TRAFFIC NOISE ANALYSIS

https://northsplit.com/noise

The I-65/I-70 North Split Project Team has completed its evaluation of potential noise impacts in the North Split project area based on guidelines outlined in the Indiana Department of Transportation Traffic Noise Analysis Procedure (INDOT Noise Policy).

NOISE REDUCTION FEATURES

The Traffic Noise Model 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. To reduce noise levels further, INDOT is incorporating additional design features that are not recognized in the Traffic Noise Model. These features include:

- "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.
- 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.
- 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.

NOISE BARRIERS RECOMMENDED FOR CONSTRUCTION

The following potential noise barriers are recommended for construction:

- 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:

- 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. 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. Forty-eight percent (48%) of NB3E benefited receptors responded, with 93% expressing support. Seventy-eight percent (78%) of NB3W benefited receptors responded, with 100% expressing support.
- 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.
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NOISE BARRIERS NOT RECOMMENDED FOR CONSTRUCTION

The following potential noise barriers are not recommended for construction:

- 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: 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 include:

- 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.
    - 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.
    - 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.
    - 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 public meetings, social media posts, emails, and door hangers, fewer than one-quarter (23%) of benefited receptors had responded, with 63% expressing support for this barrier.

- 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 include:
  - Effects to Historic Properties – Six historic districts listed on the National Register of Historic Places (NRHP) are located immediately adjacent to 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. The State Historic Preservation Office provided a letter to INDOT and FHWA, dated November 1, 2019, expressing deep concern about the visual effect of NB4, NB5, and NB7 on the setting of the historic districts near the North Split. The letter described the noise barriers as an additional and severe adverse effect to the character and setting of these resources, greatly amplifying the visual impact of the existing interstate highway intrusion within the historic districts. The letter stated the 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. A letter provided by the Administrator for the Indianapolis Historic Preservation Commission on November 8, 2019, stated NB4, NB5, and NB7 would create a severe visual adverse effect by diminishing the feeling, setting, and character of the historic properties and the historic resources within them. Several historic neighborhoods 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
  - 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 were most notable with NB7. The overall survey response rate along NB7 was only 23%, but the survey response rate from businesses was near 50%. Of those businesses that responded, 90% were opposed to the installation of noise barriers.

*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.

https://northsplit.com/noise/preliminary-noise-recommendations/

The North Split project team recently completed the **Traffic Noise Technical Report,** which evaluates the potential noise impacts of the proposed improvements within the project area. 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 conditions, reducing congestion, and improving safety at the I-65 and I-70 interchange on the northeast side of downtown Indianapolis.

NOISE BARRIERS

Based on the guidelines outlined in **INDOT's Traffic Noise Policy**, recent analyses determined that noise barriers were determined to be feasible and cost-effective at five locations:

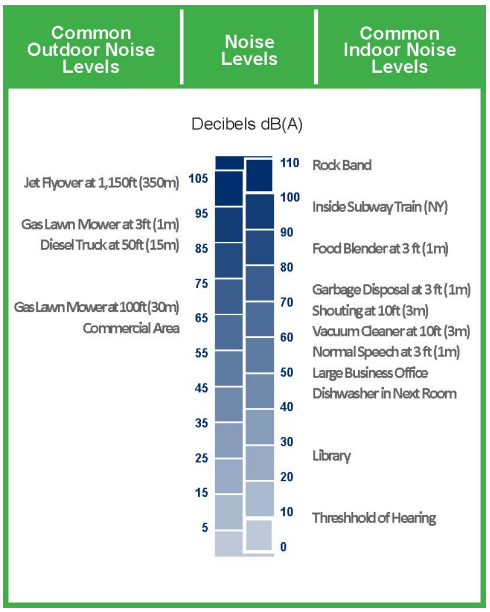
1. Noise Barrier NB3E – Westbound I-70, along the edge of the north shoulder from Commerce Avenue to Valley Avenue, near the Martindale-Brightwood neighborhood **(See the elevation and section views)**
2. Noise Barrier NB3W – Westbound I-70, along the edge of the north shoulder from approximately 240 feet west of Lewis Street and Commerce Avenue, near the Martindale-Brightwood neighborhood
3. Noise Barrier NB4 – Northbound I-65, along the edge of the north shoulder between College Avenue and Alabama Street, near the Old Northside neighborhood **(See the elevation and section views)**
4. 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 **(See the elevation and section views)**
5. 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
   (See the elevation and section views)

As part of the project development process, INDOT is asking residents and property owners who would benefit from the construction of a noise barrier whether they want the barrier to be constructed. FHWA and INDOT will consider the feedback received before making a decision whether or not to construct each noise barrier.

https://northsplit.com/noise/preliminary-noise-recommendations/traffic-noise/

The level of highway traffic noise depends on four factors:

- Volume of traffic
- Speed of traffic
- Number of large trucks
- Location of highway relative to the house



Noise is measured in decibels (dB(A)).

