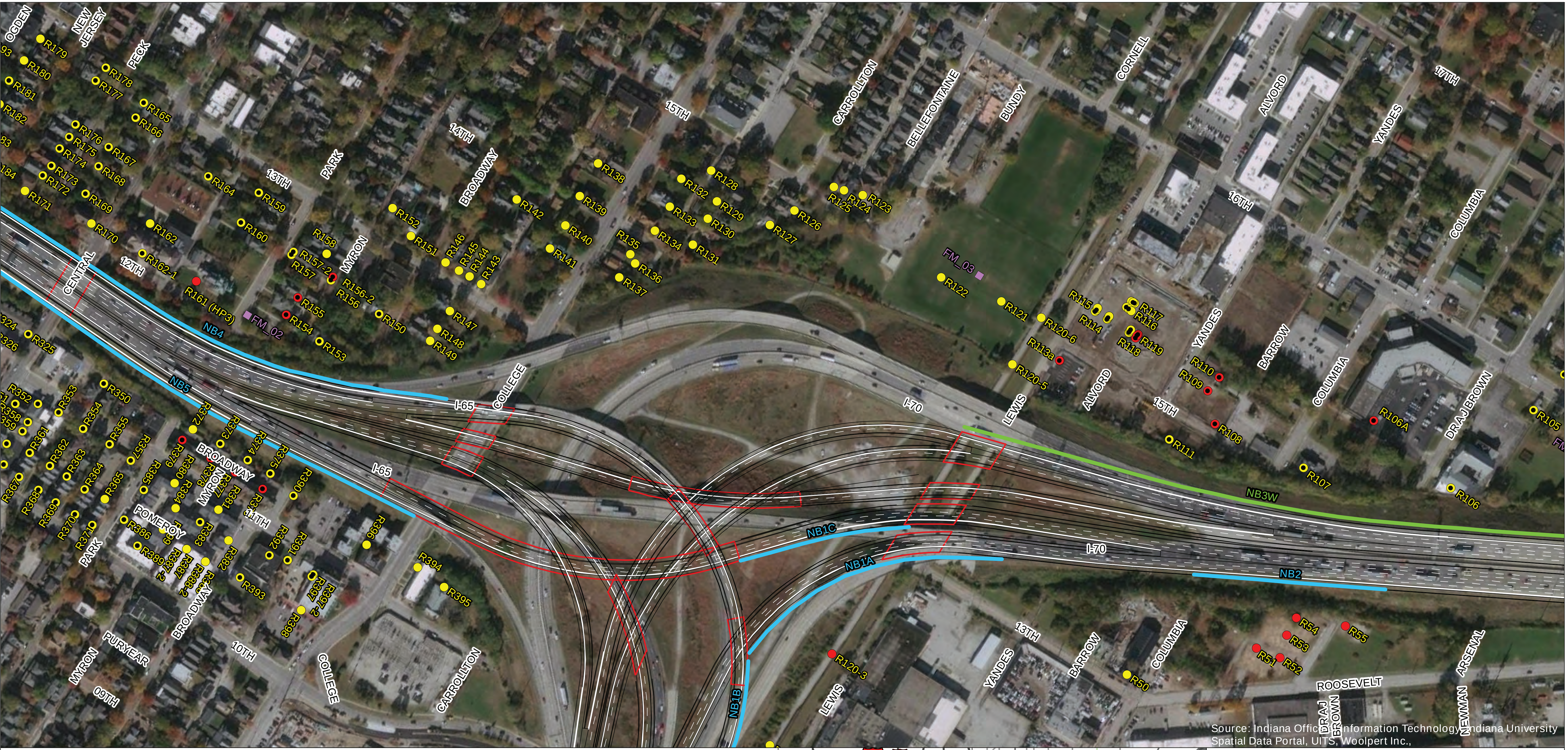


Traffic Noise Analysis Maps

Des No. 1592385 and 1600808

Page 1 of 7

Marion County, IN
Revised: 4/29/2020



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Legend

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🔴 Impacted / Not Benefited

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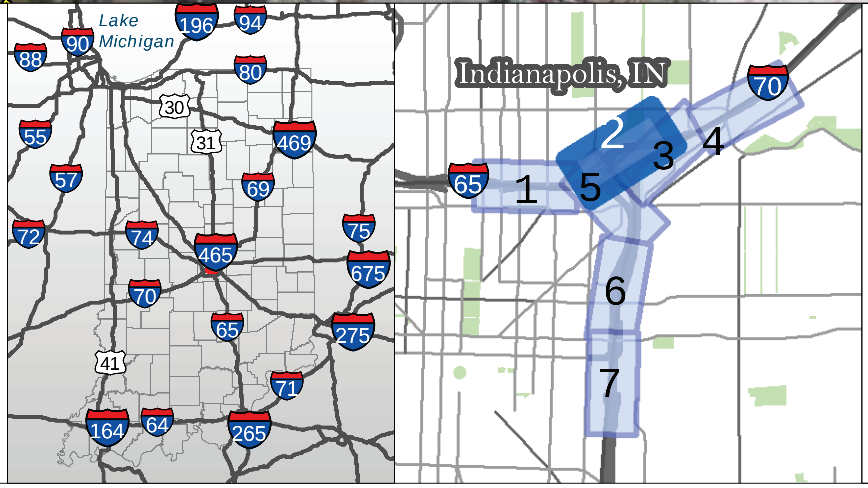
◉ Impacted / Benefited

🟪 Field Measurement Sites

〰 Noise Barriers Analyzed

〰 Feasible and Reasonable Noise Barrier

0 250 500 feet



Traffic Noise Analysis Maps

Des No. 1592385 and 1600808

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Marion County, IN

Revised: 4/29/2020

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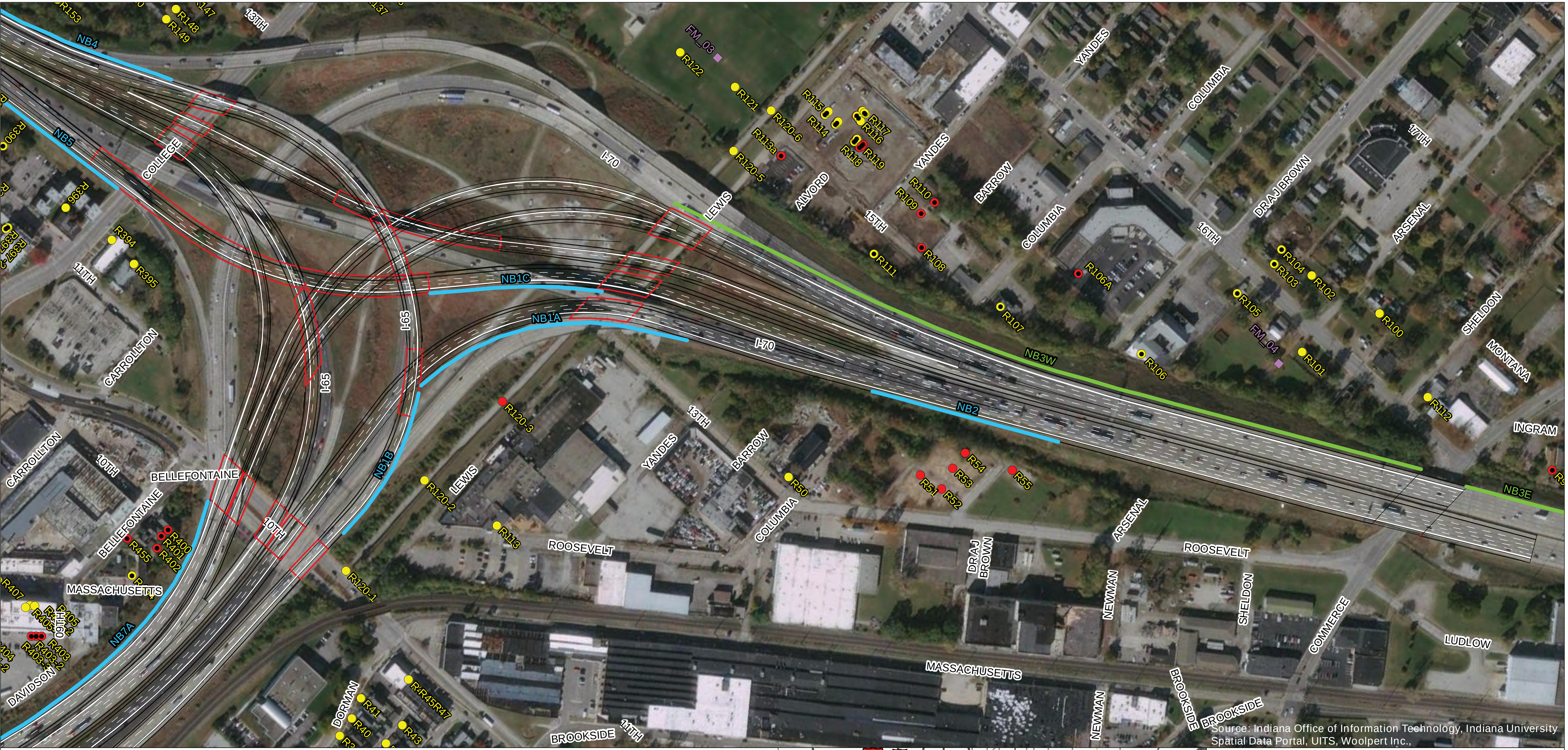

Source: Indiana Office of Information Technology, Indiana University Spatial Data Portal, UITS, Woolpert Inc.,

Legend

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🔴 Impacted / Not Benefited

◉ Not Impacted / Benefited

◉ Impacted / Benefited

🟪 Field Measurement Sites

Noise Barriers Analyzed

Feasible and Reasonable Noise Barrier

0 250 500 feet

Traffic Noise Analysis Maps

Des No. 1592385 and 1600808

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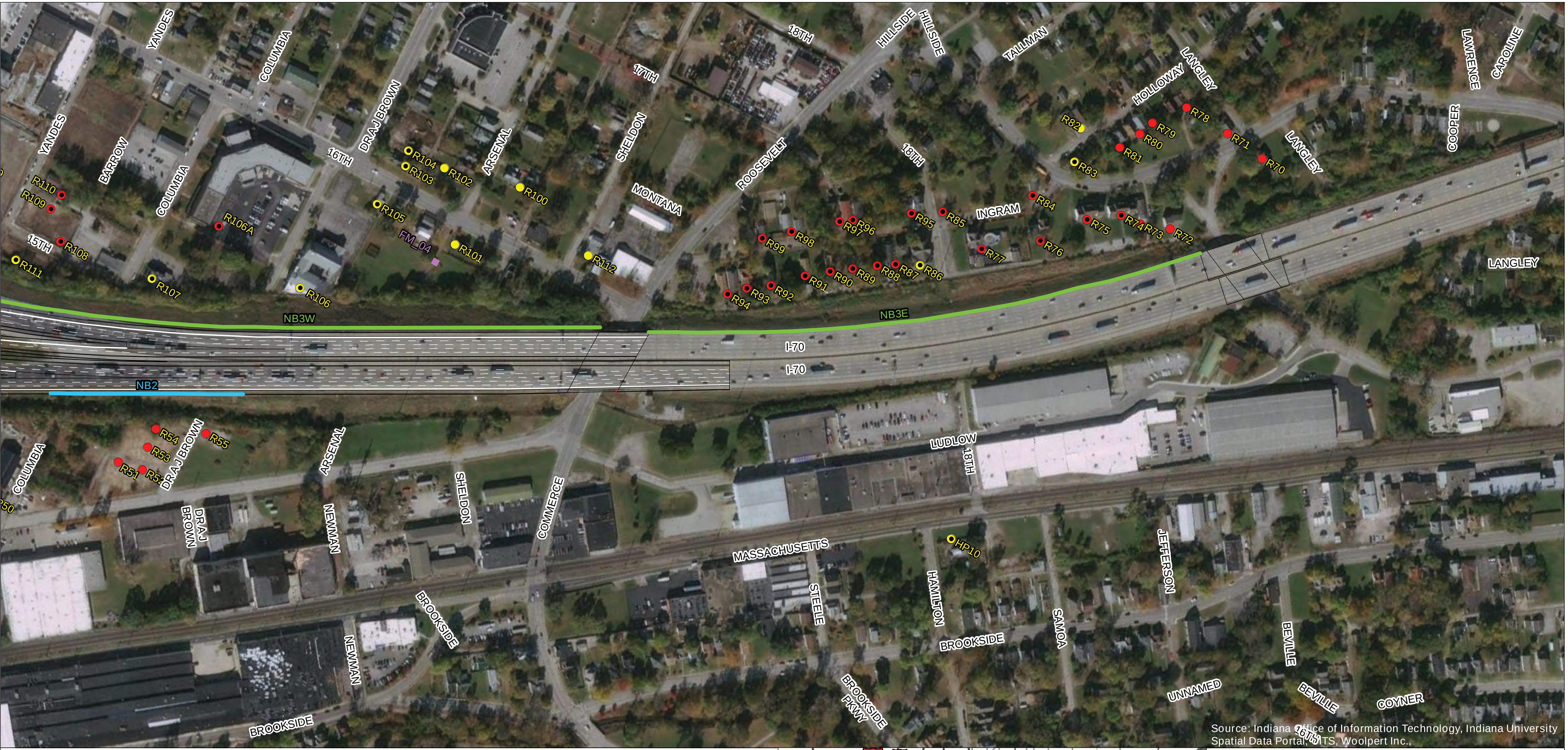
Marion County, IN
Revised: 4/29/2020



Source: Indiana Office of Information Technology, Indiana University Spatial Data Portal, NITS, Woolpert Inc.,

Legend

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●	Impacted / Not Benefited
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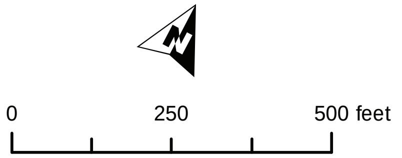
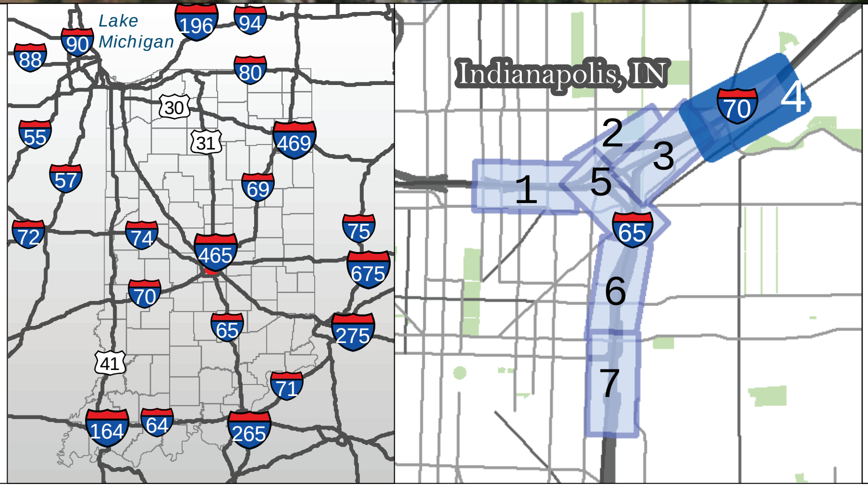
◉	Impacted / Benefited
■	Field Measurement Sites
〜	Noise Barriers Analyzed
〜	Feasible and Reasonable Noise Barrier





Traffic Noise Analysis Maps

Des No. 1592385 and 1600808

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Marion County, IN
Revised: 4/29/2020

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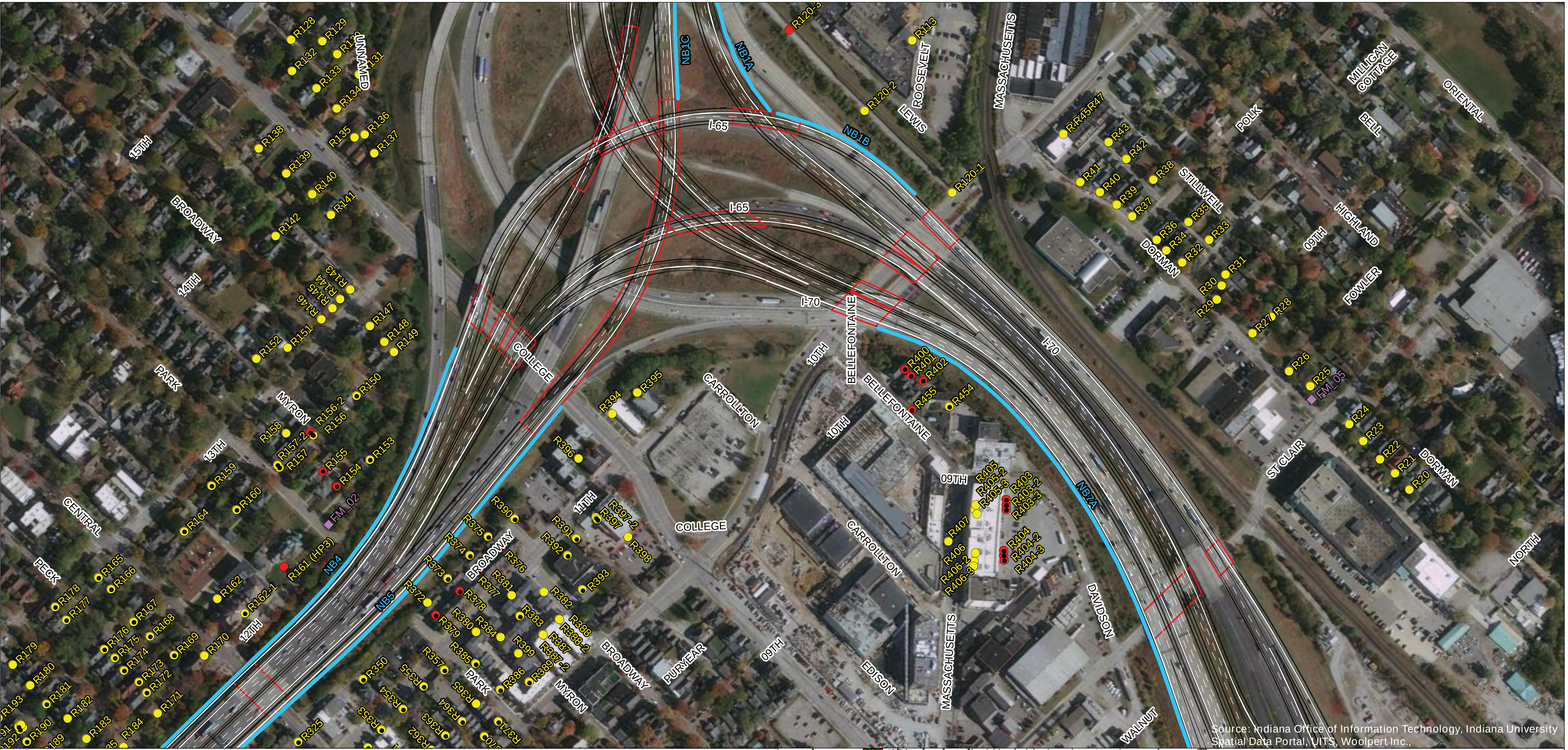

Source: Indiana Office of Information Technology, Indiana University Spatial Data Portal, UITS, Woolpert Inc.,

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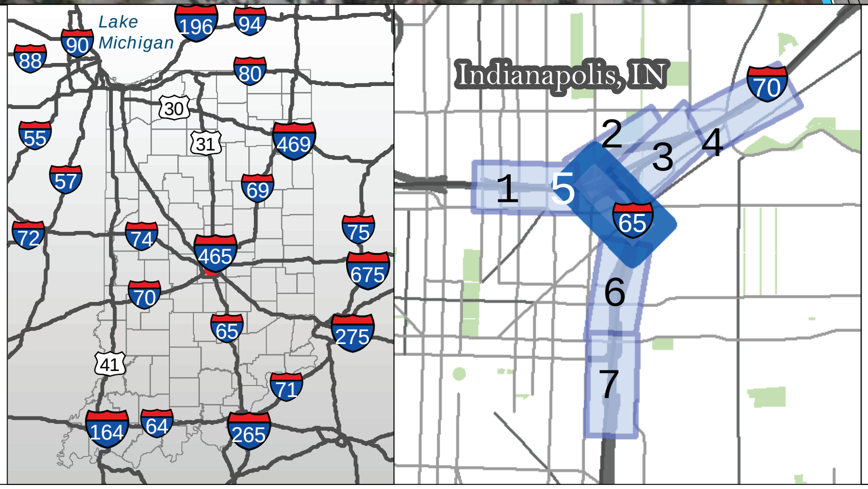
- ■ Field Measurement Sites
- Noise Barriers Analyzed
- Feasible and Reasonable Noise Barrier

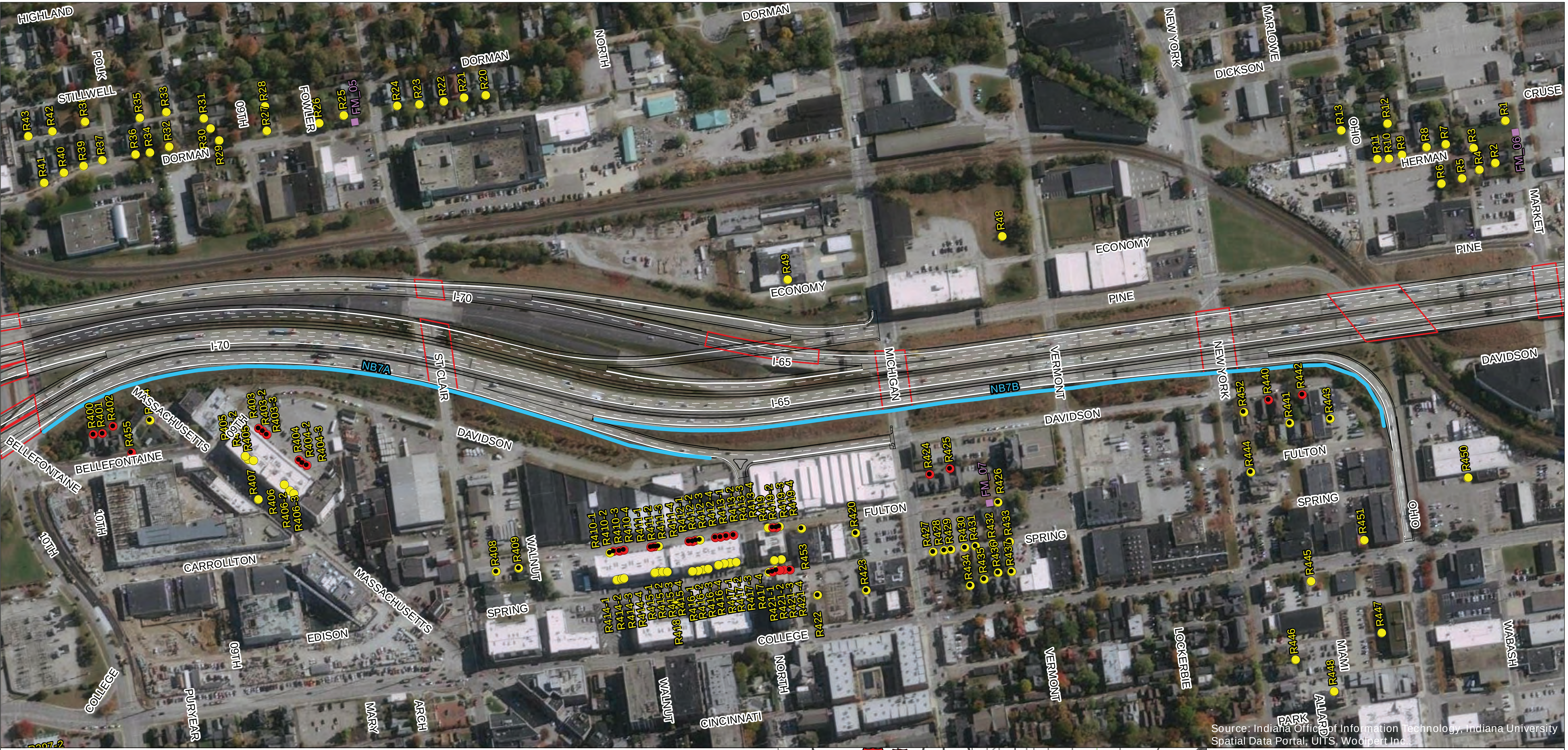


Traffic Noise Analysis Maps

Des No. 1592385 and 1600808

Page 5 of 7

Marion County, IN
Revised: 4/29/2020



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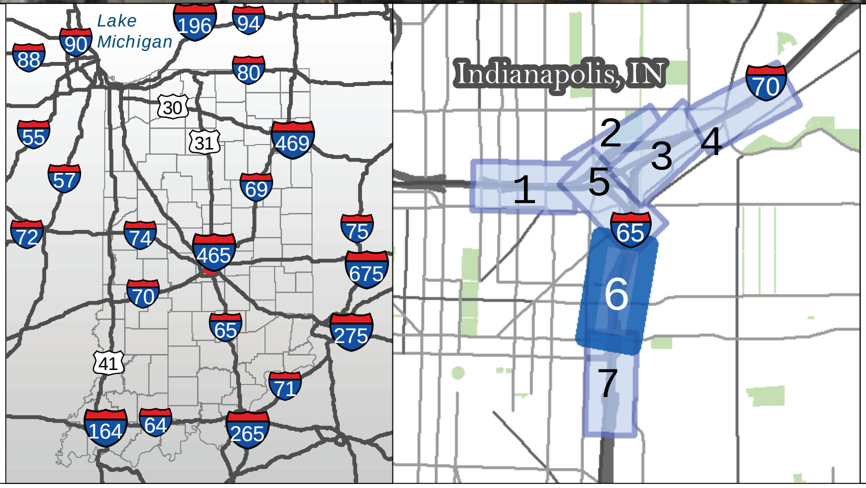
- 🟡 Not Impacted / Not Benefited
- 🔴 Impacted / Not Benefited
- ⊙ Not Impacted / Benefited
- ◉ Impacted / Benefited
- ▪ Field Measurement Sites
- 〰 Noise Barriers Analyzed
- 〰 Feasible and Reasonable Noise Barrier



Traffic Noise Analysis Maps

Des No. 1592385 and 1600808

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Marion County, IN
Revised: 4/29/2020

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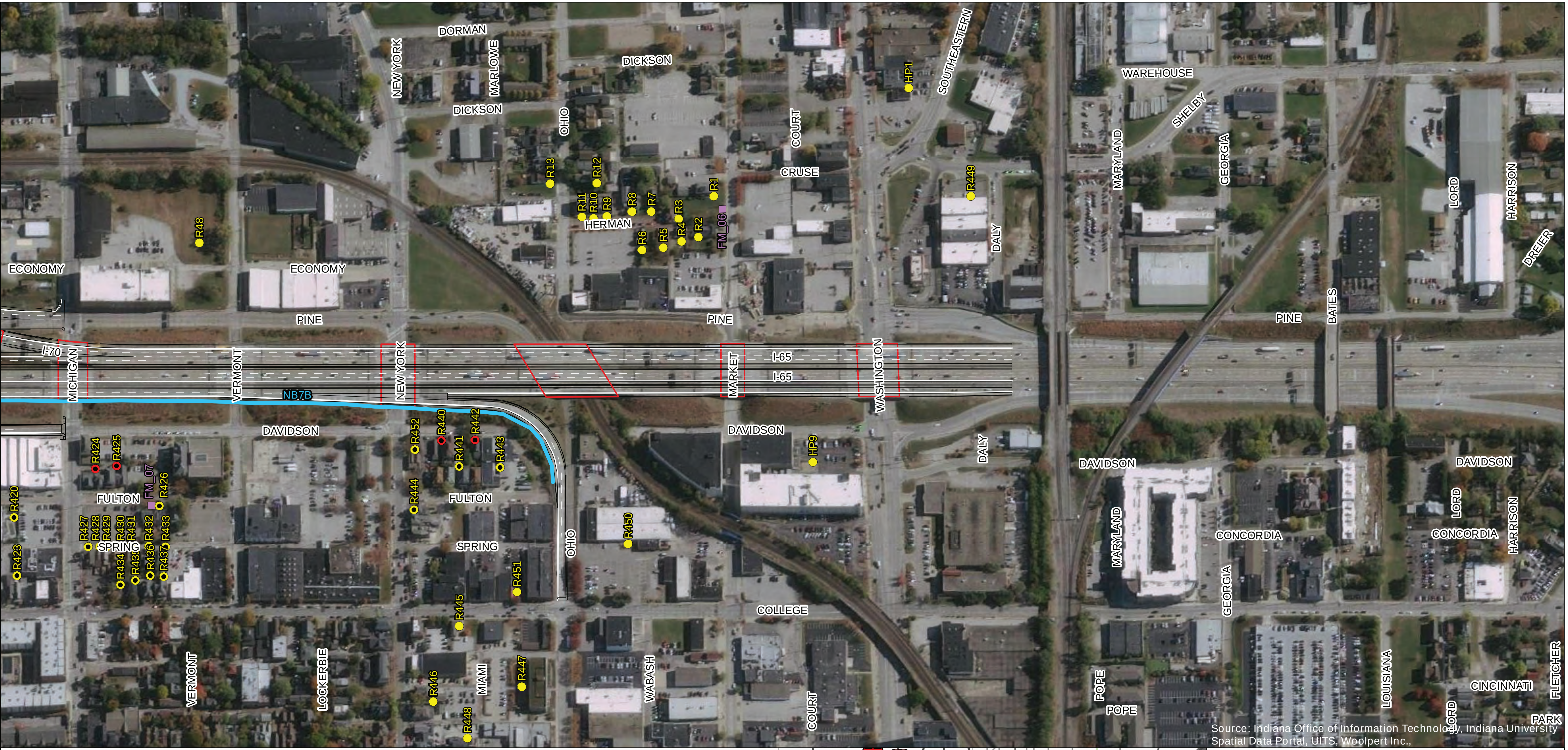

