

## 1. INTRODUCTION

### 1.1 PURPOSE

Noise and vibration assessments are key elements of the environmental impact assessment process for mass transit projects. Experience has shown that noise and vibration are among the major concerns with regard to the effects of a transit project on the surrounding community. A transit system is of necessity placed near population centers and often causes significant noise and vibration at nearby residences and other sensitive types of land use.

This manual provides guidance for preparing and reviewing the noise and vibration sections of environmental documents. In the interest of promoting quality and uniformity in assessments, the manual will be used by project sponsors and consultants in performing noise and vibration analyses for inclusion in environmental documents. The manual sets forth the methods and procedures for determining the level of noise and vibration impact resulting from most federally-funded transit projects and for determining what can be done to mitigate such impact. Since the methods have been developed to assess typical transit projects, there will be some situations not explicitly covered in this manual. The exercise of professional judgment may be required to extend the basic methods in these cases.

### 1.2 THE ENVIRONMENTAL REVIEW PROCESS

The Federal Transit Administration (FTA) provides capital assistance for a wide range of mass transit projects – from completely new rail rapid transit systems to bus maintenance facilities and vehicle purchases. The extent of environmental analysis and review will depend on the scope and complexity of the proposed project and the associated environmental impacts. FTA's environmental impact regulation classifies the most common projects according to the different levels of environmental analysis required, ranging from an environmental impact statement (EIS) to little or no environmental documentation (categorical exclusion). FTA's environmental impact regulation is codified in Title 23, Code of Federal Regulations, Part 771.<sup>(1)\*</sup>

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\*References are located at the end of each chapter.

**Environmental Impact Statements.** Large fixed-guideway projects, such as heavy rail, light rail, commuter rail and automated guideway transit systems, normally require environmental impact statements, including an in-depth noise and vibration assessment. While there may be exceptions to the EIS requirement, in the great majority of cases new rail starts or extensions to existing systems involve significant environmental effects in the context of the National Environmental Policy Act (NEPA). Because they are located in dense urban areas, noise and vibration impacts are a frequent concern; thus it is likely that for the major infrastructure projects requiring an EIS, the most detailed treatment of noise and/or vibration impacts will also be required.

There are other projects as well which may require a detailed analysis of noise and vibration impacts even if an EIS is not required to comply with NEPA. These could be bus/high-occupancy-vehicle (HOV) lanes built on existing highways or construction of certain bus or rail terminals and storage and maintenance facilities. If the project is proposed to be located in or very close to a sensitive area or site, it is prudent to use the most detailed procedures contained in the manual to predict noise and/or vibration levels since this will provide the most reliable basis for considering measures to mitigate excessive noise/vibration at a specific site.

**Categorical Exclusions.** At the other extreme is a host of smaller transit projects which normally do not cause significant environmental impacts and do not require noise and vibration assessment. These projects are listed as "categorical exclusions" in FTA's environmental regulation, meaning that FTA has determined that there are no significant environmental impacts for those types of projects and no environmental document is required. Examples are: vehicle purchases; track and railbed maintenance; installation of maintenance equipment within the facility, etc. Section 771.117(c) contains a list of transit projects predetermined to be categorical exclusions.

Other types of projects may also qualify as categorical exclusions, for example, certain transit terminals, transfer facilities, bus and rail storage and maintenance facilities (see 23 CFR 771.117(d)). These projects usually involve more construction and a greater potential for off-site impacts. They are presented in the regulation with conditions or criteria which must be met in order to qualify for categorical exclusion. The projects are reviewed individually by FTA to assure that any off-site impacts are properly mitigated. Depending on the proposed project site and the surrounding land use, a noise and vibration assessment may be needed even though the project may ultimately qualify as a categorical exclusion. The screening process in Chapters 4 and 9 will be helpful in pointing out potential noise and vibration concerns and the general assessment procedures may then be used to define the level of impact.

**Environmental Assessments.** When a proposed project is presented to FTA, if it is uncertain whether the project requires an EIS or qualifies as a categorical exclusion, FTA will direct the project sponsor to prepare an environmental assessment (EA). Generally, an EA is selected (rather than trying to process the project as a categorical exclusion) if the FTA reviewer feels that several types of impacts need further investigation, for example, air quality, noise, wetlands, historic sites, traffic, etc. An EA is a relatively brief environmental study which helps determine the magnitude of the impacts that will likely be caused by the project. If, during the analysis, it appears that any impacts are significant, an EIS will be prepared. If the analysis shows that none of the impacts is significant or if mitigation measures are incorporated in the project to adequately deal

with adverse impact, the EA will fully document this and serve as the basis for a Finding of No Significant Impact issued by FTA. It is important to note that when mitigation measures are relied on, they must be described in detail in the EA since FTA's finding is based on the inclusion of these measures in the project.

FTA's environmental regulation does not list typical projects that require EA's. An EA may be prepared for any type of project if uncertainty exists about the magnitude or extent of the impacts. Experience has shown that most of the EA's prepared for transit projects require an assessment of noise impacts.