Changes in Sound Level	Perception
3 dB(A)	Barely Perceptible
5 dB(A)	Clearly Perceptible
10 dB(A)	Twice as loud

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 outdoor uses 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). Therefore, locations where future noise levels are predicted to be 66 dB(A) or higher are considered "impacted."

or

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.

https://northsplit.com/noise/preliminary-noise-recommendations/noise-barriers/

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.

Noise barriers 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 color and texture can vary, and INDOT seeks the input of adjacent property owners. Noise barriers reduce the sound from a highway by 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.

INDOT considers noise abatement when a noise impact occurs and a barrier is considered to be feasible and reasonable.

Feasible:

- Acoustic Feasibility – Achieves at least a 5 dB(A) reduction in traffic noise for a majority (>50%) impacted properties
- Engineering Feasibility – Considers environmental, drainage, safety, existing bridges, and other issues to identify best location for a barrier

Reasonable:

- Noise Reduction Goal – 7 dB(A) reduction for impacted first-row properties
- Cost-effectiveness
  - INDOT uses $30/sq. ft. to estimate barrier cost
  - Cost per benefited receptor of $25,000 or less is considered cost-effective. Cost per benefited receptor goes up to $30,000 if the majority (>50%) of the homes were built prior to initial construction of the roadway
- Views of Residents and Property Owners
  - INDOT considers the views of all benefited residents and property owners to determine whether a barrier is appropriate for a given location

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 five 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 NB3W - Westbound I-70, along the edge of the north shoulder from approximately Lewis Street and Commerce Avenue, near the Martindale-Brightwood neighborhood
3. Noise Barrier NB4 - Northbound I-65, along the edge of the north shoulder between College Avenue and Alabama Street, near the Old Northside neighborhood
4. 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
5. 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.

Supplement to Noise Frequently Asked Questions

Common Questions at Neighborhood Meetings

How much worse will the noise be after the North Split Project if sound barriers are not installed? Put another way, just what is the overall noise impact of the North Split Project?

Noise levels are predicted to be reduced at most locations along the North Split Project even if no noise barriers are installed. Noise model results show a decrease in noise at approximately 69% of receptor locations modeled. The model only identified one receptor out of the 378 modeled receptor locations with an increase over 3.0 decibels, which is the threshold where noise change is considered perceptible.

If highway noise will be less at most locations after the North Split Project, why are noise barriers being considered at all?

Although noise levels are predicted to be lower after the North Split Project, they will still exceed current thresholds for consideration of noise abatement. According to federal regulations, noise that exceeds or approaches federal noise abatement criteria (NAC) are considered to be impacts, and consideration of noise abatement is required. Among the abatement measures considered in the North Split Traffic Noise Technical Report, only noise barriers were found to be feasible and potentially reasonable. As a result, noise barriers are being considered for the common noise environments.

Is INDOT considering actions other than noise barriers to reduce highway noise as part of the North Split Project?

The North Split Project will include several features that are not recognized as noise abatement in federal regulations or the traffic noise model, but are anticipated to have the effect of reducing highway noise. These features include the following:

- "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).
- 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.
- 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.

Does the Traffic Noise Model used to identify potential noise barrier locations account for "next generation pavement," elimination of concrete pavement joints, and elimination of bridge joints?

No. The results from the Traffic Noise Model are based on average pavement type. Although it has now been used in 14 states, next generation pavement is still "new" in the industry. This will be the first time in Indiana that this paving technique has been used throughout a project. The elimination of pavement and bridge joints can have an effect on older installations such as the North Split area, but they are too site specific for consideration in a general Traffic Noise Model designed for universal application.

I live on the east side of the interstates just south of the North Split. Our big noise concern is the CSX trains operating between us and the interstates. If a noise barrier is placed on the west side of the interstate [NB7], will the train noise "bounce back" in our direction and make things even worse?

This should not be a concern. Here's why:

1) INDOT requires absorptive (rather than reflective) noise barriers per the Noise Policy if there are noise sensitive receptors on the opposite side of the roadway. These barriers have a minimum noise reduction coefficient (NRC) of approximately 0.70. A noise reduction coefficient is an average rating of how much sound an acoustic product can absorb. An acoustic product with a 0.70 NRC rating means that 70% of sound in the space is absorbed, while the other 30% is reflected.
2) The corridor is wide in this area, and for most of the noise barrier length the CSX line sits lower than the roadway. It is not a close space with potential for direct reflection.

How tall will the noise barriers be?

The noise barriers currently under consideration have an average height that ranges from 14 to 19 feet tall. These barriers would be constructed on top of the elevated road, so the total height from ground level at adjacent properties to the top of the noise barrier would be the total of the height of the roadway and the height of the barrier.