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Legend

🟡 Not Impacted / Not Benefited

🔴 Impacted / Not Benefited

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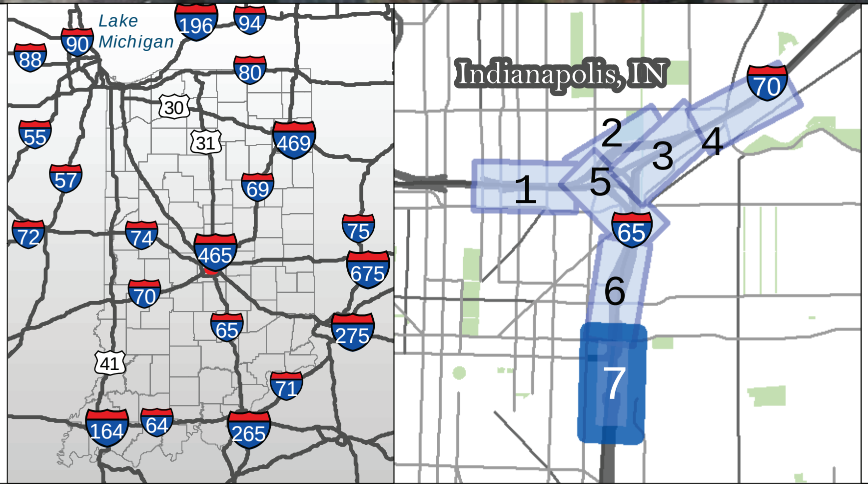
◉ Impacted / Benefited

🟪 Field Measurement Sites

〰 Noise Barriers Analyzed

〰 Feasible and Reasonable Noise Barrier

0 250 500 feet



Traffic Noise Analysis Maps

Des No. 1592385 and 1600808

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Marion County, IN

Revised: 4/29/2020

APPENDIX B: NOISE MEASUREMENT DATA SHEETS

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-65/I-70 North Split JOB #: Des BY: RJC/LB

SITE: FM 01 DATE: 10/30/2018 TIME: 13.24 - 13.44

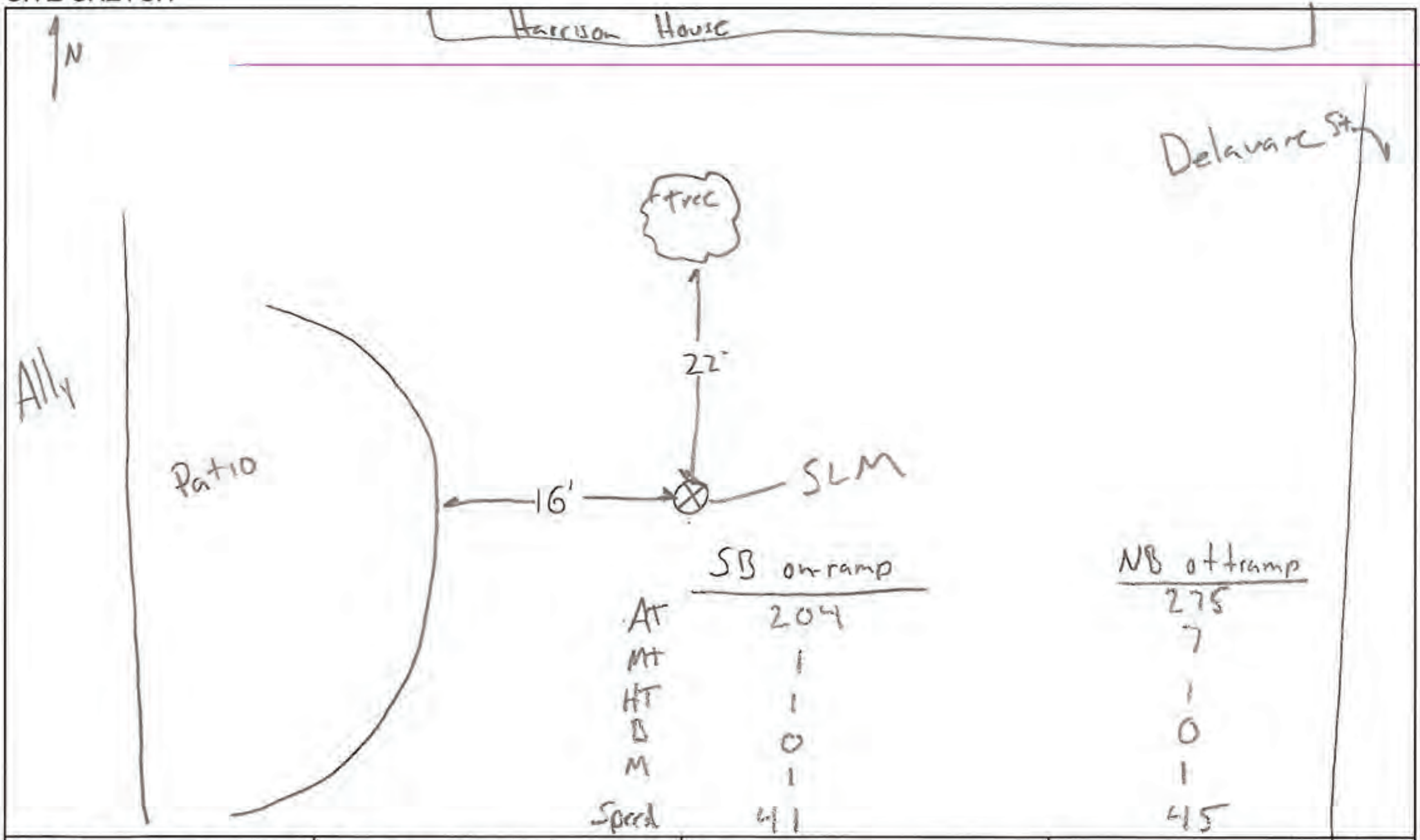
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / [✓ SLOW] WEIGHTING: [✓ A] / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	~~US 20 EB~~ I-65 NB	~~US 20 WB~~ I-65 SB
AUTOS	1022	1024
MED TRKS	41	35
HVY TRKS	83	86
BUS	9	10
MOTORCYCLE	2	1
SPEED	59	59

EQUIPMENT	
INSTRUMENT	SLM
SLM MANUFACTURER	Larson Davis
SLM MODEL	LXT
SLM	S / N 5625
PREAMPLIFIER – Type 1206	S / N 46840
MICROPHONE – Type 1225	S / N 305175
CALIBRATOR – Type 1251	S / N 12852

SITE SKETCH



MEASUREMENT DATA	Duration 20 min	Leq 68.4	

WEATHER DATA WIND SPEED (MPH) 8 DIR. SE TEMP. 71° HUMIDITY 63% CLOUD COVER Sunny

BACKGROUND NOISE None

MAJOR SOURCES I-65 dominated the noise env.

UNUSUAL EVENTS N/A

OTHER NOTES

NOISE MEASUREMENT DATA SHEET

PROJECT: I-65/I-70 North Split JOB #: Des BY: RJC/LB

SITE: FM02 DATE: 10/30/2018 TIME: 14:17-14:37

CALIBRATION: 113.8 at 1k Hz dB.

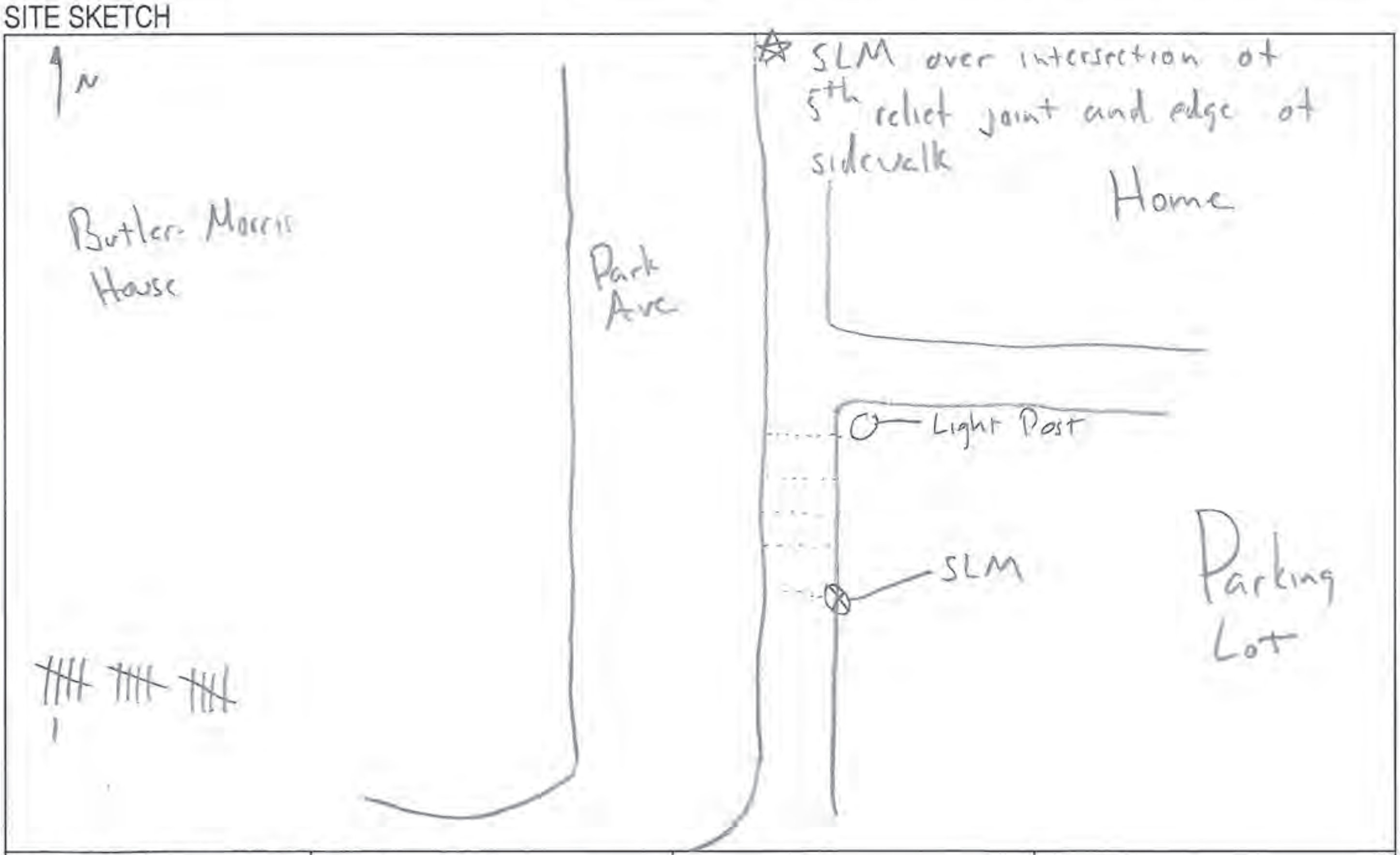
RESPONSE: FAST / [✓ SLOW]

WEIGHTING: [✓ A] / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	~~US 20 EB~~ I-65NB	~~US 20 WB~~ I-65SB
AUTOS	1377	2194
MED TRKS	26	51
HVY TRKS	107	95
BUS	15	2
MOTORCYCLE	6	0
SPEED	57	57

EQUIPMENT	
INSTRUMENT	SLM
SLM MANUFACTURER	Larson Davis
SLM MODEL	LXT
SLM	S / N 5625
PREAMPLIFIER – Type 1206	S / N 46840
MICROPHONE – Type 1225	S / N 305175
CALIBRATOR – Type 1251	S / N 12852

SITE SKETCH



MEASUREMENT DATA	Duration 20 min	Leq 68.7	

WEATHER DATA WIND SPEED (MPH) 4.5 DIR. W TEMP. 70.6 HUMIDITY 37.3 CLOUD COVER clear

BACKGROUND NOISE I-65

MAJOR SOURCES I-65 dominated noise environment

UNUSUAL EVENTS N/A

OTHER NOTES 16 Autos on park

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-65/I-70 North Split JOB #: Des BY: RJC/LB

SITE: FM03 DATE: 11/2/2018 TIME: 10:29 - 10:49

CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / [✓ SLOW] WEIGHTING: [✓ A] / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	~~US 20 EB~~ I70EB	~~US 20 WB~~ 70 WB to 65 NB
AUTOS	788	810
MED TRKS	96	6
HVY TRKS	124	54
BUS	0	0
MOTORCYCLE	4	0
SPEED	62	61

EQUIPMENT	
INSTRUMENT	SLM
SLM MANUFACTURER	Larson Davis
SLM MODEL	LXT
SLM	S / N 5625
PREAMPLIFIER – Type 1206	S / N 46840
MICROPHONE – Type 1225	S / N 305175
CALIBRATOR – Type 1251	S / N 12852

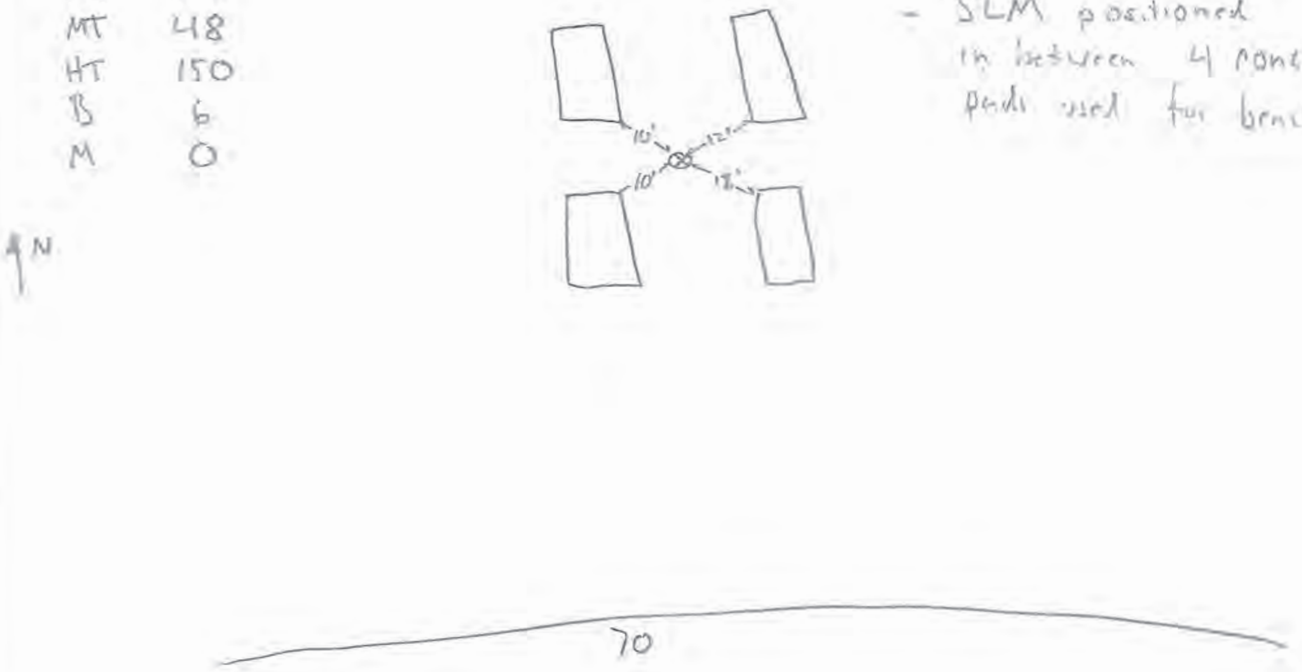
SITE SKETCH

70 WB to 65 SB = 62

AT	501
MT	48
HT	150
B	6
M	0

O Bannon Soccer Park

- SLM positioned in between 4 concrete pads used for benches



MEASUREMENT DATA	Duration 20 min	Leq 60.9	

WEATHER DATA WIND SPEED (MPH) 2 DIR. W TEMP. 43.8 HUMIDITY 81.7 CLOUD COVER Overcast

BACKGROUND NOISE Faint [illegible] at industrial building

MAJOR SOURCES 65/70

UNUSUAL EVENTS

OTHER NOTES

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-65/I-70 North Split JOB #: Des BY: RJC/LB

SITE: FM 04 DATE: 11/12/2018 TIME: 15:02 - 15:22

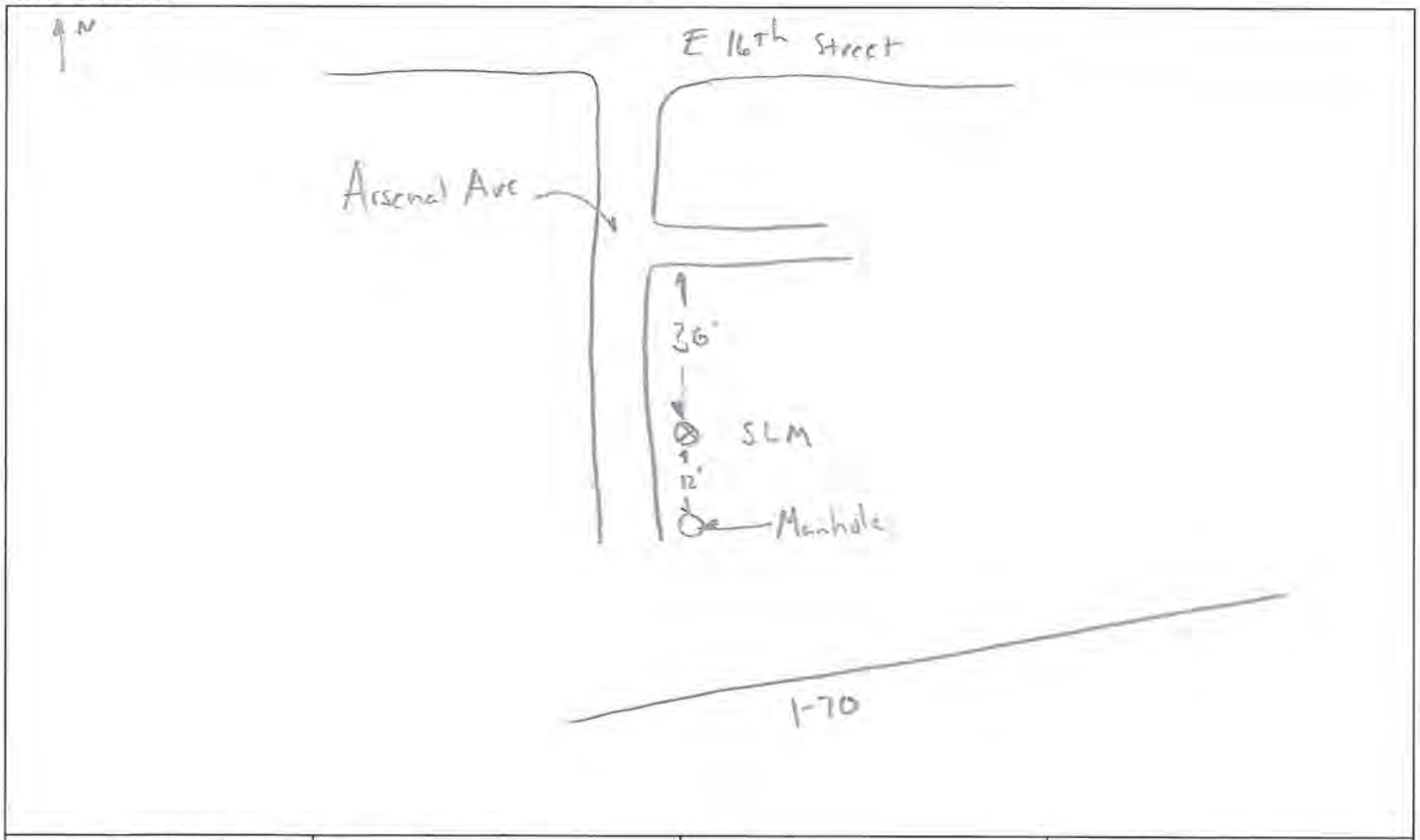
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / [✓ SLOW] WEIGHTING: [✓ A] / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	~~US 20 EB~~ I-70 EB	~~US 20 WB~~ I-70 WB
AUTOS	1328	1189
MED TRKS	37	66
HVY TRKS	84	95
BUS	4	6
MOTORCYCLE	0	0
SPEED	61	60

EQUIPMENT	
INSTRUMENT	SLM
SLM MANUFACTURER	Larson Davis
SLM MODEL	LXT
SLM	S / N 5625
PREAMPLIFIER – Type 1206	S / N 46840
MICROPHONE – Type 1225	S / N 305175
CALIBRATOR – Type 1251	S / N 12852

SITE SKETCH



MEASUREMENT DATA	Duration 20	Leq 69.3	

WEATHER DATA WIND SPEED (MPH) 2.7 DIR. W TEMP. 54.3 HUMIDITY 57.7 CLOUD COVER overcast

BACKGROUND NOISE 16th street

MAJOR SOURCES I-70 traffic on 16th did not dominate

UNUSUAL EVENTS NA

OTHER NOTES NA

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-65/I-70 North Split JOB #: Des BY: RJC/LB

SITE: FM 05 DATE: 11/2/2018 TIME: 11:38 - 11:58

CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / [✓ SLOW]

WEIGHTING: [✓ A] / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	~~US 20 EB~~ 65NB	US 20 WB 65SB
AUTOS	622	1266
MED TRKS	20	58
HVY TRKS	62	114
BUS	0	0
MOTORCYCLE	0	0
SPEED	60	60

EQUIPMENT	
INSTRUMENT	SLM
SLM MANUFACTURER	Larson Davis
SLM MODEL	LXT
SLM	S / N 5625
PREAMPLIFIER – Type 1206	S / N 46840
MICROPHONE – Type 1225	S / N 305175
CALIBRATOR – Type 1251	S / N 12852

SITE SKETCH

65SB CD		65 NB to 70EB	
AT	550	AT	640
MT	6	MT	22
HT	30	HT	136
B	0	B	2
	50		60

MEASUREMENT DATA	Duration 20 min	Leq 66.3	

WEATHER DATA WIND SPEED (MPH) 2 DIR. W TEMP. 48°F HUMIDITY 72.6 CLOUD COVER Overcast

BACKGROUND NOISE Some traffic on St Clair & Dorman

MAJOR SOURCES I-65/70

UNUSUAL EVENTS

OTHER NOTES

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-65/I-70 North Split JOB #: Des BY: RJC/LB

SITE: FM 06 DATE: 11/7/2018 TIME: 16:35- 16 55

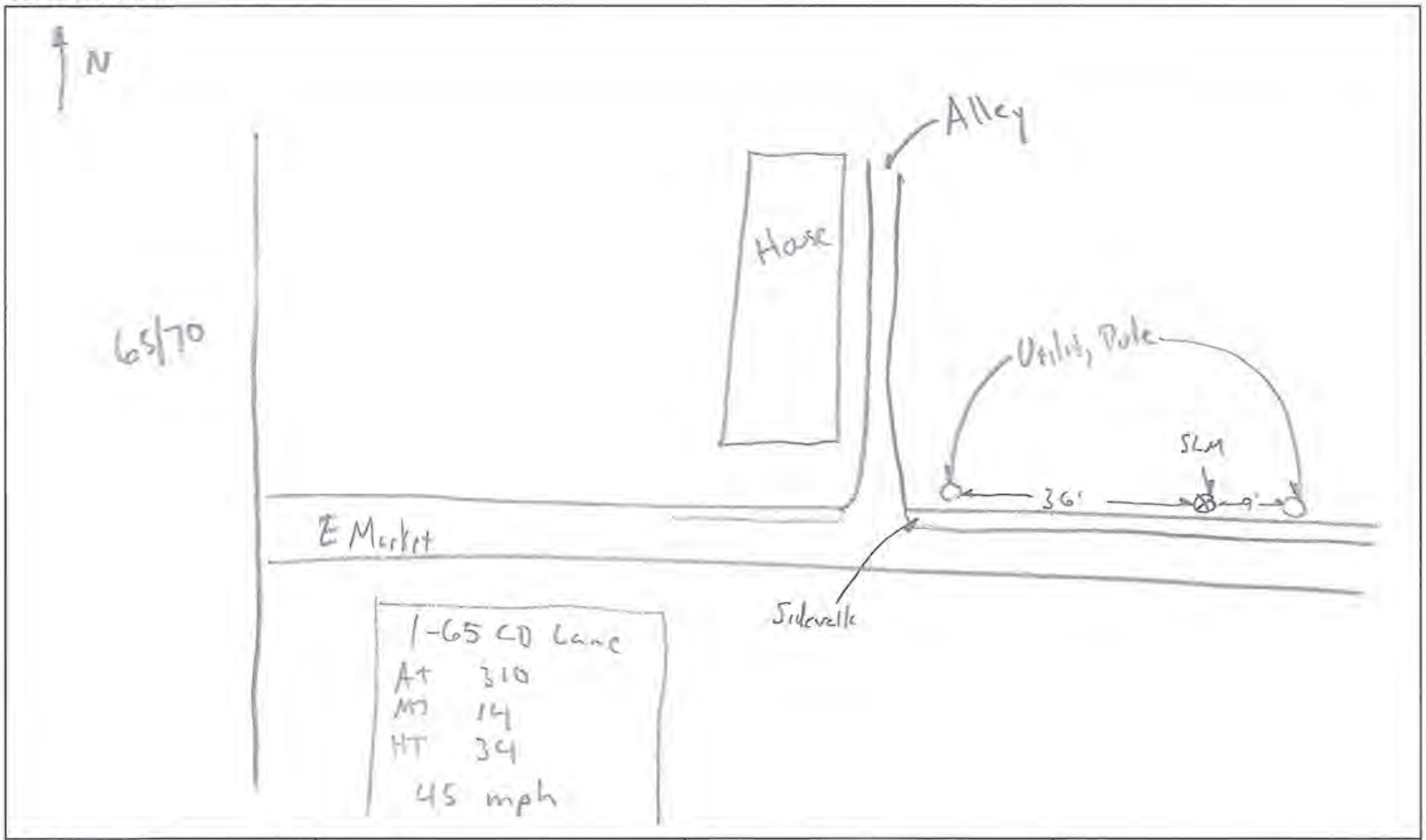
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / [✓ SLOW] WEIGHTING: [✓ A] / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	~~US 20 EB~~ I65SB	US 20 WB
AUTOS	1568	1836
MED TRKS	48	36
HVY TRKS	330	158
BUS	0	0
MOTORCYCLE	0	0
SPEED	56	56

EQUIPMENT	
INSTRUMENT	SLM
SLM MANUFACTURER	Larson Davis
SLM MODEL	LXT
SLM	S / N 5625
PREAMPLIFIER – Type 1206	S / N 46840
MICROPHONE – Type 1225	S / N 305175
CALIBRATOR – Type 1251	S / N 12852

SITE SKETCH



MEASUREMENT DATA	Duration 20 min	Leq 62.1	

WEATHER DATA WIND SPEED (MPH) 2.7 DIR. W TEMP. 54.3 HUMIDITY 57.2 CLOUD COVER overcast

BACKGROUND NOISE Some construction noise from dig project

MAJOR SOURCES 65/70 was dominant

UNUSUAL EVENTS A few loud exhausts

OTHER NOTES

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-65/I-70 North Split JOB #: Des BY: RJC/LB

SITE: FM07 DATE: 11/5/2018 TIME: 10:57 - 11:17

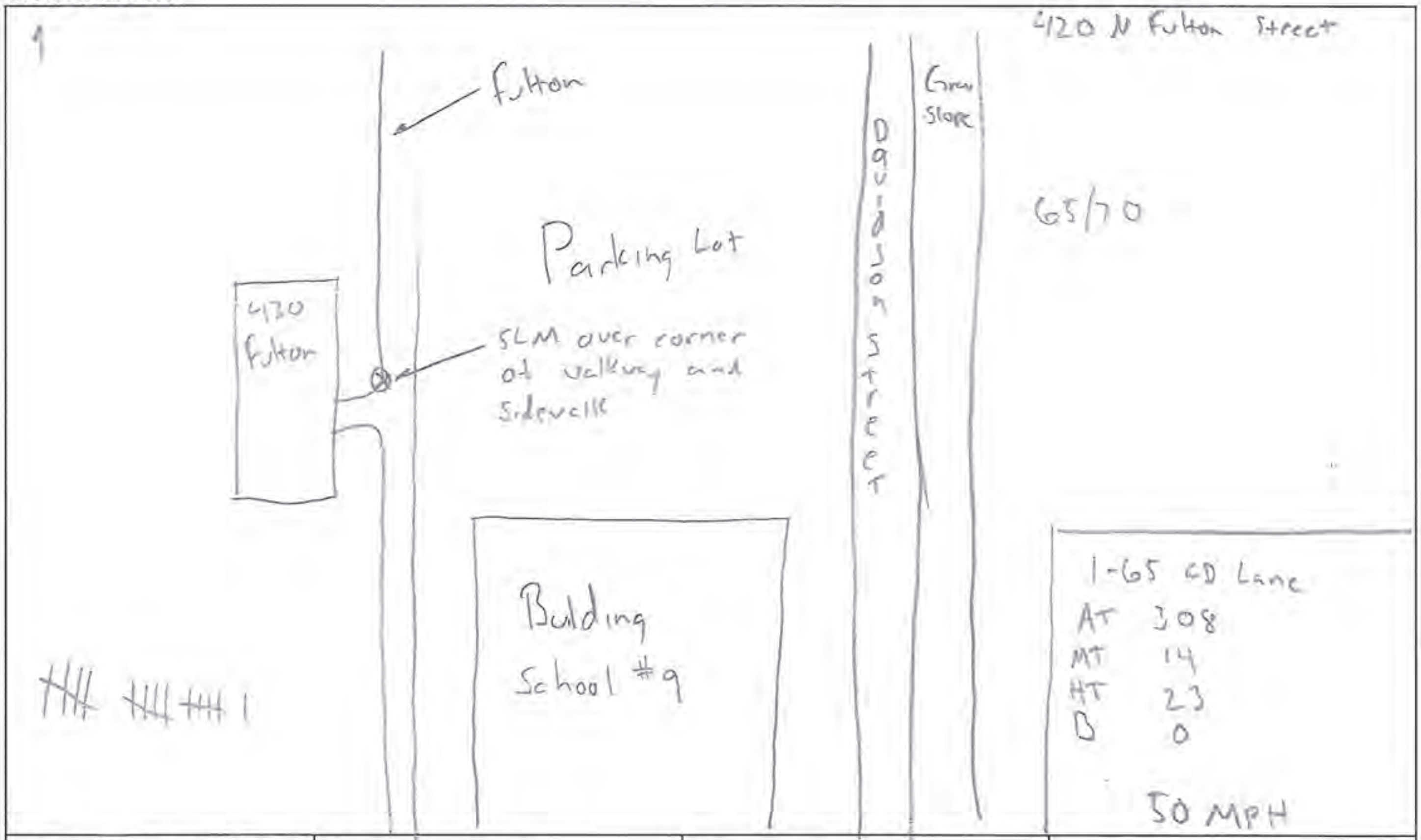
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / [✓ SLOW] WEIGHTING: [✓ A] / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	~~US 20 EB~~ I-65 NB	~~US 20 WB~~ I-65 SB
AUTOS	1081	723
MED TRKS	45	22
HVY TRKS	103	112
BUS	5	1
MOTORCYCLE	0	0
SPEED	58	58

