

Overview of the Updated United States Federal Transit Administration Noise and Vibration Impact Assessment Guidance Manual

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ABSTRACT

In 1995, the United States Federal Transit Administration (FTA) released “Transit Noise and Vibration Impact Assessment,” a guidance manual for use in conducting noise and vibration assessments for all types of transit projects. The manual represented a milestone for transit agencies in the United States in standardizing criteria, assessment methodology and policy in one document. The manual was updated in 2006, with minor technical changes and additions, along with corrections to the original manual. In 2018, a comprehensive update to the manual was released, prepared by the FTA, the Volpe Center, and Cross-Spectrum Acoustics. The updates to the manual included policy updates and clarifications, including information on how to assess multi-modal projects, how to assess projects in shared use corridors, and how to address moderate impacts and design mitigation policies. The technical updates included information on determining the level of assessment required, improved guidance on how to conduct noise measurements, noise criteria for buildings with only indoor uses, the addition of streetcars and information on how to assess non-typical transit sources for noise and vibration impacts. The revised manual is now in use on transit projects across the United States.

Keywords: Noise, Policy, Transit

I-INCE Classification of Subject Number: 82, 68, 69

1. INTRODUCTION

In 1995, the United States Federal Transit Administration (FTA) released “Transit Noise and Vibration Impact Assessment¹,” a guidance manual for use in conducting noise and vibration assessments for all types of transit projects. This manual standardized the assessment of noise and vibration for transit projects in the United States, and included detailed information on transit noise and vibration for the following topics:

- Fundamentals and descriptors
- Criteria
- Impact assessment methodologies
- Mitigation
- Policy

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The manual was developed during the 1980's and 1990's, drawing on research conducted by the United States Environmental Protection Agency (EPA)² and T.J. Shultz³ in the 1970's, to develop a unique set of noise criteria. These criteria, shown in Figure 1, are based on the both the existing noise level and the change in the noise level resulting from the introduction of a new project. The manual also set out the process for determining noise and vibration impacts from different transit modes at three different levels of assessment (a screening assessment, a general assessment and a detailed assessment), depending on the class of action and type of project being undertaken. The manual also included information on construction noise and vibration and documentation of noise and vibration assessments in environmental documents.