EQUIPMENT	
INSTRUMENT	SLM
SLM MANUFACTURER	Larson Davis
SLM MODEL	LXT
SLM	S / N 5625
PREAMPLIFIER – Type 1206	S / N 46840
MICROPHONE – Type 1225	S / N 305175
CALIBRATOR – Type 1251	S / N 12852

SITE SKETCH



I-65 CD Lane
AT 308
MT 14
HT 23
B 0
50 MPH

MEASUREMENT DATA	Duration 20	Leq 66.2

WEATHER DATA WIND SPEED (MPH) 0.8 DIR. NW TEMP. 55 HUMIDITY 71 CLOUD COVER overcast

BACKGROUND NOISE I-65/70

MAJOR SOURCES I-65/70 was dominant

UNUSUAL EVENTS 16 Autos on Fulton

OTHER NOTES

NOISE MEASUREMENT DATA SHEET

PROJECT: I-65/I-70 North Split JOB #: Des BY: RJC/LB

SITE: FM08 DATE: 10/30/2018 TIME: 14:58-15:18

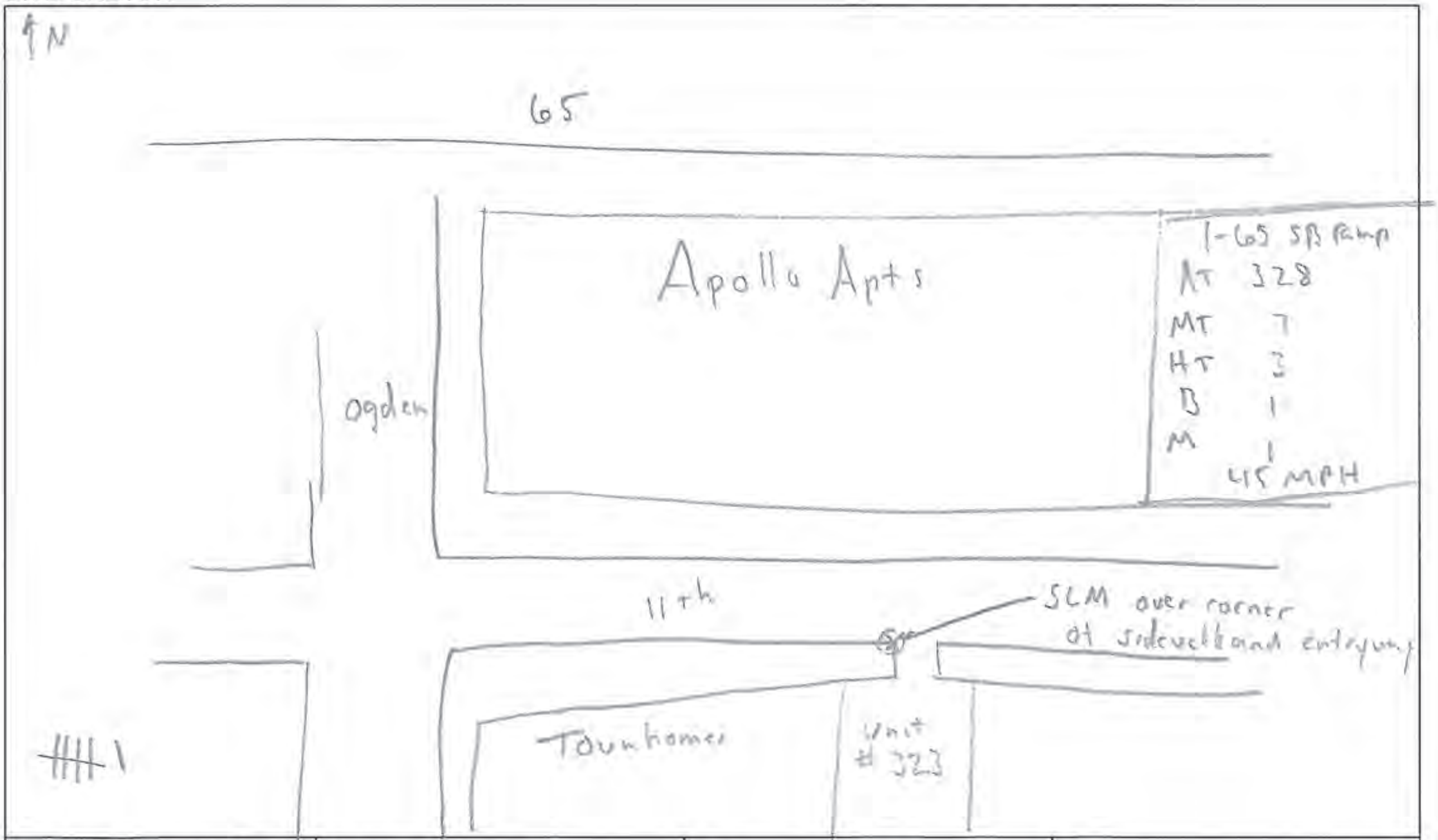
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / [✓ SLOW] WEIGHTING: [✓ A] / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	~~US 20 EB~~ I-65NB	~~US 20 WB~~ I-65 SB
AUTOS	1121	1209
MED TRKS	21	40
HVY TRKS	120	100
BUS	29	22
MOTORCYCLE	1	0
SPEED	60	0

EQUIPMENT	
INSTRUMENT	SLM
SLM MANUFACTURER	Larson Davis
SLM MODEL	LXT
SLM	S / N 5625
PREAMPLIFIER – Type 1206	S / N 46840
MICROPHONE – Type 1225	S / N 305175
CALIBRATOR – Type 1251	S / N 12852

SITE SKETCH



MEASUREMENT DATA Duration 20 Leq 60.4

WEATHER DATA WIND SPEED (MPH) 5 DIR. W TEMP. 72 HUMIDITY 53 CLOUD COVER Clear

BACKGROUND NOISE

MAJOR SOURCES I-65 was dominant 6 Autos on 11th

UNUSUAL EVENTS Loud car @ 3:04 Amb @ 3:06

OTHER NOTES

APPENDIX C: CERTIFICATES OF CALIBRATION

THE MODAL SHOP INC.
A PCB GROUP CO.

3149 East Kemper Rd.
Cincinnati, OH 45241
Ph : 513-351-9919
Fax: 513-458-2172
www.modalshop.com

~Calibration Certificate~

Manufacturer:	Larson Davis	Asset ID:	57194
Model:	CAL200	Calibration Date:	Feb 26, 2018 15:55:54
Serial Number:	12852	Due Date:	
Description:	Acoustic Calibrator	Technician:	Bradly Haarmeyer
Customer:	TMS Rental	Approval:	
Calibration Results:		Temperature:	23 °C (74 °F)
Measured SPL : 114.16 dB re. 20µPa		Humidity:	21.90%
Measured Frequency : 1,003.00 Hz		Pressure:	1004.4 mbar

Upon receipt for calibration, the instrument was found to be:
WITHIN the stated tolerance of the manufacturer's specification.

Note: **As Found / As Left: In Tolerance.**

Measurement uncertainty at 95% confidence level: 0.30 dB

The subject instrument was calibrated to the indicated specification using standards stated below or to accepted values of natural physical constants. This document certifies that the instrument met the following specification

This calibration is traceable through : A1633

Notes:
The calibration was performed under operating procedures intended to implement the requirements of ISO 9001, ISO 17025 and ANSI Z540. Unless otherwise noted, the reported value is both "as found" and "as left" data. Calibration results relate only to the items calibrated. This certificate may not be reproduced, except in full, without written permission.

Reference Equipment Used:

Manuf.	*Model*	*Serial*	*Cal. Date*	*Due Date*
GRAS	40AG	9542	2/16/2017	2/16/2018

Calibration Certificate

Certificate Number 2018005268

Customer:

The Modal Shop
3149 East Kemper Road
Cincinnati, OH 45241, United States

Model Number	LxT1
Serial Number	0005625
Test Results	**Pass**
Initial Condition	As Manufactured
Description	SoundTrack LxT Class 1 Class 1 Sound Level Meter Firmware Revision: 2.302

Procedure Number	D0001.8378		
Technician	Ron Harris		
Calibration Date	23 May 2018		
Calibration Due			
Temperature	23.42	°C	± 0.25 °C
Humidity	50.7	%RH	± 2.0 %RH
Static Pressure	86.02	kPa	± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT1 S/N 046882 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 μPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.11 (R2009) Class 1
IEC 61260:2001 Class 1	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev J Supporting Firmware Version 2.301, 2015-04-30

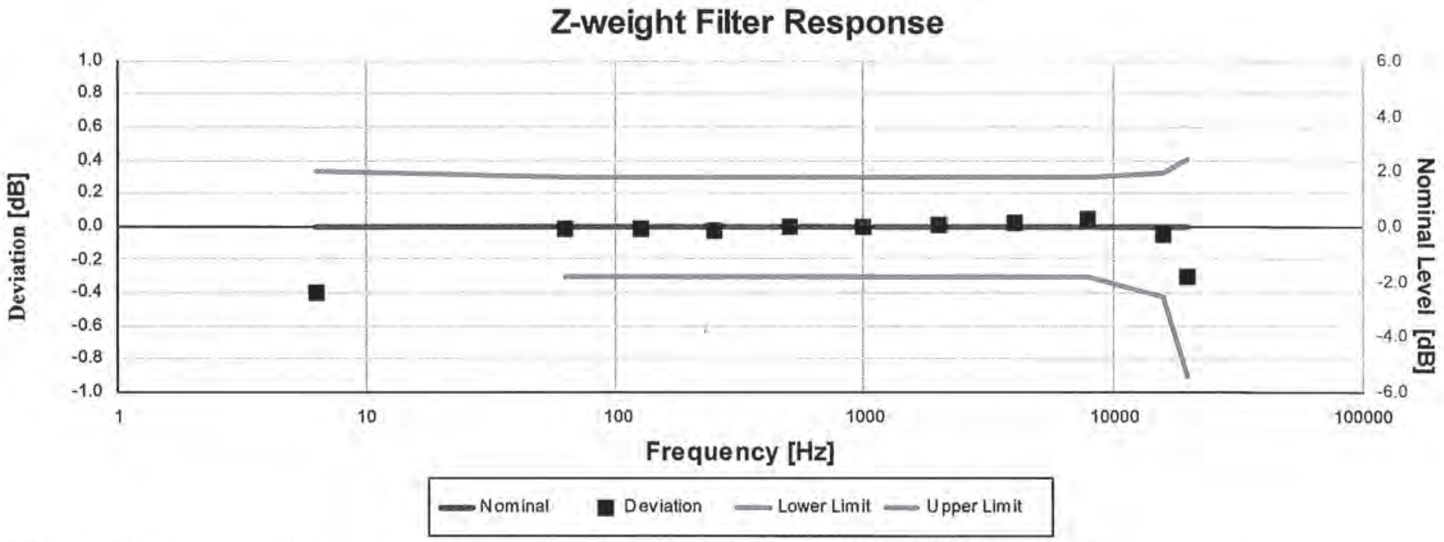
Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 μPa

ACCREDITED
Cert. #3622.01

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
SRS DS360 Ultra Low Distortion Generator	2017-06-23	2018-06-23	006311
Hart Scientific 2626-S Humidity/Temperature Sensor	2017-06-11	2018-06-11	006943

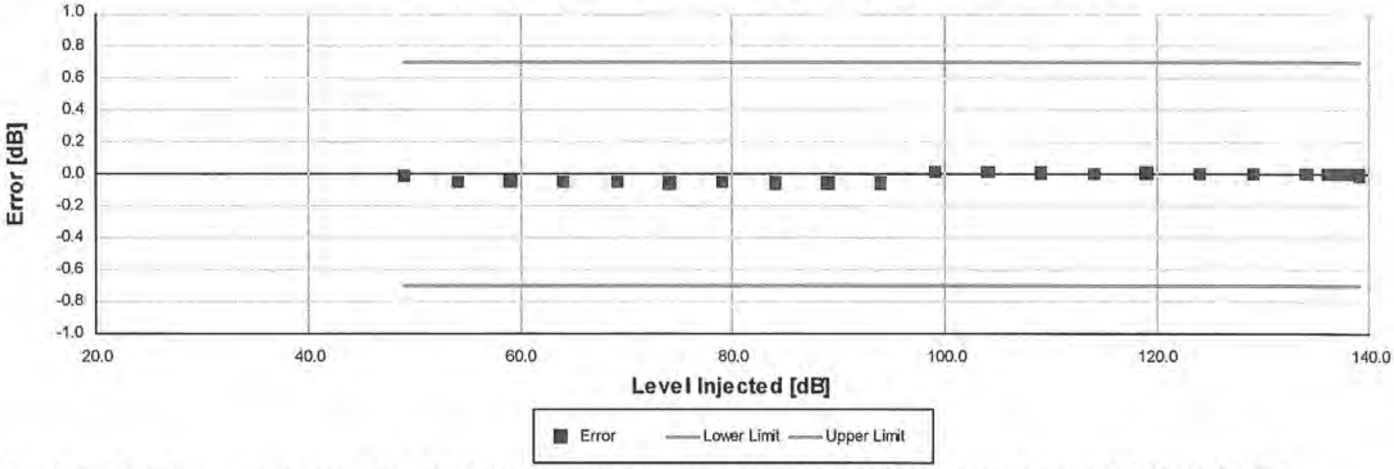


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.40	-0.40	-1.11	0.33	0.10	Pass
63.10	-0.02	-0.02	-0.30	0.30	0.09	Pass
125.89	-0.02	-0.02	-0.30	0.30	0.09	Pass
251.19	-0.02	-0.02	-0.30	0.30	0.09	Pass
501.19	-0.01	-0.01	-0.30	0.30	0.09	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.09	Pass
1,995.26	0.01	0.01	-0.30	0.30	0.09	Pass
3,981.07	0.02	0.02	-0.30	0.30	0.09	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.09	Pass
15,848.93	-0.05	-0.05	-0.42	0.32	0.09	Pass
19,952.62	-0.30	-0.30	-0.91	0.41	0.09	Pass

-- End of measurement results--

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
49.00	-0.01	-0.70	0.70	0.09	Pass
54.00	-0.05	-0.70	0.70	0.09	Pass
59.00	-0.05	-0.70	0.70	0.09	Pass
64.00	-0.05	-0.70	0.70	0.09	Pass
69.00	-0.05	-0.70	0.70	0.09	Pass
74.00	-0.06	-0.70	0.70	0.09	Pass
79.00	-0.05	-0.70	0.70	0.09	Pass
84.00	-0.06	-0.70	0.70	0.09	Pass
89.00	-0.06	-0.70	0.70	0.09	Pass
94.00	-0.06	-0.70	0.70	0.09	Pass
99.00	0.01	-0.70	0.70	0.09	Pass
104.00	0.01	-0.70	0.70	0.09	Pass
109.00	0.00	-0.70	0.70	0.09	Pass
114.00	0.00	-0.70	0.70	0.09	Pass
119.00	0.00	-0.70	0.70	0.09	Pass
124.00	0.00	-0.70	0.70	0.09	Pass
129.00	0.00	-0.70	0.70	0.09	Pass
134.00	0.00	-0.70	0.70	0.09	Pass
136.00	0.00	-0.70	0.70	0.09	Pass
137.00	0.00	-0.70	0.70	0.09	Pass
138.00	0.00	-0.70	0.70	0.09	Pass
139.00	-0.01	-0.70	0.70	0.09	Pass

-- End of measurement results--

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	138.45	137.02	139.02	0.09	Pass
		Positive Pulse	138.46	137.00	139.00	0.09	Pass
	30	Negative Pulse	137.59	137.02	139.02	0.09	Pass
		Positive Pulse	137.57	137.00	139.00	0.09	Pass

-- End of measurement results--

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.09	Pass
	5	OVLD	± 1.00	0.09	Pass
	10	OVLD	± 1.50	0.09	Pass
126.85	3	-0.13	± 0.50	0.09	Pass
	5	-0.12	± 1.00	0.11	Pass
	10	OVLD	± 1.50	0.09	Pass
116.85	3	-0.12	± 0.50	0.09	Pass
	5	-0.11	± 1.00	0.09	Pass
	10	-0.25	± 1.50	0.09	Pass
106.85	3	-0.13	± 0.50	0.09	Pass
	5	-0.12	± 1.00	0.09	Pass
	10	-0.16	± 1.50	0.09	Pass

-- End of measurement results--

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.09	Pass
	5	OVLD	± 1.00	0.09	Pass
	10	OVLD	± 1.50	0.09	Pass
126.85	3	-0.12	± 0.50	0.09	Pass
	5	-0.10	± 1.00	0.09	Pass
	10	OVLD	± 1.50	0.09	Pass
116.85	3	-0.11	± 0.50	0.09	Pass
	5	-0.11	± 1.00	0.09	Pass
	10	-0.24	± 1.50	0.09	Pass
106.85	3	-0.12	± 0.50	0.09	Pass
	5	-0.13	± 1.00	0.09	Pass
	10	-0.16	± 1.50	0.09	Pass

-- End of measurement results--

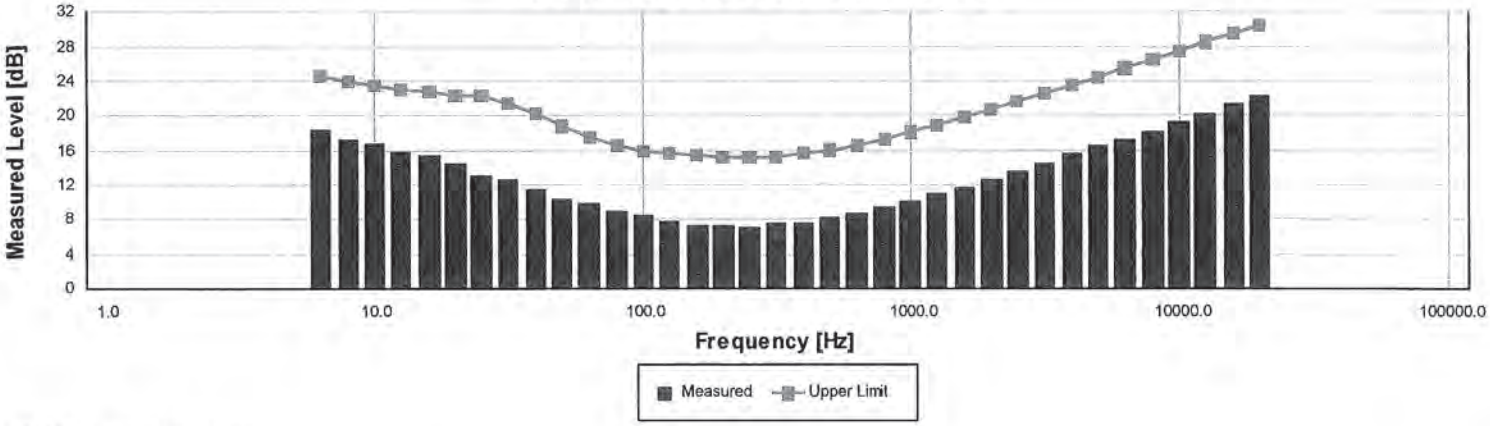
Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.94	93.90	94.10	0.09	Pass
0 dB Gain, Linearity	41.09	40.30	41.70	0.09	Pass
OBA Low Range	94.00	93.90	94.10	0.09	Pass
OBA Normal Range	94.00	93.20	94.80	0.09	Pass

-- End of measurement results--

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	18.47	24.60	Pass
8.00	17.38	24.00	Pass
10.00	16.81	23.50	Pass
12.50	15.85	23.00	Pass
16.00	15.46	22.90	Pass
20.00	14.43	22.40	Pass
25.00	13.15	22.30	Pass
31.50	12.60	21.50	Pass
40.00	11.48	20.20	Pass
50.00	10.45	18.80	Pass
63.00	9.92	17.60	Pass
80.00	9.08	16.60	Pass
100.00	8.41	15.90	Pass
125.00	7.84	15.70	Pass
160.00	7.31	15.50	Pass
200.00	7.28	15.20	Pass
250.00	7.10	15.20	Pass
315.00	7.51	15.20	Pass
400.00	7.52	15.70	Pass
500.00	8.21	16.00	Pass
630.00	8.76	16.60	Pass
800.00	9.44	17.30	Pass
1,000.00	10.13	18.10	Pass
1,250.00	10.95	18.90	Pass
1,600.00	11.81	19.80	Pass
2,000.00	12.58	20.80	Pass
2,500.00	13.53	21.70	Pass
3,150.00	14.52	22.60	Pass
4,000.00	15.57	23.50	Pass
5,000.00	16.51	24.50	Pass
6,300.00	17.38	25.50	Pass
8,000.00	18.32	26.50	Pass
10,000.00	19.39	27.40	Pass
12,500.00	20.29	28.50	Pass
16,000.00	21.34	29.50	Pass
20,000.00	22.35	30.40	Pass

-- End of measurement results--

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.90	36.00	Pass
C-weight Noise Floor	26.48	35.00	Pass
Z-weight Noise Floor	33.60	39.00	Pass

-- End of measurement results--

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.50	135.05	136.65	0.09	Pass
THD	-65.58		-58.00	0.01	Pass
THD+N	-62.02		-58.00	0.01	Pass

-- End of measurement results--

-- End of Report--

Signatory: Ron Harris

Calibration Certificate

Certificate Number 2018005269

Customer:

The Modal Shop
3149 East Kemper Road
Cincinnati, OH 45241, United States

Model Number LxT1
Serial Number 0005625
Test Results **Pass**
Initial Condition As Manufactured
Description SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.302

Procedure Number D0001.8384
Technician Ron Harris
Calibration Date 23 May 2018
Calibration Due
Temperature 23.59 °C ± 0.25 °C
Humidity 50.4 %RH ± 2.0 %RH
Static Pressure 85.99 kPa ± 0.13 kPa

Evaluation Method ***Tested with:***
Larson Davis PRMLxT1. S/N 046882
PCB 377B02. S/N 304769
Larson Davis CAL200. S/N 9079
Larson Davis CAL291. S/N 0108

Data reported in dB re 20 μPa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1
IEC 60804:2000 Type 1
IEC 61252:2002
IEC 61260:2001 Class 1
IEC 61672:2013 Class 1

ANSI S1.4-2014 Class 1
ANSI S1.4 (R2006) Type 1
ANSI S1.11 (R2009) Class 1
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.

Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev J Supporting Firmware Version 2.301, 2015-04-30

ilac-MRA
ACCREDITED
Cert. #3622.01

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 μPa

Periodic tests were performed in accordance with precedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2017-09-19	2018-09-19	001250
SRS DS360 Ultra Low Distortion Generator	2017-06-23	2018-06-23	006311
Hart Scientific 2626-S Humidity/Temperature Sensor	2017-06-11	2018-06-11	006943
Larson Davis CAL200 Acoustic Calibrator	2017-07-25	2018-07-25	007027
Larson Davis Model 831	2018-02-28	2019-02-28	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2018-03-07	2019-03-07	007185

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.00	113.80	114.20	0.14	Pass

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.22	-0.20	-1.20	0.80	0.23	Pass
1000	0.09	0.00	-0.70	0.70	0.23	Pass
8000	-2.83	-3.00	-5.50	-1.50	0.32	Pass

-- End of measurement results--

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.36

-- End of measurement results--

-- End of Report--

Signatory: Ron Harris

~ *Certificate of Calibration and Compliance* ~

Microphone Model: 377B02 Serial Number: 305175 Manufacturer: PCB

Calibration Environmental Conditions

Environmental test conditions as printed on microphone calibration chart.

Reference Equipment

Manufacturer	Model #	Serial #	PCB Control #	Cal Date	Due Date
National Instruments	PCIe-6351	1896F08	CA1918	10/20/17	10/19/18
Larson Davis	PRM915	134	CA2114	11/30/17	11/30/18
Larson Davis	PRM902	5352	CA1247	4/12/18	4/12/19
Larson Davis	PRM916	130	CA1161	9/13/17	9/13/18
Larson Davis	CAL250	5109	CA1496	10/19/17	10/19/18
Larson Davis	2201	140	CA890	5/3/17	5/3/18
Bruel & Kjaer	4192	2954556	CA2323	9/15/17	9/14/18
Larson Davis	GPRM902	3999	CA1090	9/20/17	9/20/18
Newport	iTHX-SD/N	1080002	CA1511	2/9/18	2/8/19
Larson Davis	PRA951-4	222	LD026	12/19/17	12/19/18
Larson Davis	PRM915	147	CA2179	6/6/17	6/6/18
PCB	68510-02	N/A	CA2672	12/27/17	12/27/18
0	0	0	0	not required	not required
0	0	0	0	not required	not required
0	0	0	0	not required	not required

Frequency sweep performed with B&K UA0033 electrostatic actuator.

Condition of Unit

As Found: n/a

As Left: New Unit, In Tolerance

Notes

1. Calibration of reference equipment is traceable to one or more of the following National Labs; NIST, PTB or DFM.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 10012-1, ANSI/NCSL Z540.3 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. Open Circuit Sensitivity is measured using the insertion voltage method following procedure AT603-5.
6. Measurement uncertainty (95% confidence level with coverage factor of 2) for sensitivity is +/-0.20 dB.
7. Unit calibrated per ACS-20.

Technician: Leonard Lukasik LL

Date: April 25, 2018

CALIBRATION CERT #1862.01

PCB PIEZOTRONICS™
VIBRATION DIVISION
3425 Walden Avenue, Depew, New York, 14043
TEL: 888-684-0013 FAX: 716-685-3886 www.pcb.com

ID:CAL112-3607494440.057+0

~ Calibration Report ~

Microphone Model: 377B02 Serial Number: 305175 Description: 1/2" Free-Field Microphone

Calibration Data

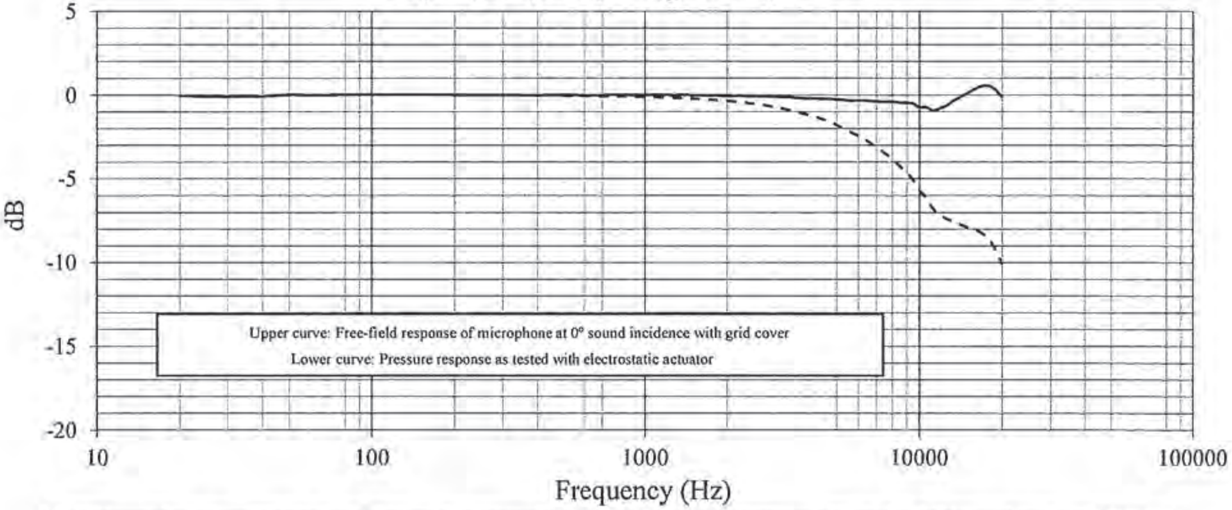
Open Circuit Sensitivity @ 251.2 Hz: 58.11 mV/Pa
-24.71 dB re 1V/Pa

Polarization Voltage, External: 0 V

Capacitance: 13.1 pF

Temperature: 72 °F (22°C) Ambient Pressure: 986 mbar Relative Humidity: 43 %

Frequency Response (0 dB @ 251.2 Hz)



Freq (Hz)	Lower (dB)	Upper (dB)	Freq (Hz)	Lower (dB)	Upper (dB)	Freq (Hz)	Lower (dB)	Upper (dB)	Freq (Hz)	Lower (dB)	Upper (dB)
20.0	-0.05	-0.05	1679	-0.28	-0.05	7499	-3.48	-0.41	-	-	-
25.1	-0.10	-0.10	1778	-0.30	-0.05	7943	-3.77	-0.38	-	-	-
31.6	-0.10	-0.10	1884	-0.33	-0.05	8414	-4.19	-0.46	-	-	-
39.8	-0.08	-0.08	1995	-0.36	-0.05	8913	-4.56	-0.45	-	-	-
50.1	0.00	0.00	2114	-0.40	-0.06	9441	-5.02	-0.50	-	-	-
63.1	-0.01	-0.01	2239	-0.42	-0.05	10000	-5.67	-0.72	-	-	-
79.4	0.01	0.01	2371	-0.49	-0.08	10593	-6.13	-0.73	-	-	-
100.0	0.02	0.02	2512	-0.54	-0.08	11220	-6.78	-0.92	-	-	-
125.9	0.01	0.01	2661	-0.58	-0.07	11885	-7.12	-0.80	-	-	-
158.5	0.01	0.01	2818	-0.65	-0.09	12589	-7.39	-0.62	-	-	-
199.5	0.00	0.00	2985	-0.73	-0.11	13335	-7.52	-0.33	-	-	-
251.2	0.00	0.00	3162	-0.81	-0.13	14125	-7.73	-0.14	-	-	-
316.2	-0.02	-0.01	3350	-0.89	-0.15	14962	-7.88	0.09	-	-	-
398.1	-0.03	-0.03	3548	-0.99	-0.17	15849	-8.01	0.34	-	-	-
501.2	-0.04	0.00	3758	-1.11	-0.21	16788	-8.20	0.52	-	-	-
631.0	-0.07	-0.03	3981	-1.20	-0.20	17783	-8.55	0.56	-	-	-
794.3	-0.09	0.01	4217	-1.33	-0.22	18837	-9.18	0.33	-	-	-
1000.0	-0.12	0.00	4467	-1.46	-0.23	19953	-10.06	-0.13	-	-	-
1059.3	-0.13	0.00	4732	-1.61	-0.24	-	-	-	-	-	-
1122.0	-0.15	-0.01	5012	-1.80	-0.27	-	-	-	-	-	-
1188.5	-0.15	0.00	5309	-2.01	-0.31	-	-	-	-	-	-
1258.9	-0.18	-0.02	5623	-2.22	-0.34	-	-	-	-	-	-
1333.5	-0.19	-0.01	5957	-2.41	-0.34	-	-	-	-	-	-
1412.5	-0.20	-0.01	6310	-2.62	-0.33	-	-	-	-	-	-
1496.2	-0.23	-0.03	6683	-2.89	-0.37	-	-	-	-	-	-
1584.9	-0.24	-0.03	7080	-3.18	-0.40	-	-	-	-	-	-