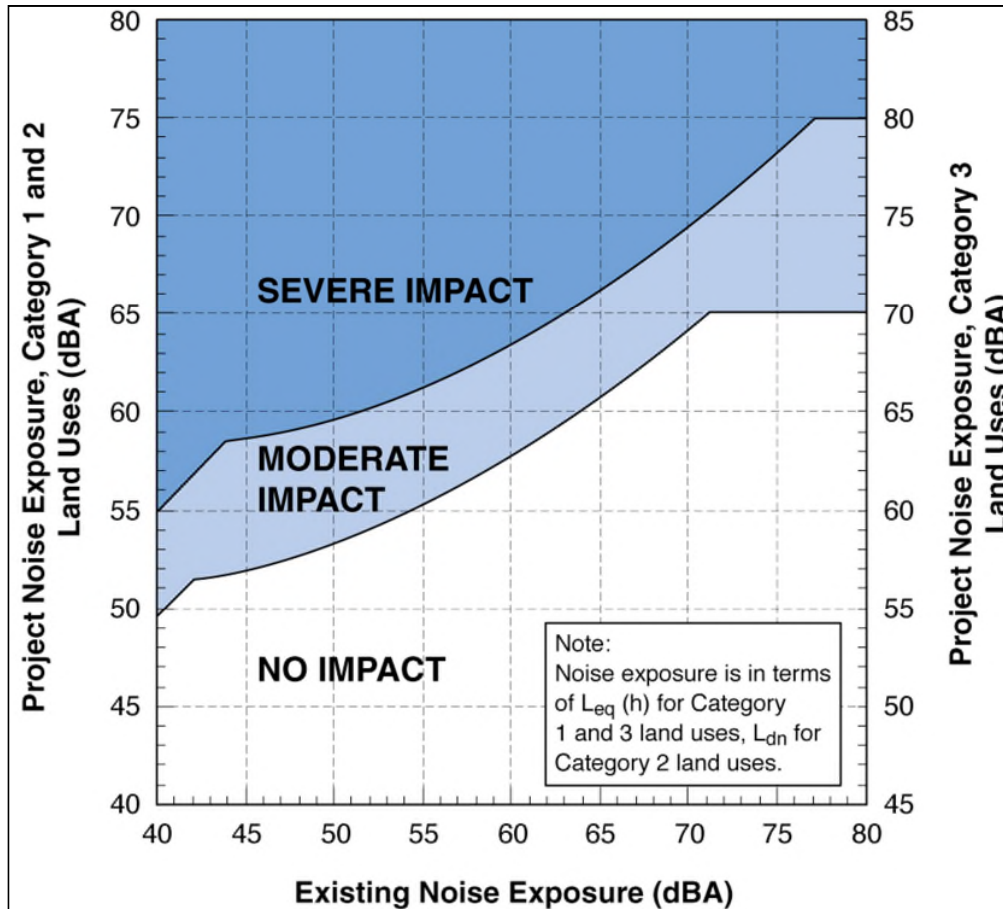


Figure 1. FTA Noise Impact Criteria

In 2006, an update to the original manual was published⁴. The 2006 updated manual included clarifications and edits to the original document, focused on improving the usage of the manual and making certain sections clearer in their intent. The major change in the 2006 manual was the addition of a set of detailed vibration criteria, as shown in Figure 2, based on ISO standards⁵, with an emphasis on highly-vibration sensitive equipment and locations.

The 2018 update to the guidance manual⁶ was started in 2014. The objectives for the revised manual were to:

- Reorganize the manual into a workflow format to allow users a step-by-step procedure for conducting FTA noise and vibration assessments

- Provide consistency with United States Federal Railroad Administration noise and vibration guidance, released in 2012⁷
- Provide new information and policy clarifications
- Expand information on key technical topics

The updated manual was released in September of 2018 and is now in use in transit projects across the United States. Unless otherwise stated, all references to the updated or revised manual refer to the 2018 manual.

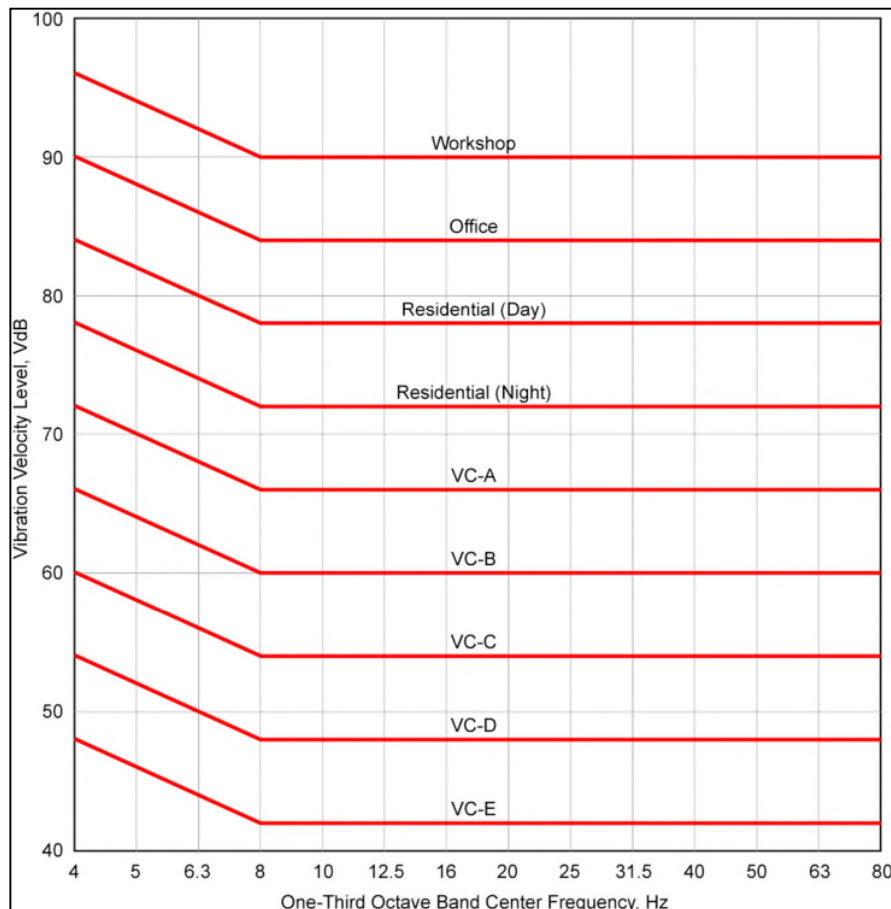


Figure 2. FTA Detailed Vibration Impact Criteria

2. POLICY UPDATES

One of the key goals of the 2018 guidance manual was to improve and clarify FTA's policy for several topics. For some users of the 2006 manual, there was confusion and uncertainty regarding portions of the policy related to the assessment methodology and mitigation requirements. Oftentimes, the manual is interpreted literally and out of context, which can lead to confusion in place of good engineering judgement that should be exercised in the assessment of noise and vibration on transit projects.

One of the challenges in the implementation of the manual is that it is used by people with a wide range of experience and expertise, including many with no acoustics background. The policy clarifications were meant to remove some of the uncertainty for users of the manual and to improve the guidance for consistency between project assessments.

2.1 Land Use Policy Updates

One of the areas in the previous versions of the manual where there was confusion on the part of the user was in determining the noise and vibration sensitivity of buildings and other land uses near proposed projects.

In the revised manual, the sensitivity of buildings and land uses with special designations as historic properties was clarified. Many users of the manual would assume that an historic building was automatically sensitive to noise or vibration, without regard to the use of the building. There are many historic buildings that are not sensitive to noise or vibration (warehouses, train depots, etc.) and this has been clarified to ensure that the use of a historic resource is captured as a part of the assessment.

A similar issue existed with parks and parklands. Many users of the manual would automatically assume that a park is noise sensitive, without regard to the use of the park. A section was added to the revised manual to clarify that active use parks (sports facilities, bike paths, etc.) are not considered noise sensitive. However, passive uses (areas for reading or other quiet activities) should be considered sensitive. It was also clarified that parks can have multiple uses and different sensitivities to noise at different locations within the park.

For more typical buildings, the sensitive use of and location within the building of that sensitive use drives the assessment. The revised manual explicitly clarifies that it is important to determine the location of sensitive uses within a building. For example, a residence should not be assessed for noise or vibration impact at a porch or garage, but rather at the occupied portion of the building. Furthermore, the assessment should be conducted at the façade of the building itself and not at the property line.

Finally, a statement was added in the revised manual that the project sponsor should address undeveloped land that has the potential for improvements and that could have noise or vibration sensitivity during the lifetime of the project development. A policy should be developed by the project sponsor and stakeholders that sets out when new developments should be considered in the noise and vibration assessment.

2.2 Noise Mitigation Policy Changes

The FTA noise impact criteria contain three levels of impact: No Impact, Moderate Impact and Severe Impact (See Figure 1). In general, at the No Impact level, mitigation is not required, and at the Severe Impact level, mitigation is required unless there are compelling reasons not to provide mitigation, such as safety concerns, or interference with operations.

At the Moderate Impact level, mitigation should be considered when reasonable. FTA allows discretion in determining what is considered reasonable at this level of impact. The revised guidance manual provides clarification and additional information on the factors that should be considered in determining the reasonableness of mitigation at the Moderate Impact level, including:

- Number of noise-sensitive sites – the greater the number of affected sites, the more compelling the need for mitigation
- Increase over existing noise levels – a larger increase in noise over existing levels increases the need for mitigation
- Noise sensitivity of the property – a greater sensitivity to noise or sites protected by other statutes increases the need for mitigation
- Effectiveness of the mitigation measures – the mitigation must provide a reasonable reduction of noise levels
- Feasibility of the mitigation measures – the mitigation should be feasible from an engineering, operations and safety perspective

- Fairness and equity of the mitigation measure – the same level of mitigation should be provided at all locations
- Existing transportation noise – a location with higher levels of existing noise from transportation sources presents a greater need for mitigation from the cumulative noise
- Community views – the views of the community should be considered in implementing mitigation
- Cost – a cost threshold for mitigation should be included to ensure that there is a reasonable expenditure of project funds for mitigation

The revised guidance manual suggests that individual agencies consider developing and adopting a mitigation policy to aid in the determination of appropriate and applicable mitigation measures for projects. Having a policy in place can aid in the project planning up front and help to improve and coordinate mitigation decisions.

For each of the nine factors listed above, the revised manual includes an example of how they could potentially be incorporated into a noise mitigation policy by a transit agency. These include setting a minimum reduction (such as at least 5 dB) in noise levels to be considered an effective form of mitigation, or to state that the engineering design of the mitigation must be feasible, that it must be compatible with operations, and that mitigation must not compromise safety.