Technician: Leonard Lukasik LL Date: April 25, 2018

CALIBRATION CERT #1862.01

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APPENDIX D: PREDICTED NOISE LEVELS

Appendix D - Predicted Noise Levels, dB(A) Leq(1h)

Receiver ID	Noise Level, dB(A) Leq(1h)			Receptors	Noise Level		Change	Impact
	Description	Category**	Criteria, Leq(1h)		2017 Leq(1h)	2041 Leq(1h)		
R1	Residential	B	66	2	63.5	62.6	-0.9	N
R2	Residential	B	66	1	65.9	65.0	-0.9	N
R3	Residential	B	66	1	65.6	64.7	-0.9	N
R4	Residential	B	66	1	65.7	64.8	-0.9	N
R5	Residential	B	66	2	64.8	64.0	-0.8	N
R6	Residential	B	66	1	64.8	63.8	-1.0	N
R7	Residential	B	66	1	65.1	64.3	-0.8	N
R8	Residential	B	66	2	64.8	64.0	-0.8	N
R9	Residential	B	66	2	64.5	63.7	-0.8	N
R10	Residential	B	66	2	64.5	63.7	-0.8	N
R11	Residential	B	66	1	64.4	63.5	-0.9	N
R12	Residential	B	66	1	63.8	63.0	-0.8	N
R13	Residential	B	66	1	61.5	60.7	-0.8	N
R20	Residential	B	66	2	58.0	59.0	1.0	N
R21	Residential	B	66	2	58.2	57.6	-0.6	N
R22	Residential	B	66	2	58.6	58.6	0.0	N
R23	Residential	B	66	2	58.9	59.1	0.2	N
R24	Residential	B	66	2	60.2	60.5	0.3	N
R25	Residential	B	66	1	59.2	59.2	0.0	N
R26	Residential	B	66	1	58.4	58.6	0.2	N
R27	Residential	B	66	1	59.5	59.7	0.2	N
R28	Residential	B	66	1	59.7	59.6	-0.1	N
R29	Residential	B	66	1	59.6	59.6	0.0	N
R30	Residential	B	66	1	60.1	60.0	-0.1	N
R31	Residential	B	66	1	59.8	59.8	0.0	N
R32	Residential	B	66	1	60.1	59.4	-0.7	N

Receiver ID	Noise Level, dB(A) Leq(1h)			Receptors	Noise Level		Change	Impact
	Description	**Category****	**Criteria, L_{eq}(1h)**		2017 Leq(1h)	2041 Leq(1h)		
R33	Residential	B	66	1	60.2	59.6	-0.6	N
R34	Residential	B	66	1	60.0	59.6	-0.4	N
R35	Residential	B	66	2	60.1	59.5	-0.6	N
R36	Residential	B	66	2	59.9	59.5	-0.4	N
R37	Residential	B	66	2	59.1	58.8	-0.3	N
R38	Residential	B	66	1	59.5	59.3	-0.2	N
R39	Residential	B	66	2	59.7	59.3	-0.4	N
R40	Residential	B	66	2	61.8	59.5	-2.3	N
R41	Residential	B	66	2	60.7	60.1	-0.6	N
R42	Residential	B	66	2	60.4	60.2	-0.2	N
R43	Residential	B	66	2	59.9	59.6	-0.3	N
R44	Residential	B	66	1	60.6	60.0	-0.6	N
R45	Residential	B	66	1	60.3	59.9	-0.4	N
R46	Residential	B	66	2	60.1	59.7	-0.4	N
R47	Residential	B	66	3	60.6	60.0	-0.6	N
R48	Community Garden	C	66	1	64.7	64.4	-0.3	N
R49	Church	D	51	4	50.0	47.5	-2.5	N
R50	Church	D	51	3	49.5	47.3	-2.2	N
R51	Residential	B	66	1	71.4	70.5	-0.9	Y
R52	Residential	B	66	1	70.9	70.2	-0.7	Y
R53	Residential	B	66	1	72.1	71.2	-0.9	Y
R54	Residential	B	66	2	72.4	71.6	-0.8	Y
R55	Residential	B	66	1	71.9	71.6	-0.3	Y
R70	Residential	B	66	1	70.1	70.4	0.3	Y
R71	Residential	B	66	1	68.4	68.3	-0.1	Y
R72	Residential	B	66	2	73.5	73.1	-0.4	Y
R73	Residential	B	66	1	71.6	71.0	-0.6	Y

Receiver ID	Noise Level, dB(A) Leq(1h)			Receptors	Noise Level		Change	Impact
	Description	Category**	Criteria, L_{eq}(1h)		2017 Leq(1h)	2041 Leq(1h)		
R74	Residential	B	66	4	70.9	70.5	-0.4	Y
R75	Residential	B	66	4	71.4	71.6	0.2	Y
R76	Residential	B	66	2	72.0	72.5	0.5	Y
R77	Residential	B	66	1	72.9	73.3	0.4	Y
R78	Residential	B	66	2	68.2	68.2	0.0	Y
R79	Residential	B	66	1	68.3	67.9	-0.4	Y
R80	Residential	B	66	2	68.5	67.7	-0.8	Y
R81	Residential	B	66	2	68.7	66.7	-2.0	Y
R82	Residential	B	66	2	67.4	65.2	-2.2	N
R83	Residential	B	66	1	68.0	65.1	-2.9	N
R84	Residential	B	66	1	68.5	66.6	-1.9	Y
R85	Residential	B	66	1	68.9	68.1	-0.8	Y
R86	Church	D	51	4	48.8	49.1	0	N
R87	Residential	B	66	2	73.3	73.6	0.3	Y
R88	Residential	B	66	1	73.4	73.7	0.3	Y
R89	Residential	B	66	1	73.5	73.8	0.3	Y
R90	Residential	B	66	1	73.2	73.6	0.4	Y
R91	Residential	B	66	1	72.9	73.5	0.6	Y
R92	Residential	B	66	1	72.3	71.5	-0.8	Y
R93	Residential	B	66	1	72.6	71.8	-0.8	Y
R94	Residential	B	66	2	72.0	71.2	-0.8	Y
R95	Residential	B	66	2	69.5	69.1	-0.4	Y
R96	Residential	B	66	1	70.3	70.3	0.0	Y
R97	Residential	B	66	2	70.5	70.6	0.1	Y
R98	Residential	B	66	2	69.9	70.2	0.3	Y
R99	Residential	B	66	1	69.6	69.6	0.0	Y
R100	Residential	B	66	2	66.5	65.6	-0.9	N
R101	Residential	B	66	1	67.6	65.8	-1.8	N

Receiver ID	Noise Level, dB(A) Leq(1h)			Receptors	Noise Level		Change	Impact
	Description	**Category****	**Criteria, Leq(1h)**		2017 Leq(1h)	2041 Leq(1h)		
R102	Residential	B	66	2	66.0	65.3	-0.7	N
R103	Residential	B	66	1	65.7	64.9	-0.8	N
R104	Residential	B	66	2	65.5	64.9	-0.6	N
R105	Residential	B	66	1	66.1	64.9	-1.2	N
R106	Church	D	51	4	43.6	41.6	-2.0	N
R106A	School Playground	C	66	12	67.1	66.7	-0.4	Y
R107	Institutional	D	51	1	43.8	43.5	-0.3	N
R108	Residential	B	66	2	67.9	67.4	-0.5	Y
R109	Residential	B	66	1	67.0	66.4	-0.6	Y
R110	Residential	B	66	2	67.2	66.2	-1.0	Y
R111	Church	D	51	3	44.1	42.8	-1.3	N
R112	Church	D	51	4	42.4	45.3	2.9	N
R113A	Residential	B	66	6	69.0	66.1	-2.9	Y
R114-1	Residential	B	66	10	66.8	64.5	-2.3	N
R114-2	Residential	B	66	10	67.9	65.1	-2.8	N
R114-3	Residential	B	66	10	68.7	65.7	-3.0	N
R115-1	Residential	B	66	10	64.4	62.2	-2.2	N
R115-2	Residential	B	66	10	65.8	63.0	-2.8	N
R115-3	Residential	B	66	10	66.7	64.0	-2.7	N
R116-1	Residential	B	66	11	65.5	63.5	-2.0	N
R116-2	Residential	B	66	11	66.7	64.2	-2.5	N
R116-3	Residential	B	66	11	67.8	65.3	-2.5	N
R117-1	Residential	B	66	11	57.4	56.1	-1.3	N
R117-2	Residential	B	66	11	58.6	56.9	-1.7	N
R117-3	Residential	B	66	11	59.3	57.9	-1.4	N
R118-1	Residential	B	66	11	67.0	64.4	-2.6	N
R118-2	Residential	B	66	11	68.2	65.1	-3.1	N

Receiver ID	Noise Level, dB(A) Leq(1h)			Receptors	Noise Level		Change	Impact
	Description	Category**	Criteria, Leq(1h)		2017 Leq(1h)	2041 Leq(1h)		
R118-3	Residential	B	66	10	69.0	66.1	-2.9	Y
R119-1	Residential	B	66	10	68.6	67.8	-0.8	Y
R119-2	Residential	B	66	10	70.2	69.0	-1.2	Y
R119-3	Residential	B	66	10	71.0	69.9	-1.1	Y
R120-1	Monon Trail	C	66	2	70.3	65.6	-4.7	N
R120-2	Monon Trail	C	66	2	69.5	64.2	-5.3	N
R120-3	Monon Trail	C	66	2	68.9	69.2	0.3	Y
R120-5	Monon Trail	C	66	2	66.7	65.8	-0.9	N
R120-6	Monon Trail	C	66	2	64.9	63.9	-1.0	N
R121	Soccer Fields	C	66	1	64.3	63.6	-0.7	N
R122	Soccer Fields	C	66	6	64.0	63.5	-0.5	N
R123	Residential	B	66	6	61.2	61.2	0.0	N
R124	Residential	B	66	1	61.1	61.3	0.2	N
R125	Residential	B	66	1	61.0	61.1	0.1	N
R126	Residential	B	66	2	61.8	61.8	0.0	N
R127	Residential	B	66	2	62.2	62.0	-0.2	N
R128	Residential	B	66	2	60.7	60.9	0.2	N
R129	Residential	B	66	1	61.4	61.3	-0.1	N
R130	Residential	B	66	1	61.8	61.6	-0.2	N
R131	Residential	B	66	2	62.9	62.5	-0.4	N
R132	Residential	B	66	1	60.7	60.7	0.0	N
R133	Residential	B	66	1	61.6	61.4	-0.2	N
R134	Residential	B	66	2	62.5	62.0	-0.5	N
R135	Residential	B	66	2	63.4	62.5	-0.9	N
R136	Residential	B	66	1	63.8	62.7	-1.1	N
R137	Residential	B	66	2	64.4	62.9	-1.5	N
R138	Residential	B	66	2	60.1	60.1	0.0	N
R139	Residential	B	66	2	61.0	60.9	-0.1	N

Receiver ID	Noise Level, dB(A) Leq(1h)			Receptors	Noise Level		Change	Impact
	Description	**Category****	**Criteria, L_{eq}(1h)**		2017 Leq(1h)	2041 Leq(1h)		
R140	Residential	B	66	1	61.9	61.6	-0.3	N
R141	Residential	B	66	1	62.9	62.2	-0.7	N
R142	Residential	B	66	2	61.6	61.2	-0.4	N
R143	Residential	B	66	1	65.2	63.3	-1.9	N
R144	Residential	B	66	1	65.0	63.2	-1.8	N
R145	Residential	B	66	1	64.5	63.0	-1.5	N
R146	Residential	B	66	1	64.0	62.4	-1.6	N
R147	Residential	B	66	1	67.2	63.9	-3.3	N
R148	Residential	B	66	1	68.0	63.9	-4.1	N
R149	Residential	B	66	1	69.0	63.9	-5.1	N
R150	Residential	B	66	1	68.5	65.1	-3.4	N
R151	Residential	B	66	1	62.4	61.0	-1.4	N
R152	Residential	B	66	1	61.4	60.9	-0.5	N
R153	Residential	B	66	1	70.6	65.5	-5.1	N
R154	Residential	B	66	1	70.0	66.4	-3.6	Y
R155	Residential	B	66	1	68.6	66.0	-2.6	Y
R156	Residential	B	66	2	67.2	65.3	-1.9	N
R156-2	Residential	B	66	2	68.7	66.0	-2.7	Y
R157	Residential	B	66	2	65.7	64.3	-1.4	N
R157-2	Residential	B	66	2	66.6	64.6	-2.0	N
R158	Residential	B	66	2	57.9	56.9	-1.0	N
R159	Residential	B	66	2	63.5	63.0	-0.5	N
R160	Residential	B	66	2	65.1	64.1	-1.0	N
R161 (HP3)	Non-Profit	C/D	66	1	70.4	66.7	-3.7	Y
R162	Non-Profit	C	66	1	57.9	56.6	-1.3	N
R162-1	Non-Profit	D	51	1	49.0	45.9	-3.1	N
R164	Residential	B	66	3	63.4	62.6	-0.8	N
R165	Residential	B	66	3	61.0	60.8	-0.2	N

Receiver ID	Noise Level, dB(A) Leq(1h)			Receptors	Noise Level		Change	Impact
	Description	Category**	Criteria, Leq(1h)		2017 Leq(1h)	2041 Leq(1h)		
R166	Residential	B	66	3	61.6	61.5	-0.1	N
R167	Residential	B	66	3	63.6	63.2	-0.4	N
R168	Residential	B	66	2	64.4	63.6	-0.8	N
R169	Residential	B	66	2	66.5	65.2	-1.3	N
R170	Residential	B	66	1	68.6	64.9	-3.7	N
R171	Residential	B	66	1	69.2	64.3	-4.9	N
R172	Residential	B	66	2	66.4	64.5	-1.9	N
R173	Residential	B	66	2	65.8	64.5	-1.3	N
R174	Residential	B	66	2	64.7	63.9	-0.8	N
R175	Residential	B	66	2	64.3	63.5	-0.8	N
R176	Residential	B	66	1	63.6	63.2	-0.4	N
R177	Residential	B	66	1	61.0	61.3	0.3	N
R178	Residential	B	66	1	60.4	60.7	0.3	N
R179	Residential	B	66	2	60.2	60.0	-0.2	N
R180	Residential	B	66	2	61.5	61.3	-0.2	N
R181	Residential	B	66	2	62.9	62.6	-0.3	N
R182	Residential	B	66	2	64.2	63.5	-0.7	N
R183	Residential	B	66	2	66.3	64.5	-1.8	N
R184	Residential	B	66	2	68.8	64.5	-4.3	N
R185	Residential	B	66	2	68.9	64.5	-4.4	N
R186	Residential	B	66	2	69.0	64.5	-4.5	N
R187	Residential	B	66	2	68.3	64.6	-3.7	N
R188	Residential	B	66	2	66.2	64.8	-1.4	N
R189	Residential	B	66	2	64.5	64.0	-0.5	N
R190	Residential	B	66	2	63.6	63.5	-0.1	N
R191	Residential	B	66	1	63.4	63.1	-0.3	N
R191-2	Residential	B	66	1	65.9	64.5	-1.4	N
R192	Residential	B	66	1	63.3	63.0	-0.3	N

Receiver ID	**Noise Level, dB(A) Leq(1h)**			**Receptors**	**Noise Level**		Change	Impact
	Description	**Category****	**Criteria, Leq(1h)**		2017 Leq(1h)	2041 Leq(1h)		
R192-2	Residential	B	66	1	65.7	64.4	-1.3	N
R193	Residential	B	66	2	61.9	61.8	-0.1	N
R200	Residential	B	66	1	59.7	59.2	-0.5	N
R201	Residential	B	66	1	59.5	59.0	-0.5	N
R202	Residential	B	66	1	59.4	59.1	-0.3	N
R203	Residential	B	66	1	59.4	59.0	-0.4	N
R204	Residential	B	66	1	60.3	59.0	-1.3	N
R205	Church	C	66	1	54.5	52.4	-2.1	N
R205-1	Church	D	51	16	47.4	44.8	-2.6	N
R206 (HP4)	Non-Profit	C/D	66	32	65.1	63.6	-1.5	N
R207	Residential	B	66	1	67.3	64.8	-2.5	N
R208	Residential	B	66	1	67.3	64.9	-2.4	N
R220	Office Building	E	71	1	69.3	67.1	-2.2	N
R221 (HP5)	Residential	HP	100	0	63.1	62.2	-0.9	N
R222 (HP6)	Residential	B	66	4	69.3	66.5	-2.8	Y
R223 (HP8)	Residential	HP	100	0	70.8	68.6	-2.2	N
R224 (HP7)	Residential	B	66	1	66.3	63.8	-2.5	N
R225	Office Building	E	71	1	70.0	68.1	-1.9	N
R226	Residential	B	66	1	70.7	68.2	-2.5	Y
R227	Residential	B	66	2	71.7	69.3	-2.4	Y
R228	Residential	B	66	1	66.4	64.3	-2.1	N
R229	Residential	B	66	1	58.8	56.8	-2.0	N
R300	Residential	B	66	2	62.1	59.6	-2.5	N
R301	Residential	B	66	1	66.8	64.3	-2.5	N
R302	Residential	B	66	2	66.9	63.7	-3.2	N
R303	Residential	B	66	2	66.0	61.8	-4.2	N
R305 (HP 12)	Residential	HP	100	0	61.4	60.5	-0.9	N
R306	Residential	B	66	1	61.4	60.4	-1.0	N

Receiver ID	Noise Level, dB(A) Leq(1h)			Receptors	Noise Level		Change	Impact
	Description	Category**	Criteria, L_{eq}(1h)		2017 Leq(1h)	2041 Leq(1h)		
R307	Residential	B	66	2	62.6	61.5	-1.1	N
R308	Residential	B	66	2	62.7	61.5	-1.2	N
R309	Residential	B	66	1	62.6	61.7	-0.9	N
R310	Residential	B	66	2	62.6	61.6	-1.0	N
R311	Residential	B	66	2	62.3	61.0	-1.3	N
R312	Residential	B	66	1	60.2	59.3	-0.9	N
R313	Residential	B	66	2	59.6	58.9	-0.7	N
R314 (HP13)	Residential	HP	100	0	58.3	57.8	-0.5	N
R315 (HP14)	Residential	HP	100	0	58.2	57.8	-0.4	N
R320	Residential	B	66	1	61.8	60.1	-1.7	N
R321	Residential	B	66	4	60.3	59.4	-0.9	N
R322	Residential	B	66	2	67.7	65.0	-2.7	N
R323	Residential	B	66	3	67.1	64.4	-2.7	N
R324	Residential	B	66	3	68.4	65.0	-3.4	N
R325	Residential	B	66	2	67.8	64.8	-3.0	N
R326	Office Building	E	71	0	70.1	68.4	-1.7	N
R327	Residential	B	66	5	64.9	62.9	-2.0	N
R328	Residential	B	66	2	62.6	61.0	-1.6	N
R329	Residential	B	66	1	62.5	60.0	-2.5	N
R330	Residential	B	66	1	62.7	59.9	-2.8	N
R331	Residential	B	66	2	62.8	60.8	-2.0	N
R332	Residential	B	66	2	60.8	60.0	-0.8	N
R333	Residential	B	66	4	62.6	61.8	-0.8	N
R334	Residential	B	66	1	63.2	61.9	-1.3	N
R335	Residential	B	66	2	62.6	61.0	-1.6	N
R336	Residential	B	66	2	62.6	61.4	-1.2	N
R337	Residential	B	66	8	60.2	59.5	-0.7	N
R338	Residential	B	66	2	62.1	61.2	-0.9	N

Receiver ID	Noise Level, dB(A) Leq(1h)			Receptors	Noise Level		Change	Impact
	Description	**Category****	**Criteria, Leq(1h)**		2017 Leq(1h)	2041 Leq(1h)		
R339	Residential	B	66	1	61.5	60.6	-0.9	N
R340	Residential	B	66	2	61.3	60.5	-0.8	N
R341	Residential	B	66	2	61.1	60.5	-0.6	N
R342	Residential	B	66	4	56.6	56.6	0.0	N
R343	Residential	B	66	7	60.8	60.5	-0.3	N
R344 (HP9)	Residential	HP	100	0	59.9	59.5	-0.4	N
R350	Residential	B	66	5	70.5	65.8	-4.7	N
R351	Residential	B	66	1	64.5	64.2	-0.3	N
R352	Residential	B	66	2	65.4	64.8	-0.6	N
R353	Residential	B	66	1	64.9	64.0	-0.9	N
R354	Residential	B	66	2	65.1	63.0	-2.1	N
R355	Residential	B	66	1	64.9	62.8	-2.1	N
R357	Residential	B	66	1	63.8	61.6	-2.2	N
R358	Residential	B	66	2	61.9	61.2	-0.7	N
R359	Residential	B	66	2	61.0	60.2	-0.8	N
R360	Residential	B	66	2	57.8	57.4	-0.4	N
R361	Residential	B	66	3	59.6	59.4	-0.2	N
R362	Residential	B	66	3	59.5	59.0	-0.5	N
R363	Residential	B	66	3	57.0	57.5	0.5	N
R364	Residential	B	66	3	58.6	57.9	-0.7	N
R365	Residential	B	66	3	57.3	56.4	-0.9	N
R366	Residential	B	66	2	58.0	58.0	0.0	N
R367	Residential	B	66	2	58.5	58.6	0.1	N
R368	Residential	B	66	2	57.3	57.5	0.2	N
R369	Residential	B	66	2	57.3	57.5	0.2	N
R370	Residential	B	66	2	57.4	57.4	0.0	N
R371	Residential	B	66	2	57.4	57.3	-0.1	N
R372	Residential	B	66	2	70.1	63.1	-7.0	N

Receiver ID	Noise Level, dB(A) Leq(1h)			Receptors	Noise Level		Change	Impact
	Description	Category**	Criteria, L_{eq}(1h)		2017 Leq(1h)	2041 Leq(1h)		
R373	Residential	B	66	2	70.0	63.6	-6.4	N
R374	Residential	B	66	2	70.0	64.7	-5.3	N
R375	Residential	B	66	2	69.7	65.0	-4.7	N
R376	Residential	B	66	4	70.2	66.6	-3.6	Y
R377	Residential	B	66	4	71.5	66.7	-4.8	Y
R378	Residential	B	66	4	71.5	66.7	-4.8	Y
R379	Residential	B	66	4	71.6	66.8	-4.8	Y
R380	Residential	B	66	6	59.4	58.7	-0.7	N
R381	Residential	B	66	6	60.8	59.4	-1.4	N
R382	Residential	B	66	4	60.1	58.7	-1.4	N
R383	Residential	B	66	4	56.5	54.9	-1.6	N
R384	Residential	B	66	4	54.0	52.9	-1.1	N
R385	Residential	B	66	4	61.5	59.9	-1.6	N
R386	Residential	B	66	5	59.6	58.1	-1.5	N
R387	Residential	B	66	2	54.6	54.9	0.3	N
R387-2	Residential	B	66	2	59.1	59.5	0.4	N
R388	Residential	B	66	2	60.5	59.1	-1.4	N
R388-2	Residential	B	66	2	63.8	61.8	-2.0	N
R389	Residential	B	66	5	56.9	55.6	-1.3	N
R390	Residential	B	66	1	69.2	65.0	-4.2	N
R391	Residential	B	66	1	64.5	62.4	-2.1	N
R392	Church	D	51	4	44.2	42.0	-2.2	N
R393	Church	D	51	3	37.6	37.6	0.0	N
R394	Restaurant	E	71	1	66.3	64.2	-2.1	N
R395	Residential	B	66	6	67.1	64.7	-2.4	N
R396	Residential	B	66	1	58.1	56.8	-1.3	N
R397	Residential	B	66	1	66.7	63.5	-3.2	N
R397-2	Residential	B	66	2	68.0	64.5	-3.5	N

Receiver ID	**Noise Level, dB(A) Leq(1h)**			**Receptors**	**Noise Level**		Change	Impact
	Description	**Category****	**Criteria, Leq(1h)**		2017 Leq(1h)	2041 Leq(1h)		
R398	Office Buidling	E	71	1	59.8	58.9	-0.9	N
R399	Residential	B	66	3	52.7	52.9	0.2	N
R400	Residential	B	66	1	69.9	69.5	-0.4	Y
R401	Residential	B	66	1	70.0	69.4	-0.6	Y
R402	Residential	B	66	1	69.4	69.4	0.0	Y
R403	Residential	B	66	6	69.6	69.6	0.0	Y
R403-2	Residential	B	66	6	71.6	71.5	-0.1	Y
R403-3	Residential	B	66	6	72.5	72.0	-0.5	Y
R404	Residential	B	66	6	67.5	67.9	0.4	Y
R404-2	Residential	B	66	6	68.9	69.1	0.2	Y
R404-3	Residential	B	66	6	70.1	70.0	-0.1	Y
R405	Residential	B	66	6	59.6	63.3	3.7	N
R405-2	Residential	B	66	6	62.3	64.9	2.6	N
R405-3	Residential	B	66	6	64.9	65.4	0.5	N
R406	Residential	B	66	6	60.2	61.8	1.6	N
R406-2	Residential	B	66	6	61.8	63.0	1.2	N
R406-3	Residential	B	66	6	64.2	63.9	-0.3	N
R407	Restaurant	E	71	1	60.0	61.6	1.6	N
R408	Residential	B	66	4	60.2	61.0	0.8	N
R409	Residential	B	66	1	60.0	60.9	0.9	N
R410-1	Residential	B	66	4	62.3	64.3	2.0	N
R410-2	Residential	B	66	4	66.3	67.3	1.0	Y
R410-3	Residential	B	66	4	67.4	68.3	0.9	Y
R410-4	Residential	B	66	4	68.3	69.0	0.7	Y
R411-1	Residential	B	66	4	63.6	65.3	1.7	N
R411-2	Residential	B	66	4	66.4	67.4	1.0	Y
R411-3	Residential	B	66	4	67.6	68.6	1.0	Y
R411-4	Residential	B	66	4	68.7	69.5	0.8	Y

Receiver ID	Noise Level, dB(A) Leq(1h)			Receptors	Noise Level		Change	Impact
	Description	Category**	Criteria, Leq(1h)		2017 Leq(1h)	2041 Leq(1h)		
R412-1	Residential	B	66	4	64.6	65.9	1.3	N
R412-2	Residential	B	66	4	66.5	67.7	1.2	Y
R412-3	Residential	B	66	4	67.9	68.9	1.0	Y
R412-4	Residential	B	66	4	69.1	70.0	0.9	Y
R413-1	Residential	B	66	4	65.2	66.1	0.9	Y
R413-2	Residential	B	66	4	66.6	68.0	1.4	Y
R413-3	Residential	B	66	4	68.2	69.3	1.1	Y
R413-4	Residential	B	66	4	69.5	70.4	0.9	Y
R414-1	Residential	B	66	4	50.5	51.6	1.1	N
R414-2	Residential	B	66	4	50.8	50.9	0.1	N
R414-3	Residential	B	66	4	51.3	51.2	-0.1	N
R414-4	Residential	B	66	4	54.6	55.0	0.4	N
R415-1	Residential	B	66	4	46.8	48.1	1.3	N
R415-2	Residential	B	66	4	47.8	48.7	0.9	N
R415-3	Residential	B	66	4	49.5	50.2	0.7	N
R415-4	Residential	B	66	4	53.0	53.7	0.7	N
R416-1	Residential	B	66	4	48.0	49.0	1.0	N
R416-2	Residential	B	66	4	50.0	50.8	0.8	N
R416-3	Residential	B	66	4	51.2	51.8	0.6	N
R416-4	Residential	B	66	4	55.5	56.0	0.5	N
R417-1	Residential	B	66	4	46.7	48.5	1.8	N
R417-2	Residential	B	66	4	48.6	49.5	0.9	N
R417-3	Residential	B	66	4	51.1	52.0	0.9	N
R417-4	Residential	B	66	4	55.5	56.1	0.6	N
R418	Residential	B	66	1	52.2	53.0	0.8	N
R419	Residential	B	66	2	57.5	58.8	1.3	N
R419-2	Residential	B	66	2	64.2	65.8	1.6	N
R419-3	Residential	B	66	2	67.2	68.5	1.3	Y

Receiver ID	Noise Level, dB(A) Leq(1h)			Receptors	Noise Level		Change	Impact
	Description	Category**	Criteria, Leq(1h)		2017 Leq(1h)	2041 Leq(1h)		
R419-4	Residential	B	66	2	68.6	69.8	1.2	Y
R419-5	Residential	B	66	4	46.6	47.1	0.5	N
R419-6	Residential	B	66	4	53.8	54.6	0.8	N
R420	Residential	B	66	1	58.5	59.4	0.9	N
R421-1	Residential	B	66	2	59.9	60.5	0.6	N
R421-2	Residential	B	66	2	61.9	62.6	0.7	N
R421-3	Residential	B	66	2	66.8	67.3	0.5	Y
R421-4	Residential	B	66	2	68.5	69.0	0.5	Y
R421-5	Residential	B	66	2	69.1	69.5	0.4	Y
R421-6	Residential	B	66	2	69.4	69.8	0.4	Y
R422	Residential	B	66	1	57.2	57.8	0.6	N
R423	Residential	B	66	2	60.7	61.8	1.1	N
R424	Residential	B	66	2	67.0	66.7	-0.3	Y
R425	Residential	B	66	3	67.3	67.2	-0.1	Y
R426	Residential	B	66	3	64.3	64.5	0.2	N
R427	Residential	B	66	1	62.5	63.2	0.7	N
R428	Residential	B	66	1	62.6	63.3	0.7	N
R429	Residential	B	66	1	62.7	63.4	0.7	N
R430	Residential	B	66	1	62.8	63.5	0.7	N
R431	Residential	B	66	1	62.7	63.2	0.5	N
R432	Residential	B	66	1	62.9	63.5	0.6	N
R433	Residential	B	66	1	62.8	63.3	0.5	N
R434	Residential	B	66	1	61.6	62.0	0.4	N
R435	Residential	B	66	2	61.9	62.0	0.1	N
R436	Residential	B	66	2	62.1	62.1	0.0	N
R437	Residential	B	66	2	62.1	62.0	-0.1	N
R440	Residential	B	66	2	67.7	66.6	-1.1	Y
R441	Residential	B	66	8	64.1	64.4	0.3	N

Receiver ID	Noise Level, dB(A) Leq(1h)			Receptors	Noise Level		Change	Impact
	Description	Category**	Criteria, Leq(1h)		2017 Leq(1h)	2041 Leq(1h)		
R442	Residential	B	66	1	66.5	66.1	-0.4	Y
R443	Residential	B	66	1	64.2	64.8	0.6	N
R444	Residential	B	66	1	65.3	64.9	-0.4	N
R445	Residential	B	66	2	59.6	59.2	-0.4	N
R446	Residential	B	66	3	58.8	58.7	-0.1	N
R447	The Nature Conservancy	C/D	66	1	59.3	59.3	0.0	N
R448	Residential	B	66	2	58.2	57.9	-0.3	N
R449	Indiana City Brewery	E	71	1	51.9	51.7	-0.2	N
R450	Sun King Brewery	E	71	1	53.3	53.5	0.2	N
R451	Easley Winery	E	71	1	58.2	58.5	0.3	N
R452	The Great Divide	E	71	1	67.8	66.9	-0.9	N
R453	Cunningham Restaurant Group Patio	E	71	1	63.3	64.9	1.6	N
R454	Black Market Outdoor Seating	E	71	1	65.8	66.4	0.6	N
R455	Indiana Cultural Trail	C	66	2	66.8	67.8	1.0	Y

APPENDIX E: NOISE BARRIER ANALYSIS RESULTS

I-65/I-70 North Split Noise Barrier Analysis

NB1 - NB I-65 EB I-70 in the southeast quadrant of the interchange along the I-70 EB ramp from the I-65 overpass to approximately 250 feet east of the I-70 EB overpass of Lewis Street. The second segment extends from approximately 10th Street to the I-65 NB over I-70 EB overpass. The third segmnet extends from the I-65 SB/I-70 EB overpass to the I-65 SB/I-70 EB over Lewis Street overpass. This noise barrier examines abatement of future noise levels at receivers R32-R47, R120-1 - R120-3 and R113. (see Appendix F).