2.3 Project Type Classification

Because there is no unified Federal noise agency or policy in the United States, noise methodologies, criteria and assessments are left to individual agencies to develop and implement. This means that the agencies in the US that oversee highways, transit, airports and housing all have different methodologies for assessing noise. For multi-modal transportation projects, specifically projects that include both transit and highway components, this can present a challenge in terms of how to evaluate the noise impacts.

The United States Federal Highway Administration (FHWA) noise assessment criteria and methodology⁸ uses different descriptors, criteria and modeling methodology than the FTA. Because of this, combining the methods can be challenging. Additionally, there has been confusion about when to use FTA and FHWA methods, especially when transit projects are located within or adjacent to highways.

The revised manual explains that the project noise determines the type of project (not the existing noise) and the use of FTA or FHWA analysis methods. A transit project in the median of or adjacent to a highway does not automatically become a multi-modal project subject to FHWA methods, unless certain conditions are met. The revised manual includes the flowchart in Figure 3 that shows the steps in determining the type of project and when to use FTA or FHWA methods. Additionally, at the “Multi-Modal Project” step of the flowchart, the FHWA recently clarified that a project is multi-modal and subject to FHWA methods if it meets all three of the following conditions:

- FTA is the lead agency and FHWA is a cooperating agency
- The main transportation purpose is transit related and not highway related
- No Federal highway funds are being used

This language has been adopted in the revised manual. The result is that in most cases, transit projects will be FTA only, including bus/BRT projects on local streets and FTA projects that do not alter a highway as a part of the project. The only times a transit project would be truly multi-modal with both FTA and FHWA methods is if there is a change occurring to a highway or if at least one of the three criteria above are not met. In that case, the remainder of the flowchart should be followed.

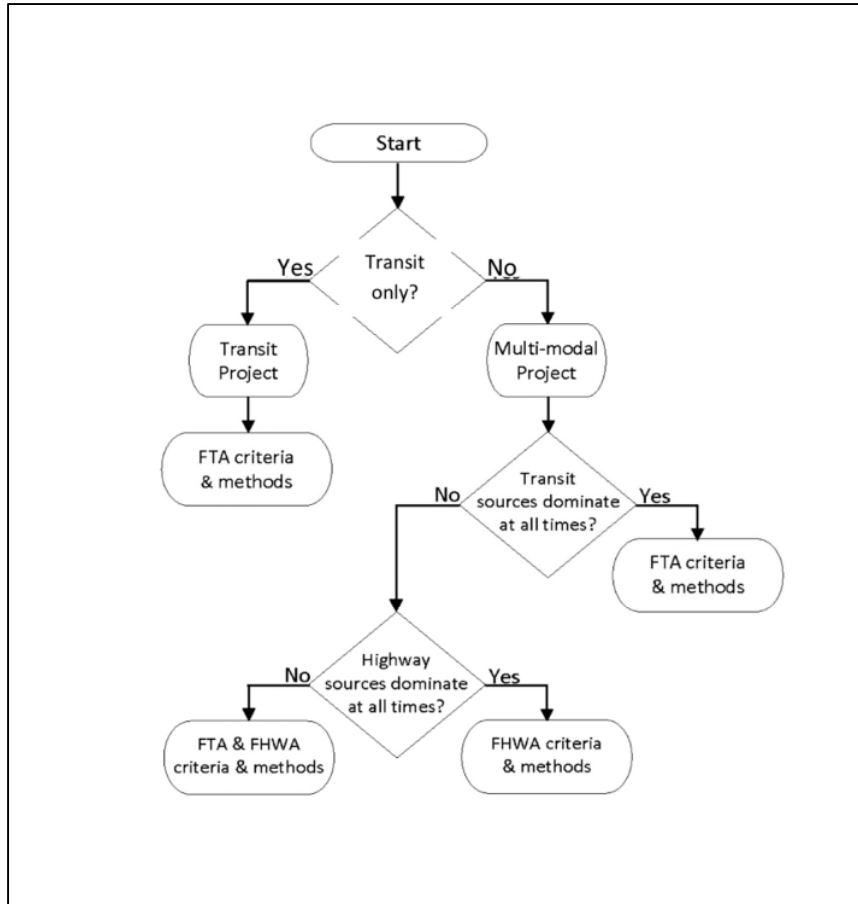


Figure 3. FTA Project Classification Flowchart

3. TECHNICAL UPDATES

In addition to the policy updates, several technical updates were made in the revised guidance manual. The technical updates included new information on sources of noise and vibration, such as streetcars and Diesel Multiple Units (DMUs), that are gaining in popularity as transit modes in the US. The revised manual also includes a new -5 dB adjustment for converting from vibration to ground-borne noise in interior spaces⁹. For more technical users, the revised manual also includes a significant number of additional source references for the information presented in the manual.