Feasibility Criteria

Achieve a 5 dBA reduction at a majority (>50%) of impacted receptors

Reasonability Criteria

Design goal of 7 dBA noise reduction for >50% of benefited first row receptors.
Receptors are considered to be benefited when they receive at a minimum 5.0 dB(A) reduction in the future noise levels.
Cost of noise barrier per benefited receptor shall not exceed $25,000.

Active Receivers	Activity Category	Criteria, Leq (h)	Dwelling Units/Receptors	Row	Existing	Future w/o Barrier	Increase (Future w/o Barrier - Existing)	Future w/ Barrier	Noise Barrier Reduction	Approach or Exceed NAC (Impacted)	Benefited Receptor	Impacted, and 5 dBA reduction	Design Goal: 7 dBA reduction and first row
R32	B	66	1	2	60.1	59.4	-0.7	57.6	1.8	No	No	No	No
R33	B	66	1	2	60.2	59.6	-0.6	57.8	1.8	No	No	No	No
R34	B	66	1	2	60.0	59.6	-0.4	57.7	1.9	No	No	No	No
R35	B	66	2	2	60.1	59.5	-0.6	57.4	2.1	No	No	No	No
R36	B	66	2	2	59.9	59.5	-0.4	57.6	1.9	No	No	No	No
R37	B	66	2	2	59.1	58.8	-0.3	56.5	2.3	No	No	No	No
R38	B	66	1	2	59.5	59.3	-0.2	56.8	2.5	No	No	No	No
R39	B	66	2	2	59.7	59.3	-0.4	56.3	3.0	No	No	No	No
R40	B	66	2	2	61.8	59.5	-2.3	56.0	3.5	No	No	No	No
R41	B	66	2	2	60.7	60.1	-0.6	55.5	4.6	No	No	No	No
R42	B	66	2	2	60.4	60.2	-0.2	56.6	3.6	No	No	No	No
R43	B	66	2	2	59.9	59.6	-0.3	55.5	4.1	No	No	No	No
R44	B	66	1	2	60.6	60.0	-0.6	55.3	4.7	No	No	No	No
R45	B	66	1	2	60.3	59.9	-0.4	55.5	4.4	No	No	No	No
R46	B	66	2	2	60.1	59.7	-0.4	55.7	4.0	No	No	No	No
R47	B	66	3	2	60.5	60.0	-0.5	55.8	4.2	No	No	No	No
R120-1	C	66	2	1	70.3	65.6	-4.7	61.2	4.4	No	No	No	No
R120-2	C	66	2	1	69.5	64.2	-5.3	58.6	5.6	No	Yes	No	No
R120-3	C	66	2	1	68.9	**69.2**	0.3	61.3	7.9	Yes	Yes	Yes	Yes
R113	D	51	24	2	39.6	38.7	-0.9	34.2	4.5	No	No	No	No
						Noise levels that approach or exceed the NAC.							

Feasibility

Number of impacted receptors		Number of impacted receptors receiving a 5 dBA reduction	% of impacted receptors receiving a 5 dBA reduction	Does the noise barrier design achieve a 5 dBA reduction at a majority (>50%) of impacted receptors?	**Yes**
2		2	100%		

Reasonability

Design Goal

First row receptors		First row receptors receiving 7 dBA or more reduction	% of benefited first row receptors with a 7 dBA	Design Goal: Is there a 7 dBA reduction for 50% of the benefited first row receptors?	**No**
6		2	33%		

Cost-effectiveness

Noise Barrier Length (feet)	1,925	Is the cost per benefited receptor less than or equal to $25,000 per benefited receptor receiving a minimum reduction of 5 dBA?	**No**
Noise Barrier Height (feet)	20		
TNM Area of Proposed Barrier, Sqft.	38,487		
Estimated Noise Barrier Cost ($30.00 x Sqft.)	$1,154,610		
Number of Benefited Receptors/Dwelling Units	4		
Cost per receptor	$288,653		

I-65/I-70 North Split Noise Barrier Analysis

NB2 - EB I-70 immediately behind the concrete safety barrier. This barrier segment extends from approxiamtely Columbia to Arsenal Streets. This noise barrier examines abatement of future noise levels at residential receivers R51 through R55, (see Appendix F).

Feasibility Criteria

Achieve a 5 dBA reduction at a majority (>50%) of impacted receptors

Reasonability Criteria

Design goal of 7 dBA noise reduction for >50% of benefited first row receptors.
Receptors are considered to be benefited when they receive at a minimum 5.0 dB(A) reduction in the future noise levels.
Cost of noise barrier per benefited receptor shall not exceed $30,000.

Active Receivers	Activity Category	Criteria, Leq (h)	Dwelling Units/Receptors	Row	Existing	Future w/o Barrier	Increase (Future w/o Barrier - Existing)	Future w/ Barrier	Noise Barrier Reduction	Approach or Exceed NAC (Impacted)	Benefited Receptor	Impacted, and 5 dBA reduction	Design Goal: 7 dBA reduction and first row
R50	D	51	2	1	49.5	47.3	-2.2	45.9	1.4	No	No	No	No
R51	B	66	1	1	71.4	**70.5**	-0.9	65.5	5.0	Yes	Yes	Yes	No
R52	B	66	1	2	70.9	**70.2**	-0.7	65.4	4.8	Yes	No	No	No
R53	B	66	1	2	72.1	**71.2**	-0.9	65.3	5.9	Yes	Yes	Yes	No
R54	B	66	2	1	72.4	**71.6**	-0.8	64.6	7.0	Yes	Yes	Yes	Yes
R55	B	66	1	1	71.9	**71.6**	-0.3	66.6	5.0	Yes	Yes	Yes	No
						Noise levels that approach or exceed the NAC.							

Feasibility

Number of impacted receptors		Number of impacted receptors receiving a 5 dBA reduction	% of impacted receptors receiving a 5 dBA reduction	Does the noise barrier design achieve a 5 dBA reduction at a majority (>50%) of impacted receptors?	**Yes**
6		5	83%		

Reasonability

Design Goal

First row receptors		First row receptors receiving 7 dBA or more reduction	% of benefited first row receptors with a 7 dBA reduction	Design Goal: Is there a 7 dBA reduction for 50% of the benefited first row receptors?	**No**
6		2	33%		

Cost-effectiveness

Noise Barrier Length (feet)	600	Is the cost per benefited receptor less than or equal to $30,000 per benefited receptor receiving a minimum reduction of 5 dBA?	**No**
Noise Barrier Height (feet)	10-12		
TNM Area of Proposed Barrier, Sqft.	6,802		
Estimated Noise Barrier Cost ($30.00 x Sqft.)	$204,060		
Number of Benefited Receptors/Dwelling Units	5		
Cost per receptor	$40,812		

I-65/I-70 North Split Noise Barrier Analysis

NB3E - WB I-70 along the edge of shoulder from the Lawrence Street overpass to the Commerce Drive overpass. This noise barrier examines abatement of future noise levels at residential receivers R70 through R112, (see Appendix F).

Feasibility Criteria

Achieve a 5 dBA reduction at a majority (>50%) of impacted receptors

Reasonability Criteria

Design goal of 7 dBA noise reduction for >50% of benefited first row receptors.
Receptors are considered to be benefited when they receive at a minimum 5.0 dB(A) reduction in the future noise levels.
Cost of noise barrier per benefited receptor shall not exceed $30,000.

Active Receivers	Activity Category	Criteria, Leq (h)	Dwelling Units/Receptors	Row	Existing	Future w/o Barrier	Increase (Future w/o Barrier - Existing)	Future w/ Barrier	Noise Barrier Reduction	Approach or Exceed NAC (Impacted)	Benefited Receptor	Impacted, and 5 dBA reduction	Design Goal: 7 dBA reduction and first row
R70	B	66	1	1	70.1	**70.4**	0.3	69.8	0.6	Yes	No	No	No
R71	B	66	1	2	68.4	**68.3**	-0.1	67.6	0.7	Yes	No	No	No
R72	B	66	2	1	73.5	**73.1**	-0.4	70.6	2.5	Yes	No	No	No
R73	B	66	1	1	71.6	**71.0**	-0.6	66.5	4.5	Yes	No	No	No
R74	B	66	4	1	70.9	**70.5**	-0.4	65.5	5.0	Yes	Yes	Yes	No
R75	B	66	4	1	71.4	**71.6**	0.2	64.9	6.7	Yes	Yes	Yes	No
R76	B	66	2	1	72.0	**72.5**	0.5	64.8	7.7	Yes	Yes	Yes	Yes
R77	B	66	1	1	72.9	**73.3**	0.4	64.9	8.4	Yes	Yes	Yes	Yes
R78	B	66	2	2	68.2	**68.2**	0.0	67.4	0.8	Yes	No	No	No
R79	B	66	1	2	68.3	**67.9**	-0.4	66.9	1.0	Yes	No	No	No
R80	B	66	2	2	68.5	**67.7**	-0.8	66.5	1.2	Yes	No	No	No
R81	B	66	2	2	68.7	**66.7**	-2.0	65.0	1.7	Yes	No	No	No
R82	B	66	2	2	67.4	65.2	-2.2	62.9	2.3	No	No	No	No
R83	B	66	1	2	68.0	65.1	-2.9	62.1	3.0	No	No	No	No
R84	B	66	1	2	68.5	**66.6**	-1.9	60.9	5.7	Yes	Yes	Yes	No
R85	B	66	1	2	68.9	**68.1**	-0.8	62.3	5.8	Yes	Yes	Yes	No
R86	D	66	4	1	48.8	49.1	0.3	40.9	8.2	No	Yes	No	Yes
R87	B	66	2	1	73.3	**73.6**	0.3	65.7	7.9	Yes	Yes	Yes	Yes
R88	B	66	1	1	73.4	**73.7**	0.3	65.8	7.9	Yes	Yes	Yes	Yes
R89	B	66	1	1	73.5	**73.8**	0.3	66.3	7.5	Yes	Yes	Yes	Yes
R90	B	66	1	1	73.2	**73.6**	0.4	65.9	7.7	Yes	Yes	Yes	Yes
R91	B	66	1	1	72.9	**73.5**	0.6	65.7	7.8	Yes	Yes	Yes	Yes
R92	B	66	1	1	72.3	**71.5**	-0.8	65.4	6.1	Yes	Yes	Yes	No
R93	B	66	1	1	72.6	**71.8**	-0.8	66.2	5.6	Yes	Yes	Yes	No
R94	B	66	2	1	72.0	**71.2**	-0.8	66.0	5.2	Yes	Yes	Yes	No
R95	B	66	2	2	69.5	**69.1**	-0.4	64.1	5.0	Yes	Yes	Yes	No
R96	B	66	1	2	70.3	**70.3**	0.0	65.2	5.1	Yes	Yes	Yes	No
R97	B	66	2	2	70.5	**70.6**	0.1	65.5	5.1	Yes	Yes	Yes	No
R98	B	66	2	2	69.9	**70.2**	0.3	64.8	5.4	Yes	Yes	Yes	No
R99	B	66	1	2	69.6	**69.6**	0.0	64.6	5.0	Yes	Yes	Yes	No
R100	B	66	2	2	66.5	65.7	-0.8	65.2	0.5	No	No	No	No
R101	B	66	1	1	67.6	65.9	-1.7	65.6	0.3	No	No	No	No
R102	B	66	2	2	66.0	65.5	-0.5	65.1	0.4	No	No	No	No
R112	D	66	1	2	47.4	45.3	-2.1	45.0	0.3	No	No	No	No
						Noise levels that approach or exceed the NAC.							

Feasibility					
Number of impacted receptors		Number of impacted receptors receiving a 5 dBA reduction	% of impacted receptors receiving a 5 dBA reduction	Does the noise barrier design achieve a 5 dBA reduction at a majority (>50%) of impacted receptors?	**Yes**
43		43	100%		

I-65/I-70 North Split Noise Barrier Analysis

<table>
<tr><td colspan="6">Reasonability</td></tr>
<tr><td colspan="6">Design Goal</td></tr>
<tr><td>First row receptors</td><td></td><td>First row receptors receiving 7 dBA or more reduction</td><td>% of benefited first row receptors with a 7 dBA reduction</td><td rowspan="2">Design Goal: Is there a 7 dBA reduction for 50% of the benefited first row receptors?</td><td rowspan="2">Yes</td></tr>
<tr><td>25</td><td></td><td>13</td><td>52%</td></tr>
<tr><td colspan="6">Cost-effectiveness</td></tr>
<tr><td colspan="3">Noise Barrier Length (feet)</td><td>1,615</td><td rowspan="6">Is the cost per benefited receptor less than or equal to $30,000 per benefited receptor receiving a minimum reduction of 5 dBA?</td><td rowspan="6">Yes</td></tr>
<tr><td colspan="3">Noise Barrier Height (feet)</td><td>10-18</td></tr>
<tr><td colspan="3">TNM Area of Proposed Barrier, Sqft.</td><td>23,031</td></tr>
<tr><td colspan="3">Estimated Noise Barrier Cost ($30.00 x Sqft.)</td><td>$690,930</td></tr>
<tr><td colspan="3">Number of Benefited Receptors/Dwelling Units</td><td>35</td></tr>
<tr><td colspan="3">Cost per receptor</td><td>$19,741</td></tr>
</table>

NB 3E Optimized

9/24/2019

I-65/I-70 North Split Noise Barrier Analysis

NB3W - WB I-70 along the edge of shoulder from the Commerce Ave overpass to the Lewis Street/Monon overpass. This noise barrier examines abatement of future noise levels at residential receivers R100 through R119, (see Appendix F).

Feasibility Criteria

Achieve a 5 dBA reduction at a majority (>50%) of impacted receptors

Reasonability Criteria

Design goal of 7 dBA noise reduction for >50% of benefited first row receptors.
Receptors are considered to be benefited when they receive at a minimum 5.0 dB(A) reduction in the future noise levels.
Cost of noise barrier per benefited receptor shall not exceed $25,000.

Active Receivers	Activity Category	Criteria, Leq (h)	Dwelling Units/Receptors	Row	Existing	Future w/o Barrier	Increase (Future w/o Barrier - Existing)	Future w/ Barrier	Noise Barrier Reduction	Approach or Exceed NAC (Impacted)	Benefited Receptor	Impacted, and 5 dBA reduction	Design Goal: 7 dBA reduction and first row
R100	B	66	2	2	66.5	65.6	-0.9	62.3	3.3	No	No	No	No
R101	B	66	1	1	67.6	65.8	-1.8	60.6	5.2	No	Yes	No	No
R102	B	66	2	2	66.0	65.3	-0.7	60.4	4.9	No	No	No	No
R103	B	66	1	2	65.7	64.9	-0.8	59.9	5.0	No	Yes	No	No
R104	B	66	2	2	65.5	64.9	-0.6	59.8	5.1	No	Yes	No	No
R105	B	66	1	2	66.1	64.9	-1.2	59.8	5.1	No	Yes	No	No
R106	D	51	4	1	43.6	41.6	-2.0	35.7	5.9	No	Yes	No	No
R106A	C	66	12	1	67.1	**66.7**	-0.4	59.0	7.7	Yes	Yes	Yes	Yes
R107	D	51	1	1	43.8	43.5	-0.3	35.7	7.8	No	Yes	No	Yes
R108	B	66	2	1	67.9	**67.4**	-0.5	59.3	8.1	Yes	Yes	Yes	Yes
R109	B	66	1	2	67.0	**66.4**	-0.6	59.0	7.4	Yes	Yes	Yes	No
R110	B	66	2	2	67.2	**66.2**	-1.0	58.6	7.6	Yes	Yes	Yes	No
R111	D	51	3	1	44.1	42.8	-1.3	34.4	8.4	No	Yes	No	Yes
R112	D	51	4	2	42.4	45.3	2.9	40.3	5.0	No	Yes	No	No
R113a	B	66	6	1	69.0	**66.1**	-2.9	60.5	5.6	Yes	Yes	Yes	No
R114-1	B	66	10	2	66.8	64.5	-2.3	53.9	10.6	No	Yes	No	No
R114-2	B	66	10	2	67.9	65.1	-2.8	55.0	10.1	No	Yes	No	No
R114-3	B	66	10	2	68.7	65.7	-3.0	56.9	8.8	No	Yes	No	No
R115-1	B	66	10	2	64.4	62.2	-2.2	59.5	2.7	No	No	No	No
R115-2	B	66	10	2	65.8	63.0	-2.8	60.6	2.4	No	No	No	No
R115-3	B	66	10	2	66.7	64.0	-2.7	61.9	2.1	No	No	No	No
R116-1	B	66	11	2	65.5	63.5	-2.0	54.7	8.8	No	Yes	No	No
R116-2	B	66	11	2	66.7	64.2	-2.5	56.5	7.7	No	Yes	No	No
R116-3	B	66	11	2	67.8	65.3	-2.5	59.4	5.9	No	Yes	No	No
R117-1	B	66	11	2	57.4	56.1	-1.3	51.4	4.7	No	No	No	No
R117-2	B	66	11	2	58.6	56.9	-1.7	52.2	4.7	No	No	No	No
R117-3	B	66	11	2	59.3	57.9	-1.4	53.9	4.0	No	No	No	No
R118-1	B	66	11	2	67.0	64.4	-2.6	58.0	6.4	No	Yes	No	No
R118-2	B	66	11	2	68.2	65.1	-3.1	59.2	5.9	No	Yes	No	No
R118-3	B	66	10	2	69.0	**66.1**	-2.9	61.1	5.0	Yes	Yes	Yes	No
R119-1	B	66	10	2	68.6	**67.8**	-0.8	58.2	9.6	Yes	Yes	Yes	No
R119-2	B	66	10	2	70.2	**69.0**	-1.2	59.2	9.8	Yes	Yes	Yes	No
R119-3	B	66	10	2	71.0	**69.9**	-1.1	60.5	9.4	Yes	Yes	Yes	No

Feasibility

Number of impacted receptors		Number of impacted receptors receiving a 5 dBA reduction	% of impacted receptors receiving a 5 dBA reduction	Does the noise barrier design achieve a 5 dBA reduction at a majority (>50%) of impacted receptors?	**Yes**
63		63	100%		

Reasonability

Design Goal

First row receptors		First row receptors receiving 7 dBA or more reduction	% of benefited first row receptors with a 7 dBA reduction	Design Goal: Is there a 7 dBA reduction for 50% of the benefited first row receptors?	**Yes**
29		18	62%		

I-65/I-70 North Split Noise Barrier Analysis

Cost-effectiveness			
Noise Barrier Length (feet)	2,463	Is the cost per benefited receptor less than or equal to $25,000 per benefited receptor receiving a minimum reduction of 5 dBA?	**Yes**
Noise Barrier Height (feet)	12-20		
TNM Area of Proposed Barrier, Sqft.	40,036		
Estimated Noise Barrier Cost ($30.00 x Sqft.)	$1,201,080		
Number of Benefited Receptors/Dwelling Units	165		
Cost per receptor	$7,279		

I-65/I-70 North Split Noise Barrier Analysis

NB4 - North of northbound I-65 along the edge of shoulder from the College Ave overpass to the Central Avenue overpass. This noise barrier examines abatement of future noise levels at residential receivers R143 through R178, (see Appendix F).

Feasibility Criteria

Achieve a 5 dBA reduction at a majority (>50%) of impacted receptors

Reasonability Criteria

Design goal of 7 dBA noise reduction for >50% of benefited first row receptors.
Receptors are considered to be benefited when they receive at a minimum 5.0 dB(A) reduction in the future noise levels.
Cost of noise barrier per benefited receptor shall not exceed $30,000.

Active Receivers	Activity Category	Criteria, Leq (h)	Dwelling Units/Receptors	Row	Existing	Future w/o Barrier	Increase (Future w/o Barrier - Existing)	Future w/ Barrier	Noise Barrier Reduction	Approach or Exceed NAC (Impacted)	Benefited Receptor	Impacted, and 5 dBA reduction	Design Goal: 7 dBA reduction and first row
R143	B	66	1	2	65.2	62.8	-2.4	60.0	2.8	No	No	No	No
R144	B	66	1	2	65.0	62.9	-2.1	59.7	3.2	No	No	No	No
R145	B	66	1	2	64.5	62.6	-1.9	59.4	3.2	No	No	No	No
R146	B	66	1	2	64.0	62.4	-1.6	59.0	3.4	No	No	No	No
R147	B	66	1	2	67.2	63.9	-3.3	60.1	3.8	No	No	No	No
R148	B	66	1	2	68.0	63.9	-4.1	59.8	4.1	No	No	No	No
R149	B	66	1	2	69.0	63.9	-5.1	59.6	4.3	No	No	No	No
R150	B	66	1	2	68.5	65.1	-3.4	58.8	6.3	No	Yes	No	No
R151	B	66	1	2	62.4	61.0	-1.4	57.7	3.3	No	No	No	No
R152	B	66	1	2	61.4	60.9	-0.5	57.2	3.7	No	No	No	No
R153	B	66	1	1	70.6	65.5	-5.1	59.0	6.5	No	Yes	No	No
R154	B	66	1	1	70.0	**66.4**	-3.6	58.9	7.5	Yes	Yes	Yes	Yes
R155	B	66	1	2	68.6	**66.0**	-2.6	58.4	7.6	Yes	Yes	Yes	No
R156	B	66	2	2	67.2	65.3	-1.9	58.3	7.0	No	Yes	No	No
R156-2	B	66	2	2	68.7	**66.0**	-2.7	58.3	7.7	Yes	Yes	Yes	No
R157	B	66	2	2	65.7	64.3	-1.4	55.3	9.0	No	Yes	No	No
R157-2	B	66	2	2	66.6	64.6	-2.0	55.2	9.4	No	Yes	No	No
R158	B	66	2	2	57.9	56.9	-1.0	53.6	3.3	No	No	No	No
R159	B	66	2	2	63.5	63.0	-0.5	56.2	6.8	No	Yes	No	No
R160	B	66	2	2	65.1	64.1	-1.0	56.4	7.7	No	Yes	No	No
R161 (HP3)	C/D	66	1	1	70.4	**66.7**	-3.7	59.0	7.7	Yes	Yes	Yes	Yes
R162	C	66	1	2	57.9	56.6	-1.3	51.8	4.8	No	No	No	No
R162-1	D	66	1	1	49.0	45.9	-3.1	38.4	7.5	No	Yes	No	Yes
R165	B	66	3	2	63.4	60.8	-2.6	54.5	6.3	No	Yes	No	No
R166	B	66	3	2	61.0	61.5	0.5	54.9	6.6	No	Yes	No	No
R164	B	66	3	2	61.6	62.6	1.0	55.9	6.7	No	Yes	No	No
R167	B	66	3	2	63.6	63.2	-0.4	55.7	7.5	No	Yes	No	No
R168	B	66	2	2	64.4	63.6	-0.8	56.1	7.5	No	Yes	No	No
R169	B	66	2	2	66.5	65.2	-1.3	58.2	7.0	No	Yes	No	No
R170	B	66	1	1	68.6	64.9	-3.7	58.7	6.2	No	Yes	No	No
R171	B	66	1	1	69.2	64.3	-4.9	60.3	4.0	No	No	No	No
R172	B	66	2	2	66.4	64.5	-1.9	58.2	6.3	No	Yes	No	No
R173	B	66	2	2	65.8	64.5	-1.3	57.5	7.0	No	Yes	No	No
R174	B	66	2	2	64.7	63.9	-0.8	56.7	7.2	No	Yes	No	No
R175	B	66	2	2	64.3	63.5	-0.8	55.9	7.6	No	Yes	No	No
R176	B	66	1	2	63.6	63.2	-0.4	55.8	7.4	No	Yes	No	No
R177	B	66	1	2	61.0	61.3	0.3	54.5	6.8	No	Yes	No	No
R178	B	66	1	2	60.4	60.7	0.3	54.2	6.5	No	Yes	No	No
R179	B	66	2	2	60.2	60.0	-0.2	55.8	4.2	No	No	No	No
R180	B	66	2	2	61.5	61.3	-0.2	56.7	4.6	No	No	No	No
R181	B	66	2	2	62.9	62.6	-0.3	57.6	5.0	No	Yes	No	No
R182	B	66	2	2	64.2	63.5	-0.7	58.6	4.9	No	No	No	No
R183	B	66	2	2	66.3	64.5	-1.8	59.7	4.8	No	No	No	No
R184	B	66	2	1	68.8	64.5	-4.3	60.5	4.0	No	No	No	No
R185	B	66	2	1	68.9	64.5	-4.4	60.6	3.9	No	No	No	No
R186	B	66	2	1	69.0	64.5	-4.5	60.8	3.7	No	No	No	No
R187	B	66	2	1	68.3	64.6	-3.7	61.4	3.2	No	No	No	No

R188	B	66	2	2	66.2	64.8	-1.4	59.6	5.2	No	Yes	No	No
R189	B	66	2	2	64.5	64.0	-0.5	58.4	5.6	No	Yes	No	No
R190	B	66	2	2	63.6	63.5	-0.1	57.8	5.7	No	Yes	No	No
R191	B	66	1	2	63.4	63.1	-0.3	57.7	5.4	No	Yes	No	No
R191-2	B	66	1	2	65.9	64.5	-1.4	59.8	4.7	No	No	No	No
R192	B	66	1	2	63.3	63.0	-0.3	57.6	5.4	No	Yes	No	No
R192-2	B	66	1	2	65.7	64.4	-1.3	59.7	4.7	No	No	No	No
R193	B	66	2	2	61.9	61.8	-0.1	56.3	5.5	No	Yes	No	No
R200	B	66	1	2	59.7	59.2	-0.5	55.9	3.3	No	No	No	No
R201	B	66	1	2	59.5	59.0	-0.5	56.6	2.4	No	No	No	No
R202	B	66	1	2	59.4	59.1	-0.3	57.1	2.0	No	No	No	No
R203	B	66	1	2	59.4	59.0	-0.4	57.5	1.5	No	No	No	No
R204	B	66	1	2	60.3	59.0	-1.3	57.9	1.1	No	No	No	No
R205	C	66	1	1	54.5	52.4	-2.1	51.8	0.6	No	No	No	No
R206 (HP4)	C/D	66	1	1	65.1	63.6	-1.5	63.6	0.0	No	No	No	No
R207	B	66	1	1	67.3	64.8	-2.5	64.0	0.8	No	No	No	No
R208	B	66	1	1	67.3	64.9	-2.4	63.8	1.1	No	No	No	No
R205-1	D	51	1	1	42.4	44.8	2.4	44.4	0.4	No	No	No	No
						>65.9 - Noise levels that approach or exceed the NAC.							

Feasibility

Number of impacted receptors		Number of impacted receptors receiving a 5 dBA reduction	% of impacted receptors receiving a 5 dBA reduction	Does the noise barrier design achieve a 5 dBA reduction at a majority (>50%) of impacted receptors?	**Yes**
5		5	100%		

Reasonability

Design Goal

First row receptors		First row receptors receiving 7 dBA or more reduction	% of benefited first row receptors with a 7 dBA reduction	Design Goal: Is there a 7 dBA reduction for 50% of the benefited first row receptors?	**Yes**
5		3	60%		

Cost-effectiveness

Noise Barrier Length (feet)	2,325	Is the cost per benefited receptor less than or equal to $30,000 per benefited receptor receiving a minimum reduction of 5 dBA?	**Yes**
Noise Barrier Height (feet)	12-20		
TNM Area of Proposed Barrier, Sqft.	42,449		
Estimated Noise Barrier Cost ($30.00 x Sqft.)	$1,273,470		
Number of Benefited Receptors/Dwelling Units	58		
Cost per receptor	$21,956		

NB5 - SB I-65 immediately behind the concrete safety barrier from the Central Ave overpass to the Alabama Street overpass. This noise barrier examines abatement of future noise levels at residential receivers R225 through R398, (see Appendix F).

Feasibility Criteria

Achieve a 5 dBA reduction at a majority (>50%) of impacted receptors

Reasonability Criteria

Design goal of 7 dBA noise reduction for >50% of benefited first row receptors.
Receptors are considered to be benefited when they receive at a minimum 5.0 dB(A) reduction in the future noise levels.
Cost of noise barrier per benefited receptor shall not exceed $25,000.

Active Receivers	Activity Category	Criteria, Leq (h)	Dwelling Units/Receptors	Row	Existing	Future w/o Barrier	Increase (Future w/o Barrier - Existing)	Future w/ Barrier	Noise Barrier Reduction	Approach or Exceed NAC (Impacted)	Benefited Receptor	Impacted, and 5 dBA reduction	Design Goal: 7 dBA reduction and first row
R228	B	66	1	2	66.4	64.3	-2.1	63.5	0.8	No	No	No	No
R229	B	66	1	2	58.8	57.0	-1.8	54.7	2.3	No	No	No	No
R300	B	66	2	2	62.1	59.7	-2.4	58.2	1.5	No	No	No	No
R301	B	66	1	2	66.8	64.2	-2.6	63.3	0.9	No	No	No	No
R302	B	66	2	2	66.9	63.6	-3.3	62.4	1.2	No	No	No	No
R303	B	66	2	2	66.0	61.8	-4.2	60.8	1.0	No	No	No	No
R306	B	66	1	2	61.4	60.3	-1.1	58.8	1.5	No	No	No	No
R307	B	66	2	2	62.6	61.4	-1.2	60.6	0.8	No	No	No	No
R308	B	66	2	2	62.7	61.5	-1.2	60.7	0.8	No	No	No	No
R309	B	66	1	2	62.6	61.7	-0.9	60.7	1.0	No	No	No	No
R310	B	66	2	2	62.6	61.5	-1.1	60.4	1.1	No	No	No	No
R311	B	66	2	2	62.3	61.0	-1.3	59.3	1.7	No	No	No	No
R312	B	66	1	2	60.2	59.4	-0.8	57.8	1.6	No	No	No	No
R313	B	66	2	2	59.6	59.0	-0.6	57.5	1.5	No	No	No	No
R314	E	71	0	2	58.3	57.9	-0.4	56.7	1.2	No	No	No	No
R315	B	66	0	2	58.2	58.0	-0.2	56.3	1.7	No	No	No	No
R320	B	66	1	2	61.8	60.1	-1.7	58.2	1.9	No	No	No	No
R321	B	66	4	2	60.3	59.4	-0.9	56.8	2.6	No	No	No	No
R322	B	66	2	1	67.7	65.0	-2.7	57.1	7.9	No	Yes	No	Yes
R323	B	66	3	1	67.1	64.4	-2.7	55.7	8.7	No	Yes	No	Yes
R324	B	66	3	1	68.4	65.0	-3.4	56.2	8.8	No	Yes	No	Yes
R325	B	66	2	1	67.8	64.7	-3.1	56.8	7.9	No	Yes	No	Yes
R326	E	71	0	2	70.1	**68.4**	-1.7	60.5	7.9	Yes	Yes	Yes	No
R327	B	66	5	2	64.9	62.9	-2.0	56.1	6.8	No	Yes	No	No
R328	B	66	2	2	62.6	61.0	-1.6	58.5	2.5	No	No	No	No
R329	B	66	1	2	62.5	60.0	-2.5	57.6	2.4	No	No	No	No
R330	B	66	1	2	62.7	59.9	-2.8	58.3	1.6	No	No	No	No
R331	B	66	2	2	62.8	60.8	-2.0	58.4	2.4	No	No	No	No
R332	B	66	2	2	60.8	59.9	-0.9	57.4	2.5	No	No	No	No
R333	B	66	4	2	62.6	61.8	-0.8	55.7	6.1	No	Yes	No	No
R334	B	66	1	2	63.2	61.9	-1.3	59.4	2.5	No	No	No	No
R335	B	66	2	2	62.6	61.0	-1.6	58.0	3.0	No	No	No	No
R336	B	66	2	2	62.6	61.5	-1.1	58.8	2.7	No	No	No	No
R337	B	66	8	2	60.2	59.6	-0.6	57.1	2.5	No	No	No	No
R338	B	66	2	2	62.1	61.3	-0.8	58.6	2.7	No	No	No	No
R339	B	66	1	2	61.5	60.7	-0.8	57.9	2.8	No	No	No	No
R340	B	66	2	2	61.3	60.5	-0.8	57.8	2.7	No	No	No	No
R341	B	66	2	2	61.1	60.5	-0.6	57.6	2.9	No	No	No	No
R342	B	66	4	2	56.6	56.8	0.2	53.4	3.4	No	No	No	No
R343	B	66	7	2	60.8	60.5	-0.3	56.5	4.0	No	No	No	No
R344 (HP9)	E	71	0	2	59.9	59.5	-0.4	55.6	3.9	No	No	No	No
R350	B	66	5	1	70.5	65.8	-4.7	59.3	6.5	No	Yes	No	No
R351	B	66	1	2	64.5	64.2	-0.3	55.6	8.6	No	Yes	No	No
R352	B	66	2	2	65.4	64.8	-0.6	57.4	7.4	No	Yes	No	No
R353	B	66	1	2	64.9	63.9	-1.0	57.0	6.9	No	Yes	No	No
R354	B	66	2	2	65.1	63.0	-2.1	57.2	5.8	No	Yes	No	No
R355	B	66	1	2	64.9	62.8	-2.1	56.7	6.1	No	Yes	No	No
R357	B	66	1	2	63.8	61.6	-2.2	56.1	5.5	No	Yes	No	No
R358	B	66	2	2	61.9	61.2	-0.7	51.8	9.4	No	Yes	No	No

R359	B	66	2	2	61.0	60.2	-0.8	51.4	8.8	No	Yes	No	No
R360	B	66	2	2	57.8	57.3	-0.5	51.0	6.3	No	Yes	No	No
R361	B	66	3	2	59.6	59.4	-0.2	52.3	7.1	No	Yes	No	No
R362	B	66	3	2	59.5	59.0	-0.5	51.7	7.3	No	Yes	No	No
R363	B	66	3	2	57.0	57.4	0.4	51.3	6.1	No	Yes	No	No
R364	B	66	3	2	58.6	57.9	-0.7	51.5	6.4	No	Yes	No	No
R365	B	66	3	2	57.3	56.4	-0.9	51.8	4.6	No	No	No	No
R366	B	66	2	2	58.0	57.9	-0.1	51.7	6.2	No	Yes	No	No
R367	B	66	2	2	58.5	58.6	0.1	52.0	6.6	No	Yes	No	No
R368	B	66	2	2	57.3	57.5	0.2	51.4	6.1	No	Yes	No	No
R369	B	66	2	2	57.3	57.4	0.1	52.2	5.2	No	Yes	No	No
R370	B	66	2	2	57.4	57.4	0.0	51.9	5.5	No	Yes	No	No
R371	B	66	2	2	57.4	57.3	-0.1	51.9	5.4	No	Yes	No	No
R372	B	66	2	1	70.1	63.1	-7.0	57.8	5.3	No	Yes	No	No
R373	B	66	2	1	70.0	63.6	-6.4	57.5	6.1	No	Yes	No	No
R374	B	66	2	1	70.0	64.7	-5.3	57.5	7.2	No	Yes	No	Yes
R375	B	66	2	1	69.7	64.9	-4.8	57.9	7.0	No	Yes	No	Yes
R376	B	66	4	2	70.2	**66.6**	-3.6	59.0	7.6	Yes	Yes	Yes	No
R377	B	66	4	2	71.5	**66.7**	-4.8	58.7	8.0	Yes	Yes	Yes	No
R378	B	66	4	2	71.5	**66.7**	-4.8	58.7	8.0	Yes	Yes	Yes	No
R379	B	66	4	2	71.6	**66.8**	-4.8	58.7	8.1	Yes	Yes	Yes	No
R380	B	66	6	2	59.4	58.6	-0.8	53.9	4.7	No	No	No	No
R381	B	66	6	2	60.8	59.3	-1.5	55.0	4.3	No	No	No	No
R382	B	66	4	2	60.1	58.6	-1.5	54.7	3.9	No	No	No	No
R383	B	66	4	2	56.5	54.9	-1.6	50.0	4.9	No	No	No	No
R384	B	66	4	2	54.0	52.8	-1.2	49.3	3.5	No	No	No	No
R385	B	66	4	2	61.5	59.9	-1.6	53.7	6.2	No	Yes	No	No
R386	B	66	5	2	59.6	58.1	-1.5	51.6	6.5	No	Yes	No	No
R387	B	66	2	2	54.6	54.9	0.3	52.9	2.0	No	No	No	No
R388	B	66	2	2	60.5	59.1	-1.4	56.4	2.7	No	No	No	No
R389	B	66	5	2	56.9	55.5	-1.4	48.6	6.9	No	Yes	No	No
R390	E	71	1	2	69.2	65.0	-4.2	58.7	6.3	No	Yes	No	No
R391	B	66	1	2	64.5	62.4	-2.1	57.3	5.1	No	Yes	No	No
R392	D	51	1	2	39.2	37.0	-2.2	36.8	0.2	No	No	No	No
R393	D	51	1	2	32.6	32.3	-0.3	34.8	-2.5	No	No	No	No
R394	E	71	1	2	66.3	64.2	-2.1	63.1	1.1	No	No	No	No
R395	B	66	6	2	67.1	64.7	-2.4	64.4	0.3	No	No	No	No
R397	B	66	1	2	66.7	63.4	-3.3	58.8	4.6	No	No	No	No
R397-2	B	66	2	2	68.0	64.5	-3.5	57.9	6.6	No	Yes	No	No
R396	B	66	1	2	58.1	56.8	-1.3	55.8	1.0	No	No	No	No
R399	B	66	3	2	52.7	52.9	0.2	49.9	3.0	No	No	No	No
R388-2	B	66	2	2	63.8	61.8	-2.0	58.7	3.1	No	No	No	No
R387-2	B	66	2	2	59.1	59.5	0.4	56.0	3.5	No	No	No	No
R398	E	71	1	2	59.8	58.9	-0.9	58.5	0.4	No	No	No	No
						Noise levels that approach or exceed the NAC.							

Feasibility					
Number of impacted receptors		Number of impacted receptors receiving a 5 dBA reduction	% of impacted receptors receiving a 5 dBA reduction	Does the noise barrier design achieve a 5 dBA reduction at a majority (>50%) of impacted receptors?	**Yes**
16		16	100%		
Reasonability					
Design Goal					
First row receptors		First row receptors receiving 7 dBA or more reduction	% of benefited first row receptors with a 7 dBA reduction	Design Goal: Is there a 7 dBA reduction for 50% of the benefited first row receptors?	**Yes**
23		14	61%		
Cost-effectiveness					

Noise Barrier Length (feet)	2,001	Is the cost per benefited receptor less than or equal to $25,000 per benefited receptor receiving a minimum reduction of 5 dBA?	**Yes**
Noise Barrier Height (feet)	12-20		
TNM Area of Proposed Barrier, Sqft.	33,562		
Estimated Noise Barrier Cost ($30.00 x Sqft.)	$1,006,860		
Number of Benefited Receptors/Dwelling Units	104		
Cost per receptor	$9,681		

I-65/I-70 North Split Noise Barrier Analysis

NB6 - SB I-65 from approximately Pennsylvania Street to approximately 200 feet east of Alabama along the edge of shoulder. This noise barrier examines abatement of future noise levels at residential receivers R220 through R342, (see Appendix F).

Feasibility Criteria

Achieve a 5 dBA reduction at a majority (>50%) of impacted receptors

Reasonability Criteria

Design goal of 7 dBA noise reduction for >50% of benefited first row receptors.
Receptors are considered to be benefited when they receive at a minimum 5.0 dB(A) reduction in the future noise levels.
Cost of noise barrier per benefited receptor shall not exceed $30,000.

Active Receivers	Activity Category	Criteria, Leq (h)	Dwelling Units/Receptors	Row	Existing	Future w/o Barrier	Increase (Future w/o Barrier - Existing)	Future w/ Barrier	Noise Barrier Reduction	Approach or Exceed NAC (Impacted)	Benefited Receptor	Impacted, and 5 dBA reduction	Design Goal: 7 dBA reduction and first row
R222 (HP6)	B	66	4	1	69.3	**66.5**	-2.8	61.5	5.0	Yes	Yes	Yes	No
R224 (HP7)	B	66	1	2	66.3	63.8	-2.5	59.6	4.2	No	No	No	No
R225	B	66	1	1	70.0	**68.1**	-1.9	60.9	7.2	Yes	Yes	Yes	Yes
R226	B	66	1	1	70.7	**68.2**	-2.5	60.2	8.0	Yes	Yes	Yes	Yes
R227	B	66	2	1	71.7	**69.3**	-2.4	61.8	7.5	Yes	Yes	Yes	Yes
R228	B	66	1	2	66.4	64.3	-2.1	58.2	6.1	No	Yes	No	No
R229	B	66	1	2	58.8	56.8	-2.0	55.6	1.2	No	No	No	No
R300	B	66	2	2	62.1	59.6	-2.5	57.4	2.2	No	No	No	No
R301	B	66	1	2	66.8	64.3	-2.5	59.2	5.1	No	Yes	No	No
R302	B	66	2	2	66.9	63.7	-3.2	59.5	4.2	No	No	No	No
R303	B	66	2	2	66.0	61.8	-4.2	57.5	4.3	No	No	No	No
R306	B	66	1	2	61.4	60.4	-1.0	57.1	3.3	No	No	No	No
R307	B	66	2	2	62.6	61.5	-1.1	57.0	4.5	No	No	No	No
R308	B	66	2	2	62.7	61.5	-1.2	57.5	4.0	No	No	No	No
R309	B	66	1	2	62.6	61.7	-0.9	58.1	3.6	No	No	No	No
R310	B	66	2	2	62.6	61.6	-1.0	58.4	3.2	No	No	No	No
R311	B	66	2	2	62.3	61.0	-1.3	58.5	2.5	No	No	No	No
R312	B	66	1	2	60.2	59.3	-0.9	56.7	2.6	No	No	No	No
R313	B	66	2	2	59.6	58.9	-0.7	56.3	2.6	No	No	No	No
R320	B	66	1	2	61.8	60.1	-1.7	57.3	2.8	No	No	No	No
R321	B	66	4	2	60.3	59.4	-0.9	58.4	1.0	No	No	No	No
R328	B	66	2	2	62.6	61.0	-1.6	59.7	1.3	No	No	No	No
R329	B	66	1	2	62.5	60.0	-2.5	58.2	1.8	No	No	No	No
R330	B	66	1	2	62.7	59.9	-2.8	58.6	1.3	No	No	No	No
R331	B	66	2	2	62.8	60.8	-2.0	59.3	1.5	No	No	No	No
R332	B	66	2	2	60.8	60.0	-0.8	58.1	1.9	No	No	No	No
R334	B	66	1	2	63.2	61.9	-1.3	60.0	1.9	No	No	No	No
R335	B	66	2	2	62.6	61.0	-1.6	59.4	1.6	No	No	No	No
R336	B	66	2	2	62.6	61.4	-1.2	59.6	1.8	No	No	No	No
R337	B	66	8	2	60.2	59.5	-0.7	57.7	1.8	No	No	No	No
R338	B	66	2	2	62.1	61.2	-0.9	59.3	1.9	No	No	No	No
R339	B	66	1	2	61.5	60.6	-0.9	58.8	1.8	No	No	No	No
R340	B	66	2	2	61.3	60.5	-0.8	58.7	1.8	No	No	No	No
R341	B	66	2	2	61.1	60.5	-0.6	58.7	1.8	No	No	No	No
R342	B	66	4	2	56.6	56.6	0.0	56.3	0.3	No	No	No	No
						Noise levels that approach or exceed the NAC.							

Feasibility					
Number of impacted receptors		Number of impacted receptors receiving a 5 dBA reduction	% of impacted receptors receiving a 5 dBA reduction	Does the noise barrier design achieve a 5 dBA reduction at a majority (>50%) of impacted receptors?	**Yes**
8		8	100%		

I-65/I-70 North Split Noise Barrier Analysis

Reasonability

Design Goal

First row receptors		First row receptors receiving 7 dBA or more reduction	% of benefited first row receptors with a 7 dBA reduction	Design Goal: Is there a 7 dBA reduction for 50% of the benefited first row receptors?	**Yes**
8		4	50%		

Cost-effectiveness

Noise Barrier Length (feet)	1,804	Is the cost per benefited receptor less than or equal to $30,000 per benefited receptor receiving a minimum reduction of 5 dBA?	**No**
Noise Barrier Height (feet)	10-16		
TNM Area of Proposed Barrier, Sqft.	24,370		
Estimated Noise Barrier Cost ($30.00 x Sqft.)	$731,100		
Number of Benefited Receptors/Dwelling Units	10		
Cost per receptor	$73,110		

I-65/I-70 North Split Noise Barrier Analysis

NB7 - SB I-65 immediately behind the concrete safety barrier. The first segment of the barrier extends from the 10th Street overpass to the offramp to North Street. A second segment of barrier extends from North Street to the Ohio Street offramp. This noise barrier examines abatement of future noise levels at residential receivers R400 through R455, (see Appendix F).

Feasibility Criteria

Achieve a 5 dBA reduction at a majority (>50%) of impacted receptors

Reasonability Criteria

Design goal of 7 dBA noise reduction for >50% of benefited first row receptors.
Receptors are considered to be benefited when they receive at a minimum 5.0 dB(A) reduction in the future noise levels.
Cost of noise barrier per benefited receptor shall not exceed $25,000.

Active Receivers	Activity Category	Criteria, Leq (h)	Dwelling Units/Receptors	Row	Existing	Future w/o Barrier	Increase (Future w/o Barrier - Existing)	Future w/ Barrier	Noise Barrier Reduction	Approach or Exceed NAC (Impacted)	Benefited Receptor	Impacted, and 5 dBA reduction	Design Goal: 7 dBA reduction and first row
R400	B	66	1	1	69.9	**69.5**	-0.4	62.9	6.6	Yes	Yes	Yes	No
R401	B	66	1	1	70.0	**69.4**	-0.6	62.6	6.8	Yes	Yes	Yes	No
R402	B	66	1	1	69.4	**69.4**	0.0	61.9	7.5	Yes	Yes	Yes	Yes
R403	B	66	6	1	69.6	**69.6**	0.0	58.7	10.9	Yes	Yes	Yes	Yes
R403-2	B	66	6	1	68.9	**71.5**	2.6	59.3	12.2	Yes	Yes	Yes	Yes
R403-3	B	66	6	1	72.5	**72.0**	-0.5	60.6	11.4	Yes	Yes	Yes	Yes
R404	B	66	6	1	67.5	**67.9**	0.4	58.5	9.4	Yes	Yes	Yes	Yes
R404-2	B	66	6	1	68.9	**69.2**	0.3	59.1	10.1	Yes	Yes	Yes	Yes
R404-3	B	66	6	1	70.1	**70.0**	-0.1	60.0	10.0	Yes	Yes	Yes	Yes
R405	B	66	6	2	59.6	63.3	3.7	59.1	4.2	No	No	No	No
R405-2	B	66	6	2	62.3	64.9	2.6	60.1	4.8	No	No	No	No
R405-3	B	66	6	2	64.9	65.4	0.5	61.0	4.4	No	No	No	No
R406	B	66	6	2	60.2	61.8	1.6	58.4	3.4	No	No	No	No
R406-2	B	66	6	2	61.8	63.0	1.2	59.1	3.9	No	No	No	No
R406-3	B	66	6	2	64.2	63.9	-0.3	60.1	3.8	No	No	No	No
R407	E	71	1	2	60.0	61.6	1.6	58.4	3.2	No	No	No	No
R408	B	66	4	2	60.2	61.0	0.8	56.0	5.0	No	Yes	No	No
R409	B	66	1	2	60.0	60.9	0.9	55.9	5.0	No	Yes	No	No
R410-1	B	66	4	2	62.3	64.3	2.0	57.6	6.7	No	Yes	No	No
R410-2	B	66	4	2	66.3	**67.3**	1.0	59.2	8.1	Yes	Yes	Yes	No
R410-3	B	66	4	2	67.4	**68.3**	0.9	60.3	8.0	Yes	Yes	Yes	No
R410-4	B	66	4	2	68.3	**69.0**	0.7	62.1	6.9	Yes	Yes	Yes	No
R411-1	B	66	4	2	63.6	65.3	1.7	57.1	8.2	No	Yes	No	No
R411-2	B	66	4	2	66.4	**67.4**	1.0	59.2	8.2	Yes	Yes	Yes	No
R411-3	B	66	4	2	67.6	**68.6**	1.0	60.6	8.0	Yes	Yes	Yes	No
R411-4	B	66	4	2	68.7	**69.5**	0.8	62.6	6.9	Yes	Yes	Yes	No
R412-1	B	66	4	2	64.6	65.9	1.3	57.8	8.1	No	Yes	No	No
R412-2	B	66	4	2	66.5	**67.7**	1.2	59.6	8.1	Yes	Yes	Yes	No
R412-3	B	66	4	2	67.9	**68.9**	1.0	61.1	7.8	Yes	Yes	Yes	No
R412-4	B	66	4	2	69.1	**70.0**	0.9	63.4	6.6	Yes	Yes	Yes	No
R413-1	B	66	4	2	65.2	**66.1**	0.9	58.2	7.9	Yes	Yes	Yes	No
R413-2	B	66	4	2	66.6	**68.0**	1.4	60.1	7.9	Yes	Yes	Yes	No
R413-3	B	66	4	2	68.2	**69.3**	1.1	62.0	7.3	Yes	Yes	Yes	No
R413-4	B	66	4	2	69.5	**70.4**	0.9	64.6	5.8	Yes	Yes	Yes	No
R414-1	B	66	4	2	50.5	51.6	1.1	50.5	1.1	No	No	No	No
R414-2	B	66	4	2	50.8	50.9	0.1	49.2	1.7	No	No	No	No
R414-3	B	66	4	2	51.3	51.2	-0.1	49.4	1.8	No	No	No	No
R414-4	B	66	4	2	54.6	55.0	0.4	52.9	2.1	No	No	No	No
R415-1	B	66	4	2	46.8	48.1	1.3	45.9	2.2	No	No	No	No
R415-2	B	66	4	2	47.8	48.7	0.9	46.3	2.4	No	No	No	No
R415-3	B	66	4	2	49.5	50.2	0.7	47.3	2.9	No	No	No	No
R415-4	B	66	4	2	53.0	53.7	0.7	50.3	3.4	No	No	No	No
R416-1	B	66	4	2	48.0	49.0	1.0	46.2	2.8	No	No	No	No

R416-2	B	66	4	2	50.0	50.8	0.8	47.6	3.2	No	No	No	No
R416-3	B	66	4	2	51.2	51.8	0.6	48.5	3.3	No	No	No	No
R416-4	B	66	4	2	55.5	56.0	0.5	52.8	3.2	No	No	No	No
R417-1	B	66	4	2	46.7	48.5	1.8	45.7	2.8	No	No	No	No
R417-2	B	66	4	2	48.6	49.5	0.9	46.8	2.7	No	No	No	No
R417-3	B	66	4	2	51.1	52.0	0.9	48.5	3.5	No	No	No	No
R417-4	B	66	4	2	55.5	56.1	0.6	53.4	2.7	No	No	No	No
R418	B	66	1	2	52.2	53.0	0.8	51.2	1.8	No	No	No	No
R419	B	66	2	2	57.5	58.8	1.3	53.9	4.9	No	No	No	No
R419-2	B	66	2	2	64.2	65.8	1.6	58.4	7.4	No	Yes	No	No
R419-3	B	66	2	2	67.2	**68.5**	1.3	63.5	5.0	Yes	Yes	Yes	No
R419-4	B	66	2	2	68.6	**69.8**	1.2	64.4	5.4	Yes	Yes	Yes	No
R419-5	B	66	4	2	46.6	47.1	0.5	45.9	1.2	No	No	No	No
R419-6	B	66	4	2	53.8	54.6	0.8	51.2	3.4	No	No	No	No
R420	B	66	1	2	58.5	59.4	0.9	54.1	5.3	No	Yes	No	No
R421-1	B	66	2	2	59.9	60.5	0.6	54.0	6.5	No	Yes	No	No
R421-2	B	66	2	2	61.9	62.6	0.7	57.4	5.2	No	Yes	No	No
R421-3	B	66	2	2	66.8	**67.3**	0.5	61.5	5.8	Yes	Yes	Yes	No
R421-4	B	66	2	2	68.5	**69.0**	0.5	64.0	5.0	Yes	Yes	Yes	No
R421-5	B	66	2	2	69.1	**69.5**	0.4	64.8	4.7	Yes	No	No	No
R421-6	B	66	2	2	69.4	**69.8**	0.4	65.6	4.2	Yes	No	No	No
R422	B	66	1	2	57.2	57.8	0.6	52.8	5.0	No	Yes	No	No
R423	B	66	2	2	60.7	61.8	1.1	54.7	7.1	No	Yes	No	No
R424	B	66	2	1	67.0	**66.7**	-0.3	58.6	8.1	Yes	Yes	Yes	Yes
R425	B	66	3	1	67.3	**67.2**	-0.1	59.1	8.1	Yes	Yes	Yes	Yes
R426	B	66	3	2	64.3	64.5	0.2	57.3	7.2	No	Yes	No	No
R427	B	66	1	2	62.5	63.2	0.7	56.1	7.1	No	Yes	No	No
R428	B	66	1	2	62.6	63.3	0.7	56.3	7.0	No	Yes	No	No
R429	B	66	1	2	62.7	63.4	0.7	56.3	7.1	No	Yes	No	No
R430	B	66	1	2	62.8	63.5	0.7	56.5	7.0	No	Yes	No	No
R431	B	66	1	2	62.7	63.2	0.5	56.4	6.8	No	Yes	No	No
R432	B	66	1	2	62.9	63.5	0.6	56.5	7.0	No	Yes	No	No
R433	B	66	1	2	62.8	63.3	0.5	56.4	6.9	No	Yes	No	No
R434	B	66	1	2	61.6	62.0	0.4	55.1	6.9	No	Yes	No	No
R435	B	66	2	2	61.9	62.0	0.1	55.3	6.7	No	Yes	No	No
R436	B	66	2	2	62.1	62.1	0.0	55.5	6.6	No	Yes	No	No
R437	B	66	2	2	62.1	62.0	-0.1	55.7	6.3	No	Yes	No	No
R440	B	66	2	1	67.7	**66.6**	-1.1	59.7	6.9	Yes	Yes	Yes	No
R441	B	66	8	2	64.1	64.4	0.3	57.8	6.6	No	Yes	No	No
R442	B	66	1	1	66.5	**66.1**	-0.4	58.1	8.0	Yes	Yes	Yes	Yes
R443	B	66	1	2	64.2	64.8	0.6	58.2	6.6	No	Yes	No	No
R444	B	66	1	2	65.3	64.9	-0.4	58.8	6.1	No	Yes	No	No
R445	B	66	2	2	59.6	59.2	-0.4	57.7	1.5	No	No	No	No
R446	B	66	3	2	58.8	58.7	-0.1	56.6	2.1	No	No	No	No
R447	C/D	66	1	2	59.3	59.3	0.0	57.6	1.7	No	No	No	No
R448	B	66	2	2	58.2	57.9	-0.3	56.1	1.8	No	No	No	No
R450	E	71	1	2	53.3	53.5	0.2	52.6	0.9	No	No	No	No
R451	E	71	1	2	58.2	58.5	0.3	55.7	2.8	No	No	No	No
R452	E	71	1	2	67.8	**67.0**	-0.8	60.0	7.0	Yes	Yes	Yes	No
R453	E	71	1	2	63.3	64.9	1.6	57.8	7.1	No	Yes	No	No
R454	E	71	1	1	65.8	**66.4**	0.6	57.3	9.1	Yes	Yes	Yes	Yes
R455	C	66	2	2	66.8	**67.8**	1.0	58.8	9.0	Yes	Yes	Yes	No
						Noise levels that approach or exceed the NAC.							