3.1 Guidance for Vibration Assessment Curves

At the general level of vibration assessment, when vibration measurements are not conducted, a series of curves of vibration level vs. distance (see Figure 3) are used as the starting point for the assessment of vibration impact. The three curves are defined for specific transit vehicle types, but there was no guidance on how to apply the three curves to other transit modes. The revised manual provides guidance on how to apply these curves to other transit modes, such as intercity trains, streetcars, Electric Multiple Units (EMUs) and DMUs. In addition, the revised guidance includes the equations that define the three curves in Figure 4 for use in assessments.

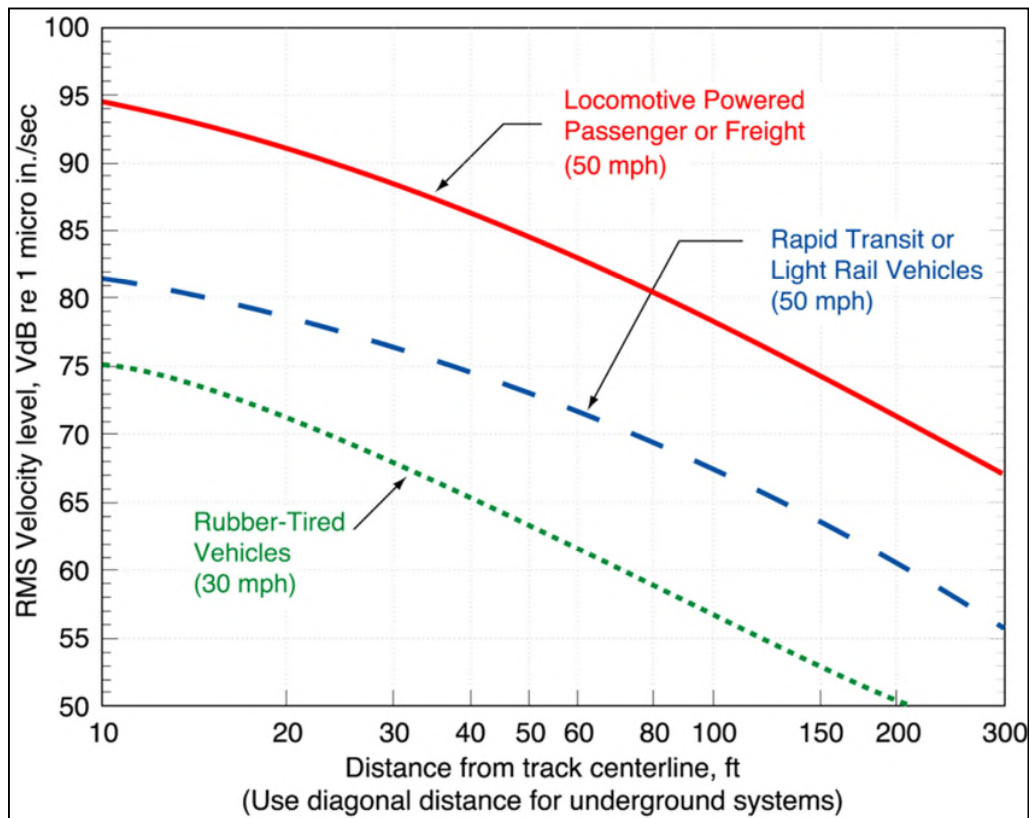


Figure 4. FTA General Vibration Assessment Curves

3.2 Vibration in Shared Use Corridors

The FTA vibration criteria are based on the maximum vibration levels and are not typically assessed relative to existing vibration, since in most cases there are not significant sources of existing vibration. However, in locations where projects would be in the same corridor as an existing vibration source (such as freight trains) the existing vibration sources need to be considered in the assessment.

Guidance on this topic was included in the 2006 version of the guidance manual, but the discussion was not clear to users. The revised manual improved the discussion on vibration in corridors with existing trains and added a flowchart (see Figure 5) to help in determining how to assess the vibration from a new project in a location with significant existing vibration levels. The guidance uses both the relative vibration levels between the existing source and new source as well as the number of existing operations in the corridor in determining the approach to take with the vibration assessment.

3.3 Interior Noise Criterion

The FTA noise criteria are based on outdoor noise levels and the approach is to attempt to provide noise mitigation for both outdoor and indoor uses, where required. However, in some cases, there are limits to providing outdoor mitigation, such as in downtown areas with high rise apartments or hotels. In these cases, where there is no outdoor use and impacts are identified, a supplemental indoor noise criterion is used to determine impact.

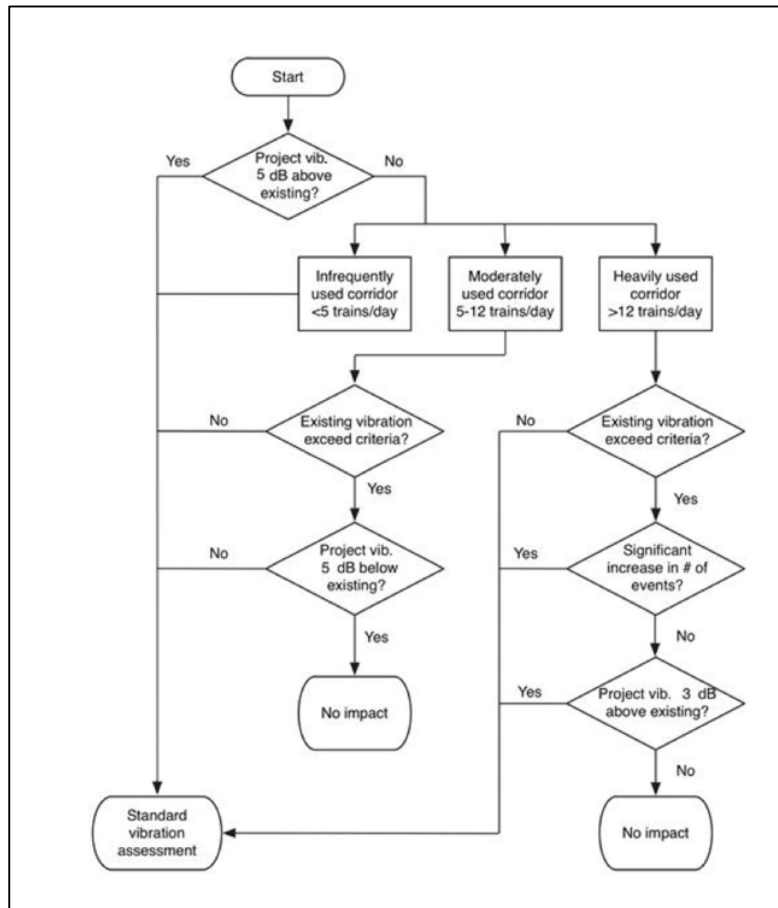


Figure 5. FTA Shared Corridor Vibration Assessment Flowchart

The revised guidance manual provides an improved discussion of interior noise levels and mitigation decisions. A 45 dBA Ldn criterion is used to assess the potential for interior noise impacts at locations with no outdoor use. For these locations, if the noise levels exceed the interior criterion, sound insulation of the building should be considered.

Some buildings, especially in locations with high existing noise levels, may already have sufficient sound insulation to meet the indoor criterion. Therefore, testing should be conducted to determine if the buildings already meet the criterion, and if not, what measures should be implemented to improve the outdoor-to-indoor noise reduction to meet the 45 dBA Ldn interior criterion.

This procedure regarding interior noise levels and sound insulation is consistent with the United States Federal Aviation Administration approach to noise assessments and mitigation.¹⁰

4. CONCLUSIONS

The 2018 version of the guidance manual is now in use on transit projects across the United States. The manual includes a revised layout which emphasizes a step by step method for conducting assessments to improve the accessibility for new or inexperienced users. The policy updates and technical additions should improve the clarity and usage of the document and provide some consistency with other Federal agencies. Additionally, there is now an appendix in the revised manual which lays out a procedure for petitioning the FTA for and approving the use of non-standard methods in conducting noise and

vibration assessments for transit projects. Finally, the revised manual is now presented in electronic format on the FTA's website to reduce the use of paper in printing and distributing the manual.

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