I-65/I-70 North Split Noise Barrier Analysis

Feasibility

Number of impacted receptors		Number of impacted receptors receiving a 5 dBA reduction	% of impacted receptors receiving a 5 dBA reduction	Does the noise barrier design achieve a 5 dBA reduction at a majority (>50%) of impacted receptors?	**Yes**
115		111	97%		

Reasonability

Design Goal

First row receptors		First row receptors receiving 7 dBA or more reduction	% of benefited first row receptors with a 7 dBA reduction	Design Goal: Is there a 7 dBA reduction for 50% of the benefited first row receptors?	**Yes**
48		44	92%		

Cost-effectiveness

Noise Barrier Length (feet)	4,734	Is the cost per benefited receptor less than or equal to $25,000 per benefited receptor receiving a minimum reduction of 5 dBA?	**Yes**
Noise Barrier Height (feet)	14-20		
TNM Area of Proposed Barrier, Sqft.	90,389		
Estimated Noise Barrier Cost ($30.00 x Sqft.)	$2,711,670		
Number of Benefited Receptors/Dwelling Units	166		
Cost per receptor	$16,335		

NB 7 Optimized

6/5/2020

APPENDIX F: NOISE BARRIER DESIGN SUMMARY

Advanced Noise Barrier Optimization Tool 8/1/2019

North Split
NB 1

	Analysis1	Analysis2	Analysis3	Analysis4	Analysis5	Analysis6	Analysis7	Analysis8	Analysis9	Analysis10	Analysis11	Analysis12	Analysis13	Analysis14	Analysis15	Units
Average Wtd I.L. (benefited)	6.8	6.1	6.7	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**dBA**
Maximum I.L.	7.9	7	6.7	0	0	0	0	0	0	0	0	0	0	0	0	**dBA**
Benefited/Impacted ≥ AFG	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Benefited/Non Impact ≥ AFG	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Total Benefited	4	4	2	0	0	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Impacted Units ≥ NRDG	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Benefited Units ≥ NRDG	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Percent of impacts ≥ AFG	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**%**
Percent of benefits ≥ NRDG	50%	50%	0%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**%**
"Cost-Reasonable" ?	No	No	No	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**----**
Surface Area	58,545	38,487	34,639	-	-	-	-	-	-	-	-	-	-	-	-	**sq-feet or sq-meters**
Surface Area/Ben Rec	14,636	9,622	17,320	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**sq-ft or sq-m / ben rec**
Barrier Length	2,928	1,925	1,925	-	-	-	-	-	-	-	-	-	-	-	-	**ft or m**
Min Height	20	20	18	-	-	-	-	-	-	-	-	-	-	-	-	**ft or m**
Max Height	20	20	18	-	-	-	-	-	-	-	-	-	-	-	-	**ft or m**
Avg Height	20	20	18	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**ft or m**
Total Barrier Cost	1,756,350	1,154,610	1,039,170	-	-	-	-	-	-	-	-	-	-	-	-	**$**
Cost/Ben Rec	439,088	288,653	519,585	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**$ / ben rec**
Effectiveness/Cost Metric (E/C)	34.2	52.0	-	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**----**

Acoustical Feasibilty Goal (dBA)	5
Acoustical Feasibilty Goal (%)	50%
Noise Reduction Design Goal (dBA)	7
Noise Reduction Design Goal (%)	50%

U.S. Department of Transportation
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Advanced Noise Barrier Optimization Tool 8/1/2019

North Split
NB2

	Analysis1	Analysis2	Analysis3	Analysis4	Analysis5	Analysis6	Analysis7	Analysis8	Analysis9	Analysis10	Analysis11	Analysis12	Analysis13	Analysis14	Analysis15	Units
Average Wtd I.L. (benefited)	9.5	6.4	7.2	7.3	7.9	6.6	6	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	dBA
Maximum I.L.	11.1	6.5	7.8	8.7	8.4	7.6	7	0	0	0	0	0	0	0	0	dBA
Benefited/Impacted ≥ AFG	6	3	6	6	6	6	5	0	0	0	0	0	0	0	0	# of dwelling units
Benefited/Non Impact ≥ AFG	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	# of dwelling units
Total Benefited	9	3	6	9	6	6	5	0	0	0	0	0	0	0	0	# of dwelling units
Impacted Units ≥ NRDG	6	0	4	6	6	2	2	0	0	0	0	0	0	0	0	# of dwelling units
Benefited Units ≥ NRDG	9	0	4	6	6	2	2	0	0	0	0	0	0	0	0	# of dwelling units
Percent of impacts ≥ AFG	100%	50%	100%	100%	100%	100%	83%	0%	0%	0%	0%	0%	0%	0%	0%	%
Percent of benefits ≥ NRDG	100%	0%	67%	67%	100%	33%	40%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	%
"Cost-Reasonable" ?	No	No	No	No	No	No	No	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	----
Surface Area	46,166	18,466	23,087	27,705	15,602	8,402	6,802	-	-	-	-	-	-	-	-	sq-feet or sq-meters
Surface Area/Ben Rec	5,130	6,155	3,848	3,078	2,600	1,400	1,360	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	sq-ft or sq-m / ben rec
Barrier Length	2,308	2,308	2,308	2,308	1,300	700	600	-	-	-	-	-	-	-	-	ft or m
Min Height	20	8	10	12	12	12	10	-	-	-	-	-	-	-	-	ft or m
Max Height	20	8	10	12	12	12	12	-	-	-	-	-	-	-	-	ft or m
Avg Height	20	8	10	12	12	12	11	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	ft or m
Total Barrier Cost	1,384,980	553,980	692,610	831,150	468,060	252,060	204,060	-	-	-	-	-	-	-	-	$
Cost/Ben Rec	153,887	184,660	115,435	92,350	78,010	42,010	40,812	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	$ / ben rec
Effectiveness/Cost Metric (E/C)	32.5	-	28.9	54.1	64.1	39.7	40.8	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	----

Acoustical Feasibilty Goal (dBA)	5
Acoustical Feasibilty Goal (%)	50%
Noise Reduction Design Goal (dBA)	7
Noise Reduction Design Goal (%)	50%

Advanced Noise Barrier Optimization Tool 8/1/2019

North Split
NB3E

	Analysis1	Analysis2	Analysis3	Analysis4	Analysis5	Analysis6	Analysis7	Analysis8	Analysis9	Analysis10	Analysis11	Analysis12	Analysis13	Analysis14	Analysis15	Units
Average Wtd I.L. (benefited)	9.5	9	7.7	7	7.4	7	7.3	7.4	6.6	6.5	6.4	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**dBA**
Maximum I.L.	11.7	11	9.4	8.6	9.4	8.9	9.4	9.2	8.8	8.3	8.4	0	0	0	0	**dBA**
Benefited/Impacted ≥ AFG	43	43	43	41	43	31	43	36	31	27	31	0	0	0	0	**# of dwelling units**
Benefited/Non Impact ≥ AFG	11	11	11	8	5	4	5	4	4	4	4	0	0	0	0	**# of dwelling units**
Total Benefited	54	54	54	49	48	35	48	40	35	31	35	0	0	0	0	**# of dwelling units**
Impacted Units ≥ NRDG	43	43	32	27	21	13	21	20	13	9	9	0	0	0	0	**# of dwelling units**
Benefited Units ≥ NRDG	48	47	36	31	25	17	25	24	17	13	13	0	0	0	0	**# of dwelling units**
Percent of impacts ≥ AFG	100%	100%	100%	95%	100%	72%	100%	84%	72%	63%	72%	0%	0%	0%	0%	**%**
Percent of benefits ≥ NRDG	89%	87%	67%	63%	52%	49%	52%	60%	49%	42%	37%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**%**
"Cost-Reasonable" ?	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**----**
Surface Area	73,827	66,443	51,677	44,297	38,012	36,125	36,844	36,035	31,868	21,934	23,031	-	-	-	-	**sq-feet or sq-meters**
Surface Area/Ben Rec	1,367	1,230	957	904	792	1,032	768	901	911	708	658	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**sq-ft or sq-m / ben rec**
Barrier Length	3,690	3,690	3,690	3,690	2,715	2,580	2,715	2,715	2,396	1,615	1,615	-	-	-	-	**ft or m**
Min Height	20	18	14	12	14	14	12	8	8	10	10	-	-	-	-	**ft or m**
Max Height	20	18	14	12	14	14	14	14	14	14	18	-	-	-	-	**ft or m**
Avg Height	20	18	14	12	14	14	14	13	13	14	14	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**ft or m**
Total Barrier Cost	2,214,810	1,993,290	1,550,310	1,328,910	1,140,360	1,083,750	1,105,320	1,081,050	956,040	658,020	690,930	-	-	-	-	**$**
Cost/Ben Rec	41,015	36,913	28,709	27,121	23,758	30,964	23,028	27,026	27,315	21,226	19,741	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**$ / ben rec**
Effectiveness/Cost Metric (E/C)	17.0	18.9	18.1	16.2	14.3	6.8	14.8	12.0	7.7	6.9	7.4	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**----**

Acoustical Feasibilty Goal (dBA)	5
Acoustical Feasibilty Goal (%)	50%
Noise Reduction Design Goal (dBA)	7
Noise Reduction Design Goal (%)	50%

Advanced Noise Barrier Optimization Tool **10/30/2019**

North Split
NB3W

	Analysis1	Analysis2	Analysis3	Analysis4	Analysis5	Analysis6	Analysis7	Analysis8	Analysis9	Analysis10	Analysis11	Analysis12	Analysis13	Analysis14	Analysis15	Units
Average Wtd I.L. (benefited)	8	7	7.7	7.6	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**dBA**
Maximum I.L.	11.1	8.6	10.5	10.6	0	0	0	0	0	0	0	0	0	0	0	**dBA**
Benefited/Impacted ≥ AFG	52	41	52	52	0	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Benefited/Non Impact ≥ AFG	164	91	143	119	0	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Total Benefited	216	132	195	171	0	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Impacted Units ≥ NRDG	41	32	35	35	0	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Benefited Units ≥ NRDG	132	76	111	100	0	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Percent of impacts ≥ AFG	100%	79%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**%**
Percent of benefits ≥ NRDG	61%	58%	57%	58%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**%**
"Cost-Reasonable" ?	Yes	Yes	Yes	Yes	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**----**
Surface Area	56,112	39,279	50,498	40,036	-	-	5,401	24,336	8,640	29,435	10,011	-	-	-	-	**sq-feet or sq-meters**
Surface Area/Ben Rec	260	298	259	234	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**sq-ft or sq-m / ben rec**
Barrier Length	2,806	2,806	2,806	2,463	-	-	417	1,805	617	2,204	718	-	-	-	-	**ft or m**
Min Height	20	14	18	12	-	-	12	8	10	8	10	-	-	-	-	**ft or m**
Max Height	20	14	18	20	-	-	14	16	16	14	16	-	-	-	-	**ft or m**
Avg Height	20	14	18	16	#DIV/0!	#DIV/0!	13	14	14	13	14	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**ft or m**
Total Barrier Cost	1,683,360	1,178,370	1,514,940	1,201,080	-	-	162,030	730,080	259,200	883,050	300,330	-	-	-	-	**$**
Cost/Ben Rec	7,793	8,927	7,769	7,024	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**$ / ben rec**
Effectiveness/Cost Metric (E/C)	58.4	39.8	50.0	55.3	#DIV/0!	#DIV/0!	-	-	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**----**

Acoustical Feasibilty Goal (dBA)	5
Acoustical Feasibilty Goal (%)	50%
Noise Reduction Design Goal (dBA)	7
Noise Reduction Design Goal (%)	50%

U.S. Department of Transportation
Federal Highway Administration

Advanced Noise Barrier Optimization Tool

8/10/2019

North Split
NB4

	Analysis1	Analysis2	Analysis3	Analysis4	Analysis5	Analysis6	Analysis7	Analysis8	Analysis9	Analysis10	Analysis11	Analysis12	Analysis13	Analysis14	Analysis15	Units
Average Wtd I.L. (benefited)	6.2	6.6	6.7	6.8	6.3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**dBA**
Maximum I.L.	8.4	8.9	9	9.4	8.6	0	0	0	0	0	0	0	0	0	0	**dBA**
Benefited/Impacted ≥ AFG	5	5	5	5	5	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Benefited/Non Impact ≥ AFG	30	30	38	53	26	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Total Benefited	35	35	43	58	31	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Impacted Units ≥ NRDG	5	5	5	5	5	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Benefited Units ≥ NRDG	9	14	14	28	9	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Percent of impacts ≥ AFG	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**%**
Percent of benefits ≥ NRDG	26%	40%	33%	48%	29%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**%**
"Cost-Reasonable" ?	Yes	No	Yes	Yes	Yes	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**----**
Surface Area	34,704	38,559	39,563	42,449	28,961	-	-	-	-	-	-	-	-	-	-	**sq-feet or sq-meters**
Surface Area/Ben Rec	992	1,102	920	732	934	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**sq-ft or sq-m / ben rec**
Barrier Length	1,929	1,929	2,029	2,325	1,628	-	-	-	-	-	-	-	-	-	-	**ft or m**
Min Height	18	20	10	12	14	-	-	-	-	-	-	-	-	-	-	**ft or m**
Max Height	18	20	20	20	20	-	-	-	-	-	-	-	-	-	-	**ft or m**
Avg Height	18	20	20	18	18	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**ft or m**
Total Barrier Cost	1,041,120	1,156,770	1,186,890	1,273,470	868,830	-	-	-	-	-	-	-	-	-	-	**$**
Cost/Ben Rec	29,746	33,051	27,602	21,956	28,027	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**$ / ben rec**
Effectiveness/Cost Metric (E/C)	201.7	181.5	217.4	273.3	214.1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**----**

Acoustical Feasibilty Goal (dBA)	5
Acoustical Feasibilty Goal (%)	50%
Noise Reduction Design Goal (dBA)	7
Noise Reduction Design Goal (%)	50%

Advanced Noise Barrier Optimization Tool 9/16/2019

North Split
NB 5

	Analysis1	Analysis2	Analysis3	Analysis4	Analysis5	Analysis6	Analysis7	Analysis8	Analysis9	Analysis10	Analysis11	Analysis12	Analysis13	Analysis14	Analysis15	Units
Average Wtd I.L. (benefited)	6.4	6.9	6.9	6.7	6.4	6.4	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	dBA
Maximum I.L.	7.4	9.4	9.4	7.4	7.4	8.2	0	0	0	0	0	0	0	0	0	dBA
Benefited/Impacted ≥ AFG	16	16	16	16	16	16	0	0	0	0	0	0	0	0	0	# of dwelling units
Benefited/Non Impact ≥ AFG	25	89	88	16	25	50	0	0	0	0	0	0	0	0	0	# of dwelling units
Total Benefited	41	105	104	32	41	66	0	0	0	0	0	0	0	0	0	# of dwelling units
Impacted Units ≥ NRDG	16	16	16	12	16	16	0	0	0	0	0	0	0	0	0	# of dwelling units
Benefited Units ≥ NRDG	20	43	43	16	20	24	0	0	0	0	0	0	0	0	0	# of dwelling units
Percent of impacts ≥ AFG	100%	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	%
Percent of benefits ≥ NRDG	49%	41%	41%	50%	49%	36%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	%
"Cost-Reasonable" ?	Yes	Yes	Yes	Yes	Yes	Yes	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	----
Surface Area	19,914	30,002	33,562	20,439	19,914	22,880	-	-	-	-	-	-	-	-	-	sq-feet or sq-meters
Surface Area/Ben Rec	486	286	323	639	486	347	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	sq-ft or sq-m / ben rec
Barrier Length	1,159	2,001	2,001	1,059	1,159	1,344	-	-	-	-	-	-	-	-	-	ft or m
Min Height	16	12	12	18	16	16	-	-	-	-	-	-	-	-	-	ft or m
Max Height	20	20	20	20	20	20	-	-	-	-	-	-	-	-	-	ft or m
Avg Height	17	15	17	19	17	17	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	ft or m
Total Barrier Cost	597,420	900,060	1,006,860	613,170	597,420	686,400	-	-	-	-	-	-	-	-	-	$
Cost/Ben Rec	14,571	8,572	9,681	19,162	14,571	10,400	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	$ / ben rec
Effectiveness/Cost Metric (E/C)	128.7	218.7	193.7	73.4	128.7	180.3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	----

Acoustical Feasibilty Goal (dBA)	5
Acoustical Feasibilty Goal (%)	50%
Noise Reduction Design Goal (dBA)	7
Noise Reduction Design Goal (%)	50%

U.S. Department of Transportation
Federal Highway Administration

Advanced Noise Barrier Optimization Tool **8/13/2019**

North Split
NB6

	Analysis1	Analysis2	Analysis3	Analysis4	Analysis5	Analysis6	Analysis7	Analysis8	Analysis9	Analysis10	Analysis11	Analysis12	Analysis13	Analysis14	Analysis15	Units
Average Wtd I.L. (benefited)	6.5	6.3	7.3	6.1	6.7	6.5	6.5	6.3	6.1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**dBA**
Maximum I.L.	9.3	8.7	8	6.9	7.6	6.7	7.3	7.3	8	0	0	0	0	0	0	**dBA**
Benefited/Impacted ≥ AFG	8	8	4	4	4	3	3	4	8	0	0	0	0	0	0	**# of dwelling units**
Benefited/Non Impact ≥ AFG	6	4	2	1	2	0	2	2	2	0	0	0	0	0	0	**# of dwelling units**
Total Benefited	14	12	6	5	6	3	5	6	10	0	0	0	0	0	0	**# of dwelling units**
Impacted Units ≥ NRDG	4	4	4	0	3	0	2	3	4	0	0	0	0	0	0	**# of dwelling units**
Benefited Units ≥ NRDG	5	5	4	0	3	0	2	3	4	0	0	0	0	0	0	**# of dwelling units**
Percent of impacts ≥ AFG	100%	100%	50%	50%	50%	38%	38%	50%	100%	0%	0%	0%	0%	0%	0%	**%**
Percent of benefits ≥ NRDG	36%	42%	67%	0%	50%	0%	40%	50%	40%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**%**
"Cost-Reasonable" ?	No	No	No	No	No	No	No	No	No	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**----**
Surface Area	36,106	28,884	25,274	18,051	15,944	8,914	13,664	14,040	24,370	-	-	-	-	-	-	**sq-feet or sq-meters**
Surface Area/Ben Rec	2,579	2,407	4,212	3,610	2,657	2,971	2,733	2,340	2,437	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**sq-ft or sq-m / ben rec**
Barrier Length	1,804	1,804	1,804	1,804	1,138	636	1,138	1,138	1,804	-	-	-	-	-	-	**ft or m**
Min Height	20	16	14	10	14	14	12	10	10	-	-	-	-	-	-	**ft or m**
Max Height	20	16	14	10	14	14	12	14	16	-	-	-	-	-	-	**ft or m**
Avg Height	20	16	14	10	14	14	12	12	13	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**ft or m**
Total Barrier Cost	1,083,180	866,520	758,220	541,530	478,320	267,420	409,920	421,200	731,100	-	-	-	-	-	-	**$**
Cost/Ben Rec	77,370	72,210	126,370	108,306	79,720	89,140	81,984	70,200	73,110	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**$ / ben rec**
Effectiveness/Cost Metric (E/C)	24.2	26.0	14.8	-	17.6	-	11.4	20.0	25.6	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**----**

Acoustical Feasibilty Goal (dBA)	5
Acoustical Feasibilty Goal (%)	50%
Noise Reduction Design Goal (dBA)	7
Noise Reduction Design Goal (%)	50%

U.S. Department of Transportation
Federal Highway Administration

Advanced Noise Barrier Optimization Tool **8/13/2019**

North Split
NB7

	Analysis1	Analysis2	Analysis3	Analysis4	Analysis5	Analysis6	Analysis7	Analysis8	Analysis9	Analysis10	Analysis11	Analysis12	Analysis13	Analysis14	Analysis15	Units
Average Wtd I.L. (benefited)	8	7.6	7.1	7.6	7.8	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**dBA**
Maximum I.L.	12.2	11.6	10.5	11.6	12.2	0	0	0	0	0	0	0	0	0	0	**dBA**
Benefited/Impacted ≥ AFG	107	103	95	96	109	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Benefited/Non Impact ≥ AFG	57	49	48	27	57	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Total Benefited	164	152	143	123	166	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Impacted Units ≥ NRDG	89	73	51	56	79	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Benefited Units ≥ NRDG	129	102	60	65	101	0	0	0	0	0	0	0	0	0	0	**# of dwelling units**
Percent of impacts ≥ AFG	95%	91%	84%	85%	96%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**%**
Percent of benefits ≥ NRDG	79%	67%	42%	53%	61%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**%**
"Cost-Reasonable" ?	Yes	Yes	Yes	Yes	Yes	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**----**
Surface Area	94,631	85,172	75,700	65,783	90,389	-	-	-	-	-	-	-	-	-	-	**sq-feet or sq-meters**
Surface Area/Ben Rec	577	560	529	535	545	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**sq-ft or sq-m / ben rec**
Barrier Length	4,734	4,734	4,734	3,657	4,734	-	-	-	-	-	-	-	-	-	-	**ft or m**
Min Height	20	18	16	18	14	-	-	-	-	-	-	-	-	-	-	**ft or m**
Max Height	20	18	16	18	20	-	-	-	-	-	-	-	-	-	-	**ft or m**
Avg Height	20	18	16	18	19	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**ft or m**
Total Barrier Cost	2,838,930	2,555,160	2,271,000	1,973,490	2,711,670	-	-	-	-	-	-	-	-	-	-	**$**
Cost/Ben Rec	17,311	16,810	15,881	16,045	16,335	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**$ / ben rec**
Effectiveness/Cost Metric (E/C)	12.1	10.2	7.5	8.2	11.4	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	**----**

Acoustical Feasibilty Goal (dBA)	5
Acoustical Feasibilty Goal (%)	50%
Noise Reduction Design Goal (dBA)	7
Noise Reduction Design Goal (%)	50%

APPENDIX G: PUBLIC INVOLVEMENT MATERIALS

NORTH SPLIT UPGRADES DRIVING PROGRESS

I-65/I-70 North Split Project

Noise Barrier Neighborhood Meetings

October – November 2019

Major Project Milestones

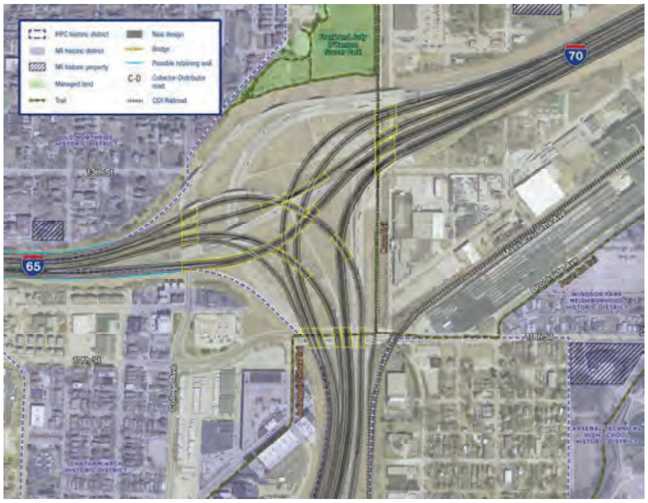
September 2017	Project Initiation
May 2018	System-Level Analysis of Downtown Interstates
September 2018	Alternatives Screening Report
Spring 2019	Design Refinement and Context Sensitive Solutions (CSS)
Fall 2019	**Environmental Data Collection and CSS continues**
Mid-2020	Environmental Assessment complete
2021 – 2022	Project Construction

NORTH SPLIT UPGRADES DRIVING PROGRESS

Preliminary Preferred Alternative

Interchange Reconstruction 4C

- Improves safety at the most hazardous locations
- Removes the worst bottlenecks
- More compact interchange
- Does not add through lanes
- Within existing right-of-way
- Minimizes outside walls
- Two restricted ramp movements
- **Replaces pavement / bridges**

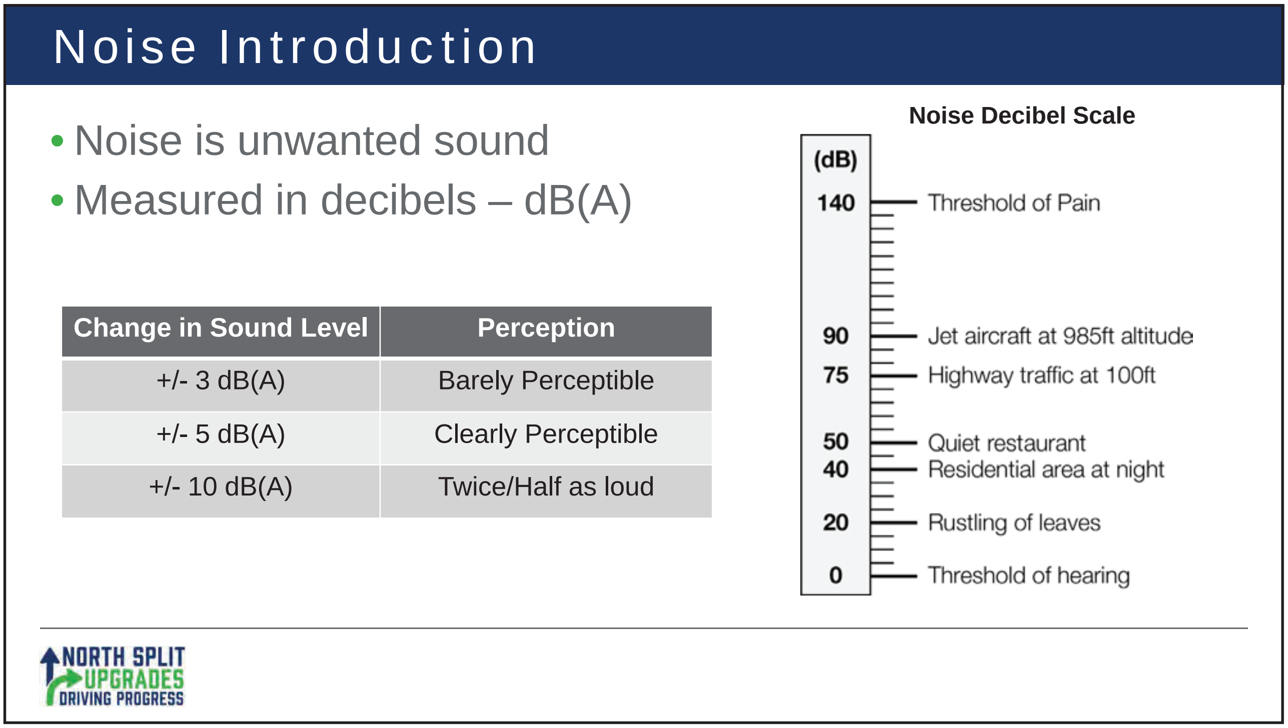


NORTH SPLIT UPGRADES DRIVING PROGRESS

Investing in Innovative and Modern Technologies

- **CRC Pavement – Continuous Reinforced Concrete**
  - Jointless pavement
  - More than double the design life
- **“Next Generation” Pavement Grooving**
  - Longitudinal grooves, rather than transverse
  - Reduces pavement noise 3 to 5 decibels
  - 14th State to invest in advanced paving technology to reduce noise
- **Jointless Concrete Bridges**
  - More durable, quieter structures than existing
  - Integral / Semi-Integral ends

NORTH SPLIT UPGRADES DRIVING PROGRESS



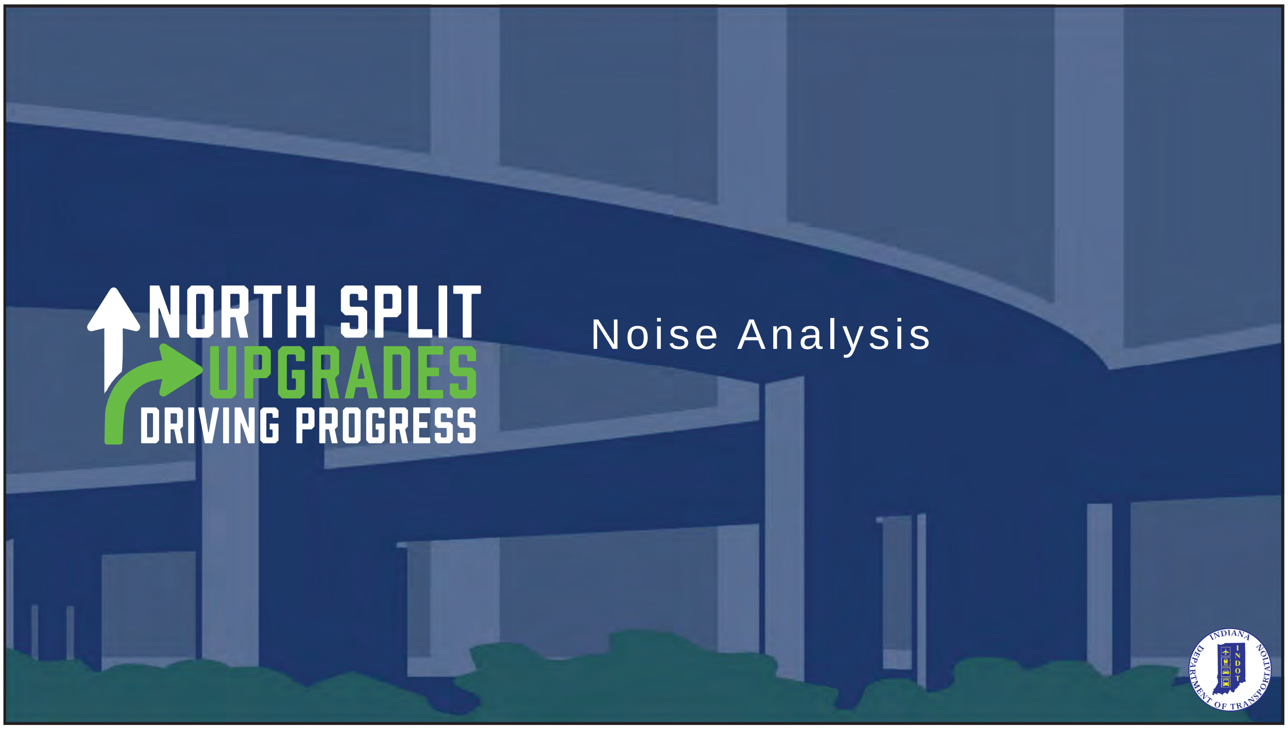
Noise Introduction

- Noise is unwanted sound
- Measured in decibels – dB(A)

Change in Sound Level	Perception
+/- 3 dB(A)	Barely Perceptible
+/- 5 dB(A)	Clearly Perceptible
+/- 10 dB(A)	Twice/Half as loud

Noise Decibel Scale

(dB)	
140	Threshold of Pain
90	Jet aircraft at 985ft altitude
75	Highway traffic at 100ft
50	Quiet restaurant
40	Residential area at night
20	Rustling of leaves
0	Threshold of hearing



NORTH SPLIT
UPGRADES
DRIVING PROGRESS

Noise Analysis

Noise Policy

INDOT Traffic Noise Analysis Procedure (2017)

Indiana Department of Transportation

Traffic Noise Analysis Procedure

2017

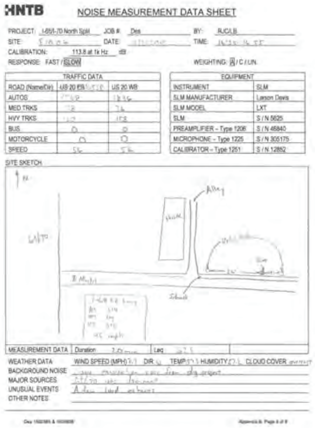
Joe McGuinness, Commissioner
Indiana Department of Transportation

Mayela Sosa
Mayela Sosa, Administrator
Federal Highway Administration
Indiana Division

NORTH SPLIT
UPGRADES
DRIVING PROGRESS

Measuring Traffic Noise

- DRAFT Traffic Noise Technical Report, September 2019
  - northsplit.com/noise
- Design Year (2041) Noise Levels
  - Predicted by FHWA Traffic Noise Model
  - Field measurements to validate
  - 3-D model predicts noise levels
- Highway noise level factors
  - Traffic volume
  - Traffic speed
  - Number of large trucks
  - Location of highway relative to building



HNTB NOISE MEASUREMENT DATA SHEET

PROJECT: I-65/I-70 North Split JOB #: Des BY: RJC/LB
SITE: [illegible] DATE: [illegible] TIME: [illegible]
CALIBRATION: 113.8 at 1k Hz dB
RESPONSE: FAST / SLOW WEIGHTING: A / C / LIN

TRAFFIC DATA		
ROAD (Name/Dir)	US 20 EB	US 20 WB
AUTOS	[illegible]	[illegible]
MED TRKS	[illegible]	[illegible]
HVY TRKS	[illegible]	[illegible]
BUS	0	0
MOTORCYCLE	0	0
SPEED	[illegible]	[illegible]

EQUIPMENT	
INSTRUMENT	SLM
SLM MANUFACTURER	Larson Davis
SLM MODEL	LXT
SLM	S / N 5625
PREAMPLIFIER – Type 1206	S / N 46840
MICROPHONE – Type 1225	S / N 305175
CALIBRATOR – Type 1251	S / N 12852

SITE SKETCH

MEASUREMENT DATA Duration [illegible] Leq [illegible]
WEATHER DATA WIND SPEED (MPH) [illegible] DIR [illegible] TEMP [illegible] HUMIDITY [illegible] CLOUD COVER [illegible]
BACKGROUND NOISE [illegible]
MAJOR SOURCES [illegible]
UNUSUAL EVENTS [illegible]
OTHER NOTES

NORTH SPLIT
UPGRADES
DRIVING PROGRESS

Measuring Traffic Noise

Noise Impact (per INDOT Noise Policy)

1. Predicted noise levels increase by 15 dB(A) over existing
    - Does not occur in North Split project

or…

2. Predicted noise levels approach or exceed criteria
    - Noise Abatement Criteria (NAC) vary
    - Example: 66 dB(A) for residences

NORTH SPLIT
UPGRADES
DRIVING PROGRESS

Measuring Traffic Noise - Definitions

Receptor: A discrete or representative location of a noise sensitive area

- Dwelling unit
- Area of frequent human use

Impacted Receptor: Receptor where predicted noise levels approach or exceed the Noise Abatement Criteria (NAC)

Benefited Receptor: Receptor that receives a minimum 5 dB(A) reduction in future noise levels as predicted by the model

NORTH SPLIT
UPGRADES
DRIVING PROGRESS

Noise Barriers

- Considered where there are **noise impacts**
- Barriers can reduce noise levels by 5 to 10 dB(A)
- Location and height determined by the Traffic Noise Model

NORTH SPLIT
UPGRADES
DRIVING PROGRESS

Noise Barriers

A noise barrier must be both **FEASIBLE** and **REASONABLE**

NORTH SPLIT
UPGRADES
DRIVING PROGRESS

Noise Barriers

Feasible

1. Acoustic - Achieves at least a 5 dB(A) reduction in traffic noise for a majority (>50%) impacted receptors
2. Engineering - Considers environmental issues, drainage, safety, existing bridge condition, and other design concerns

---

Noise Barriers

Reasonable

1. Noise Reduction Goal: 7 dB(A) reduction for majority of receptors on property directly adjacent to roadway
2. Cost-effective (at $30 per square foot of wall)

Cost per benefited receptor	Result
$0 - $25,000*	Cost-effective
$25,000* and up	NOT cost-effective

*$30,000 if majority of homes were built before initial road construction

Noise Barriers

Reasonable

3. Views of Residents and Property Owners
   - INDOT considers the views of all benefited receptors to determine whether a barrier is appropriate for a given location
   - Surveys sent to benefited receptors to ask whether they are in favor of a noise barrier being constructed
   - Surveys sent to adjacent businesses with blocked sight lines

* North Split surveys sent in October and November

NORTH SPLIT
UPGRADES
DRIVING PROGRESS

NORTH SPLIT
UPGRADES
DRIVING PROGRESS

Possible Noise Barriers

Noise Results

- Barely perceptible change < 3 decibels — 89.0% of receptors
- Perceptible reduction (over 3 decibels) — 10.7% of receptors
- Perceptible increase (over 3 decibels) — 1 receptor, or 0.3%

Noise Barriers

- Five possible noise barrier locations
- Each location feasible
- Possibly reasonable
- Subject to input by benefited receptors

NB3E – 1,615 ft long
Valley to Commerce
14 ft tall (average)

NB4 – 2,325 ft long
Alabama to College
19 ft tall (average)

NB3W – 2,463 ft long
Commerce to Lewis
16 ft tall (average)

NB5 – 2,001 ft long
Alabama to College
15 ft tall (average)

NB7 – 4,734 ft long
10th St to Ohio
19 ft tall (average)

NB3E

- I-70 WB
- North side of highway
- From Valley to Commerce
- 1,615 ft long
- Height range 10 ft – 18 ft
- Average 14 ft tall

NORTH SPLIT UPGRADES DRIVING PROGRESS

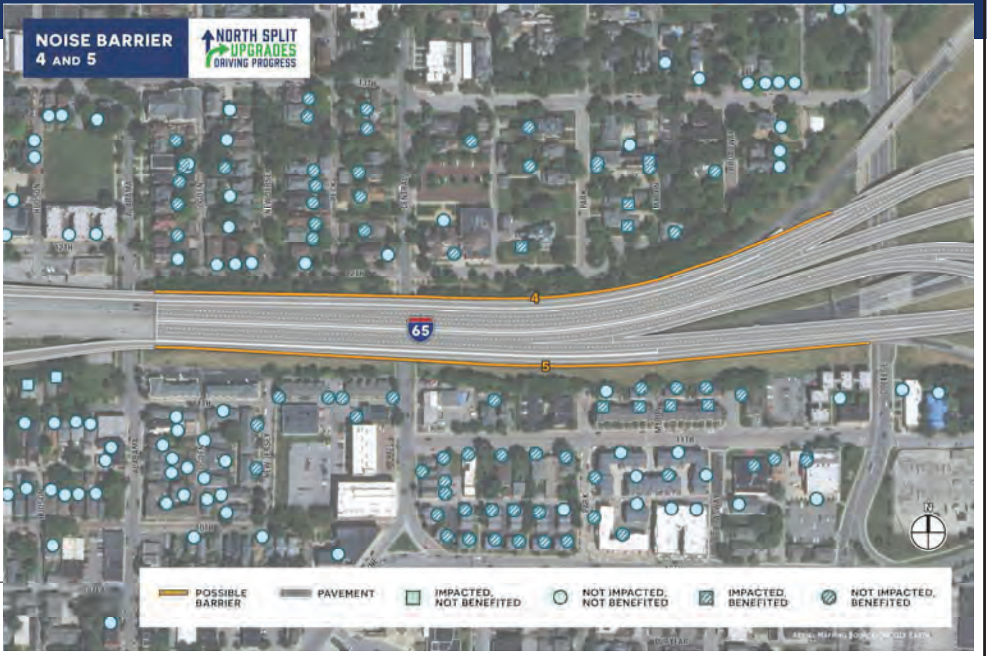
NB3W

- I-70 WB
- North side of highway
- From Commerce to Lewis
- 2,463 ft long
- Height range 12 ft – 20 ft
- Average 16 ft tall

NORTH SPLIT UPGRADES DRIVING PROGRESS

NB4

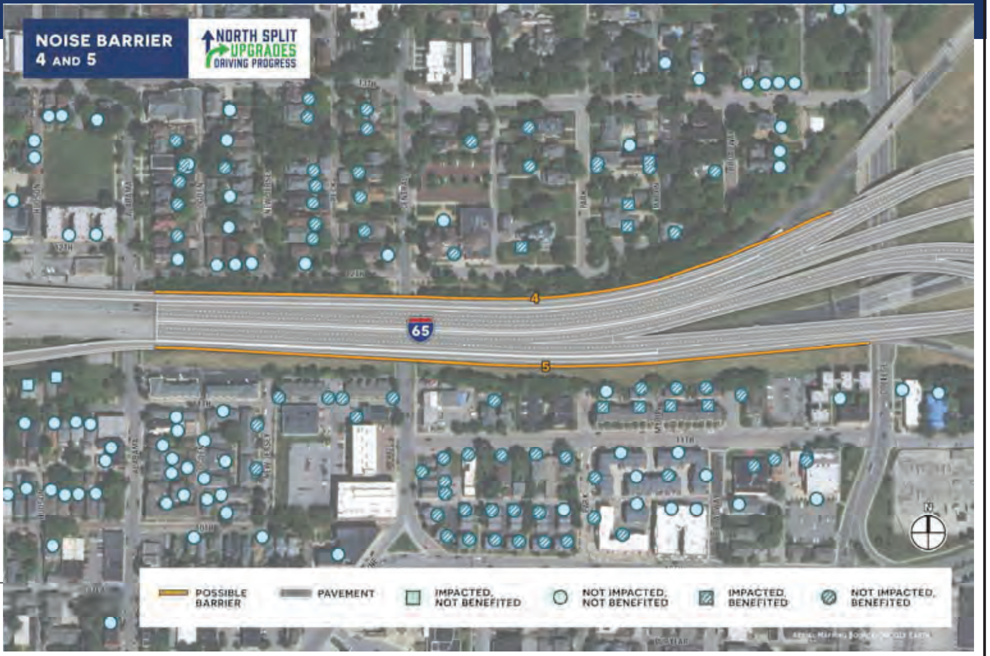
- I-65 NB
- North side of highway
- From College to Alabama
- 2,325 ft long
- Height range 12 ft – 20 ft
- Average 19 ft tall



NORTH SPLIT UPGRADES DRIVING PROGRESS

NB5

- I-65 SB
- South side of highway
- From College to Alabama
- 2,001 ft long
- Height range 12 ft – 20 ft
- Average 15 ft tall



NORTH SPLIT UPGRADES DRIVING PROGRESS

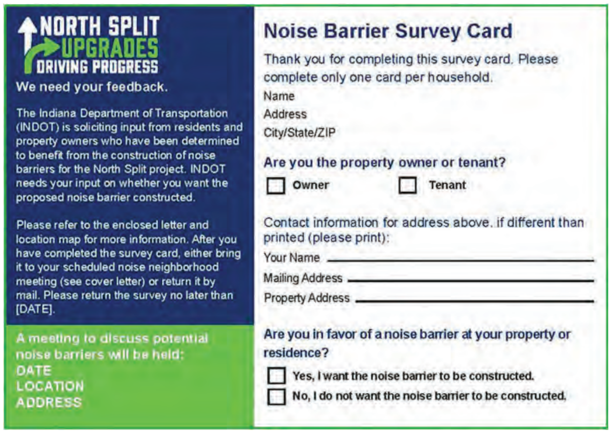
NB7

- I-65/I-70 Collector-Distributor Road/Exits
- From 10th Street to Ohio
- 4,734 ft long
- Height range: 14 ft – 20 ft
- Average 19 ft tall

NORTH SPLIT UPGRADES DRIVING PROGRESS

Noise Survey

- Who receives a survey?
  - All benefited receptors
  - Adjacent businesses with blocked sight lines
  - Sent to property owner and current resident, if different
- Mailed to 455 addresses
- If response rate is less than 50%, **second survey is required**



NORTH SPLIT UPGRADES DRIVING PROGRESS

We need your feedback.

The Indiana Department of Transportation (INDOT) is soliciting input from residents and property owners who have been determined to benefit from the construction of noise barriers for the North Split project. INDOT needs your input on whether you want the proposed noise barrier constructed.

Please refer to the enclosed letter and location map for more information. After you have completed the survey card, either bring it to your scheduled noise neighborhood meeting (see cover letter) or return it by mail. Please return the survey no later than [DATE].

A meeting to discuss potential noise barriers will be held:
DATE
LOCATION
ADDRESS

Noise Barrier Survey Card

Thank you for completing this survey card. Please complete only one card per household.

Name
Address
City/State/ZIP

Are you the property owner or tenant?

☐ **Owner** ☐ **Tenant**

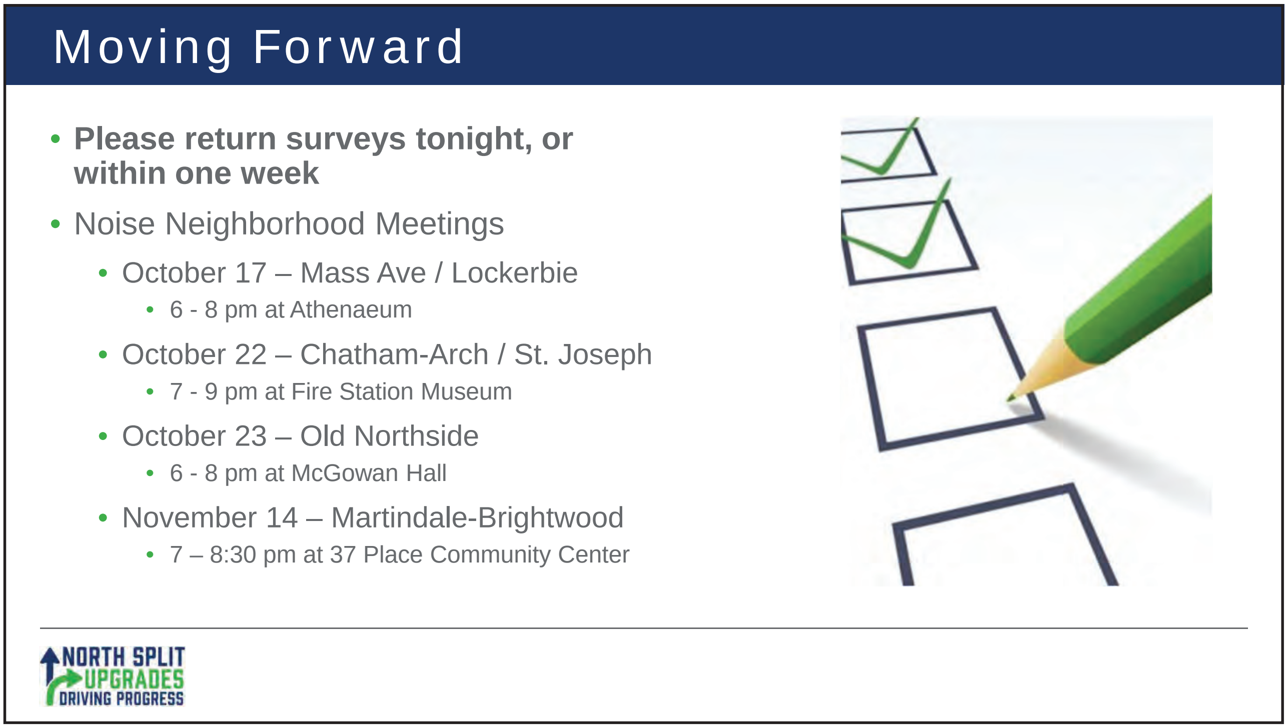
Contact information for address above. if different than printed (please print):

Your Name ____________________
Mailing Address ____________________
Property Address ____________________

Are you in favor of a noise barrier at your property or residence?

☐ **Yes, I want the noise barrier to be constructed.**
☐ **No, I do not want the noise barrier to be constructed.**

NORTH SPLIT UPGRADES DRIVING PROGRESS



Moving Forward

- **Please return surveys tonight, or within one week**
- Noise Neighborhood Meetings
  - October 17 – Mass Ave / Lockerbie
    - 6 - 8 pm at Athenaeum
  - October 22 – Chatham-Arch / St. Joseph
    - 7 - 9 pm at Fire Station Museum
  - October 23 – Old Northside
    - 6 - 8 pm at McGowan Hall
  - November 14 – Martindale-Brightwood
    - 7 – 8:30 pm at 37 Place Community Center

NORTH SPLIT UPGRADES DRIVING PROGRESS

NORTH SPLIT UPGRADES DRIVING PROGRESS

Thank you

NORTH SPLIT
UPGRADES
DRIVING PROGRESS

October 4, 2019

Dear Resident/Property Owner:

The Indiana Department of Transportation (INDOT) is seeking input from residents and property owners who would benefit from the construction of noise barriers for the I-65/I-70 North Split Project. This project includes replacing and repairing deteriorating bridges, upgrading pavement, reducing congestion, and improving safety at the I-65 and I-70 interchange on the northeast side of downtown Indianapolis.

INDOT evaluates noise abatement measures for feasibility and reasonableness. If proven feasible and reasonable, any residents and/or property owners that have been determined to benefit from the construction of a noise barrier are given the opportunity to provide their input. INDOT then makes the decision whether to construct the noise barrier based on feasibility, reasonableness, and percentage of supportive responses from the benefitted residents and/or property owners. Preliminary findings show that a potential noise barrier near your residence or property is both feasible and reasonable. At this time, INDOT needs your input on whether you want the proposed noise barrier constructed in your area.

INDOT is holding a neighborhood meeting to discuss potential noise barriers. At the meeting, the project team will present INDOT's noise mitigation process and proposed noise barrier locations. Project team staff will be available to answer questions and solicit input from the public. Your attendance and participation are encouraged.

The meeting will be held:
November 12, 2019 from 7:00 to 8:30 pm
Open House: 7:00 to 7:30 pm; Presentation: 7:30 pm
37 Place Community Center Gymnasium
2605 E. 25th Street, Indianapolis, IN 46218

Enclosed are maps showing the location of the potential noise barriers and the survey postcard. Please either bring the survey postcard to the meeting or mail the completed survey postcard to the address on the card by **November 19, 2019. Your input is needed regarding the possible construction of a noise barrier near your neighborhood. It is very important that you submit the survey postcard.**

If requested, special accommodations will be made at the meeting for individuals needing auxiliary aids or the services of interpreters, readers or large print materials. If you need special accommodations, please contact Rickie Clark with INDOT's Office of Public Involvement at 317-232-6601 or rclark@indot.in.gov

We look forwarding to seeing you at the meeting on November 12, 2019. If you have additional questions regarding the meeting or survey, please contact Kia Gillette at HNTB at 317-917-5240 or via email at kgillette@hntb.com.

Sincerely,

Kia Gillette
HNTB, Environmental Project Manager

NOISE BARRIER 3E

NORTH SPLIT UPGRADES DRIVING PROGRESS

09-26-2019

Aerial Mapping Source: Google Earth

PROJECT OVERVIEW MAP

NORTH SPLIT UPGRADES DRIVING PROGRESS

SEPTEMBER 26, 2019 1:42 PM

Noise Frequently Asked Questions

General Noise FAQs

What influences traffic noise?
The level of highway traffic noise depends on four factors:

1. Volume of traffic
2. Speed of traffic
3. Number of large trucks
4. Location of highway relative to house

As any of these factors change, noise levels change.

Who regulates traffic noise?
The Federal Highway Administration (FHWA) has developed regulations regarding noise analysis on federally funded highway projects, and the Indiana Department of Transportation (INDOT) has outlined its implementation guidance in its Traffic Noise Analysis Procedure (2017) (Traffic Noise Policy) - https://www.in.gov/indot/files/2017%20INDOT%20Noise%20Policy.pdf.

What is the noise impact level?
The INDOT Traffic Noise Policy establishes two criteria for identifying an impact resulting from a project:

1. Identifying where future predicted noise levels would approach or exceed a set of Noise Abatement Criteria (NAC) established in the FHWA regulations. For exterior areas where frequent human use occurs in residential areas, the NAC is 67 decibels (dB(A)); INDOT defines "approaching the NAC" as within 1 dB (66 dB(A)) for residential areas). Locations where future noise levels are predicted to be 66 dB(A) or higher are considered "impacted."
2. Identifying locations where noise levels are expected to increase by 15 dB(A) or more over existing levels. There were no increases of 15 dB(A) or more for the North Split Project.

How does INDOT predict noise levels?
The FHWA Traffic Noise Model (TNM) Version 2.5 accounts for traffic noise factors to generate a 3-D model that can predict noise levels during the noisiest hour of the day. Based on noise levels predicted with a project, the model identifies where noise impacts occur and where mitigation should be considered.

How can noise be reduced?
Traffic noise can be potentially reduced by modifying either the source of the noise (speed, volume or type of vehicles), the location of the receiver (the person who hears the noise), or the path by which the noise reaches the receiver. Because it is impractical to reduce the speed, volume or type of vehicles on a highway, or to relocate residences solely due to noise impacts, the most common approach to mitigating noise is the construction of noise barriers.

What is a noise barrier?
Noise barriers are solid obstructions built between the highway and businesses or residences along a highway. Effective noise barriers typically reduce noise levels by 5 to 10 dB(A), which reduces the loudness of traffic noise by as much as one-half.

The most common noise barriers that INDOT has constructed typically consist of concrete/wood composite panels placed between steel supports. The height and location of a barrier is determined by the TNM analysis. The design-build contractor team will complete the final design of the noise barriers. This team will gather the input of adjacent property owners during the design phase to determine the final color and texture.

How does a noise barrier work?
Noise barriers reduce the sound from a highway by either absorbing the sound, reflecting it back across the highway, or forcing it to take a longer path to receivers. A noise barrier must be tall enough and long enough to block traffic noise from the area that is to be protected.

How does INDOT determine whether to construct a noise barrier?
INDOT considers noise abatement when a noise impact occurs and a barrier is considered to be feasible and reasonable.

What is a feasible noise barrier?
INDOT requires noise abatement measures to be based on sound engineering practices and standards and requires that any measure be evaluated at the best location. Noise barriers require long, uninterrupted segments to be effective. If there are existing roadway access points and/or driveways, it may not be feasible to construct effective noise barriers. Engineering feasibility also takes into account topography, drainage, safety, barrier height, utilities, existing bridges, and maintenance needs.

INDOT requires that noise barriers achieve a minimum 5 dB(A) reduction at a majority (greater than 50%) of the impacted noise receptors. If a barrier cannot achieve this acoustic goal, it is not considered to be acoustically feasible.

What is a reasonable noise barrier?
The cost of constructing a noise barrier is a significant factor in determining whether a barrier is reasonable. To determine cost-effectiveness, the estimated cost of construction (including installation and additional necessary construction, such as foundations or guardrails) is divided by the number of benefited receptors. The INDOT Traffic Noise Policy considers a material and design cost of $25,000 or less per benefited receptor to be cost-effective. Development in which more than 50% of the receptors were in place prior to the initial construction of the roadway in its current state will receive additional consideration for noise abatement. The criteria for cost-effectiveness in these cases is 20% greater ($30,000 per benefited receptor).

INDOT's noise reduction design goal is 7dB(A) for a majority of the benefited first row receptors.

In addition to meeting INDOT's cost-benefit analysis, the noise barrier must also be desired by landowners.

What is a benefited receptor?
Benefited receptors are those properties that receive a minimum 5 dB(A) reduction in future noise levels.

Can mature trees be used in place of traditional noise barriers?
Vegetation, if it is high enough, wide enough and dense enough that it cannot be seen over or through can decrease highway traffic noise. A wide strip of trees with very thick undergrowth can lower noise levels. Ninety feet of dense vegetation can reduce noise by 5 dB(A). However, it is not feasible to plant enough trees and other vegetation along a highway to achieve such a reduction. As it pertains to noise, trees and other vegetation can be planted for psychological and/or aesthetic benefit, but not to physically lessen noise levels.

Project-specific Noise FAQs

Where can I get a copy of the North Split Traffic Noise Technical Report?
This report is available on the North Split website at northsplit.com/noise**.**

Where is INDOT suggesting noise barriers be constructed?
Recent analyses determined that noise barriers may be feasible and reasonable at four locations:

1. Noise Barrier NB3E - Westbound I-70, along the edge of the north shoulder from Commerce Avenue to Valley Avenue, near the Martindale-Brightwood neighborhood
2. Noise Barrier NB4 - Northbound I-65, along the edge of the north shoulder between College Avenue and Alabama Street, near the Old Northside neighborhood
3. Noise Barrier NB5 - Southbound I-65, along the edge of the south shoulder between College Avenue and Alabama Street, near the Chatham Arch and Saint Joseph neighborhoods
4. Noise Barrier NB7 - Southbound I-65/Westbound I-70, along the edge of the west shoulder between 10th Street and Ohio Street near Massachusetts Avenue and the Lockerbie Square neighborhood

Will INDOT construct clear noise barriers?
In concurrence with the INDOT Traffic Noise Policy, current barrier design allows for absorptive barriers on the roadway side due to noise sensitive receptors on the opposite sides of the roadway. Transparent barriers are not absorptive and are not currently on the approved materials list. A potential transparent barrier manufacturer would have to meet the requirements for the absorptive roadside barrier.

What is a noise survey?
A noise survey helps determine if a noise barrier is reasonable, which requires INDOT to gather input from benefited receptors (residents and property owners), in close proximity to a proposed barrier. A noise survey is a postcard that is mailed to benefited residents and property owners to solicit their opinions about noise barriers. If the property owner is different from the current resident, both the owner and resident are surveyed.

If a barrier is proposed directly adjacent to the property line of a business, the business will also be mailed a survey to determine whether they have any concerns about line of sight.

When can residents learn more about noise barriers?
INDOT will hold neighborhood meetings to discuss potential noise barriers for each feasible and reasonable noise barrier location. The North Split Project Team will present INDOT’s noise mitigation process and potential barrier locations and answer resident questions.

How do benefited receptors obtain a noise survey?
Noise surveys will be mailed directly to benefited receptors.

What if I don’t receive a survey?
Residents and property owners who do not receive a noise survey in the mail are not considered benefited receptors for a barrier under the INDOT Traffic Noise Policy. It is possible they may still receive some noise reduction from a noise barrier and may still participate in the neighborhood meetings. But only the opinions of benefited receptors and businesses with concerns about line of sight will be considered by FHWA and INDOT.

What if the benefited receptors don’t complete the noise survey?
If a majority (greater than 50%) of benefited residents and property owners do not respond to the survey, a second survey will be required. FHWA and INDOT will discuss the results of the surveys received and determine the next course of action if a majority of benefited receptors do not respond.

What if residents don’t want a noise barrier?
INDOT surveys benefited property owners individually to determine whether or not they support a noise barrier. Once the public involvement efforts about the noise barriers are complete, FHWA and INDOT review the surveys to determine the public opinion.

Is it possible that INDOT would construct one or two noise barriers and not construct the others?
Yes. Each noise barrier is analyzed separately to determine if it is reasonable and feasible.

When and how will INDOT determine where to install noise barriers?
The final decision of any abatement measures will be made upon final design and the conclusion of the public involvement process. It is essential that benefited receptors participate in the noise survey so INDOT can consider their opinions.

Is noise analysis part of the Section 106 process?
Section 106 considers noise impacts and the visual impacts of noise barriers on properties that are listed in or eligible for the National Register of Historic Places. Noise impacts under INDOT’s Traffic Noise Policy may not result in impacts under Section 106.

How much do noise barriers cost?
INDOT uses $30/square foot to estimate noise barrier construction cost. The noise barrier designs analyzed for the North Split project ranged from 600 to 4,734 feet in length, 11 to 20 feet high, and $204,060 to $2,711,670 in cost.

Noise Barrier Meeting

A meeting to discuss potential noise barriers will be held:

November 12, 2019 from 7-8:30 p.m.
37 Place Community Center Gymnasium
2605 E. 25th Street, Indianapolis

Doors will open at 7 p.m. with a presentation at 7:30 p.m. Members of the North Split Project Team will be available for questions before and after the presentation.

Please return this survey card by November 19, 2019.

www.northsplit.com/noise

PO Box 44141, Indianapolis, Indiana 46224

☎ **(317) 749-0309**

#NorthSplit

@NorthSplit

Text "NORTHSPLIT" to 33222

Des. Nos. 1592385 & 1600808

INDIANA DEPARTMENT OF TRANSPORTATION

100 N. Senate Avenue
Room N755
Indianapolis, Indiana 46204

HNTB Corporation
Attn: Kia Gillette
111 Monument Circle
Suite 1200
Indianapolis, IN 46204

NORTH SPLIT UPGRADES DRIVING PROGRESS

We need your feedback.

The Indiana Department of Transportation (INDOT) is soliciting input from residents and property owners who have been determined to benefit from the construction of noise barriers for the North Split project. INDOT needs your input on whether you want the proposed noise barrier constructed.

Please refer to the enclosed letter and location map for more information. After you have completed the survey card, either bring it to your scheduled noise neighborhood meeting (see cover letter) or return it by mail. Please return the survey no later than November 19, 2019.

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www.northsplit.com/noise

Noise Barrier Survey Card

Thank you for completing this survey card. Please complete only one card per household.

Contact information:

Name

Address

City/State/ZIP

Are you the property owner or tenant?

☐ **Owner**
☐ **Tenant**

Contact information, if different from above (please print):

Name ______________________________

Address ______________________________

City/State/ZIP ______________________________

Are you in favor of a noise barrier at your property or residence?

☐ **Yes, I want the noise barrier to be constructed.**
☐ **No, I do not want the noise barrier to be constructed.**

From: Miller, Brandon
To: Kia Gillette; Richard Connolly
Cc: Shi, Runfa; Hilden, Laura; Bales, Ronald
Subject: Des No 1592385 and 1600808, I-65/I-70 North Split Project, Marion County, Indiana (Noise Report)
Date: Wednesday, June 10, 2020 3:33:01 PM
Attachments: image001.png
image002.png
image003.png
image004.png

Good afternoon,

A traffic noise analysis report was completed by HNTB Corporation in June 2020 to evaluate potential traffic noise impacts for the proposed I-65/I-70 North Split Project in Marion County, Indiana. Traffic noise was evaluated at all receptors within 500 feet of edge of pavement within the study area. Traffic noise levels were evaluated for the existing (2017) and projected (2041) traffic volumes for the build alternative.

This report evaluated potential noise impacts for the proposed improvements for the I-65/SR 267 interchange modification and the I-65/I-70 North Split Project in compliance with the Federal Highway Administration's (FHWA) Procedures for Abatement of Highway Traffic Noise and Construction Noise as presented in the Code of Federal Regulations, Title 23 Part 772 (23 CFR 772) and the Indiana Department of Transportation (INDOT) *Traffic Noise Analysis Procedure* (2017).

Predicted design year (2041) noise levels would approach or exceed the Noise Abatement Criteria (NAC) at ninety-two (92) receivers representing two hundred fifty-nine (259) receptors resulting in the need to evaluate noise abatement. Noise abatement was analyzed along eight barrier locations with multiple acoustic designs per barrier. Two (2) noise barriers have met both the feasibility and reasonableness criterion established by the INDOT *Traffic Noise Analysis Procedure* (2017).

Based on the studies thus far accomplished, the State of Indiana has identified those two locations where noise abatement is likely. A re-evaluation of the noise analysis will occur during final design. If during final design it has been determined that conditions have changed such that noise abatement is not feasible and reasonable, the abatement measures might not be provided. If during final design it has been determined that conditions have changed such that noise abatement is feasible and reasonable in the other locations where it was found to not meet the policy at this time, then noise abatement measures might be provided. The final decision on the installation of any abatement measure(s) will be made upon the completion of the project's final design and the public involvement process.

This email will serve as INDOT's approval of the traffic noise analysis report for the proposed I-65/I-70 North Split Project (Des 1592385 and 1600808).

Brandon Miller
Major Projects/LPA Review Liaison
INDOT Environmental Services
100 N. Senate Ave., Rm. 642
Indianapolis, IN 46204
Office: (317) 234-5108
Email: bramiller1@indot.in.gov