### **1.3 NOISE AND VIBRATION ANALYSIS IN PLANNING AND PROJECT DEVELOPMENT**

Major capital investment projects are developed initially from a comprehensive transportation planning process conducted in metropolitan areas (see 23 CFR 450.300). The metropolitan planning process includes the consideration of social, economic, and environmental effects of proposed major infrastructure improvements. However, at this stage, environmental effects are usually considered on a broad scale, for example, overall development patterns, impact on greenspace, and regional air quality. Noise and vibration assessments are not typically done at the systems planning stage since the proposed infrastructure improvements lack the necessary detail.

Once the need for a major capital investment in a corridor is established in the metropolitan transportation plan, the task then becomes identifying the transit mode and alignment best suited for the corridor. If FTA capital investment funds will be pursued, the project sponsor must perform an "alternatives analysis."<sup>(2)</sup> Often combined with a Draft EIS, the alternatives analysis presents information on benefits, costs, and impacts of alternative strategies for meeting the need for new capacity. Usually, several alternatives ranging in cost will be evaluated. If environmental impacts of the alternatives will be assessed, noise and, to a lesser extent, vibration are primary issues. The screening and general assessment procedures described in this manual are well-suited to compare and contrast noise/vibration effects among different modes and alignments. In fact, the general assessment procedures were developed partly to respond to this need. In addition, they can be used for any specific project where the screening procedure indicates potential for impact and the project sponsor wants a relatively quick assessment of the level of impact.

If the results of the alternatives analysis justify further development of a major capital investment, FTA will approve entry of the proposed project into preliminary engineering. During preliminary engineering, the environmental review process is completed. With the mode and alignment determined, the impact assessment at this stage focuses on the locally preferred alternative for a major capital investment. The detailed analysis procedures for noise can be used to produce the most accurate estimates of noise impact for the proposed project. The detailed procedures should be used as the basis for reaching any decisions on the need for noise reduction measures and the types of measures that are appropriate for the project.

After the NEPA process is completed for a major project, federal funding for final design may be granted. If vibration impacts were identified during preliminary engineering, a detailed analysis of vibration impact may be conducted during final design. Final design activities will produce the geotechnical information needed to

refine the impact assessment and allow the most detailed consideration of vibration control measures, if needed. Even for smaller transit projects, if vibration impact is predicted in a general assessment, vibration mitigation measures should only be specified after a detailed analysis has been done. Detailed vibration analysis is best accomplished during final design of the project.

Once the project enters construction, there may still be a need for noise or vibration analysis in some circumstances. Large construction projects in densely populated residential areas may require noise monitoring to make sure that agreed-upon noise limits are not exceeded. Vibration testing may be needed in the final stages of construction to determine whether vibration control measures are having the predicted effect.

Considering that transit projects must be located amid or very close to concentrations of people, noise and vibration impacts can be a concern throughout the planning and project development phases. This manual offers the flexibility to address noise and vibration at different stages in the development of a project and in different levels of detail depending on the types of decisions that need to be made.

There are three levels of analysis which may be employed, depending on the type and scale of the project, the stage of project development, and the environmental setting. The technical content of each of the three levels is specified in the body of this document, but a summary of each level is given in the following paragraphs:

- **Screening Procedure:** Identifies noise- and vibration-sensitive land uses in the vicinity of a project and whether there is likely to be impact. It also serves to determine the noise and vibration study areas for further analysis when sensitive locations are present. The screening process may be all that is required for many of the smaller transit projects which qualify as categorical exclusions. When noise/vibration-sensitive receivers are found to be present, there are two levels of quantitative analysis available to predict impact and assess the need for mitigation measures.
- **General Assessment:** Identifies location and estimated severity of noise and vibration impacts in the noise and vibration study areas identified in the screening procedure. For major capital investments, the General Assessment provides the appropriate level of detail to compare alternative modes and alignments in alternatives analysis. It can be used in conjunction with established highway noise prediction procedures to compare and contrast highway, transit and multimodal alternatives. Before basic decisions have been reached on mode and alignment in a corridor, it is not prudent to conduct the most detailed level of noise and vibration analysis. For smaller transit projects, this level is used for a closer examination of projects which show possible impacts as a result of screening. For many smaller projects, this level may be sufficient to define impacts and determine whether mitigation is necessary.
- **Detailed Analysis:** Quantifies impacts through an in-depth analysis usually only performed for a single alternative. Delineates site-specific impacts and mitigation measures for the preferred alternative in major investment projects during preliminary engineering. For other smaller projects, Detailed Analysis may be warranted as part of the initial environmental assessment if there are potentially severe impacts due to close proximity of sensitive land uses.

The three levels of noise and vibration assessment are described in the chapters which follow.

## **1.4 ORGANIZATION OF THE MANUAL**

The guidance manual is divided into two parts, noise and vibration. Each part has parallel organization according to the following subjects:

### **Noise/Vibration**

- Basic Concepts
- Criteria
- Screening Procedure
- General Assessment
- Detailed Analysis

### **Construction Noise/Vibration**

### **Documentation**

### **Appendices**

- Glossary
- Background for Transit Noise Impact Criteria
- Receiver Selection
- Existing Noise Determination
- Noise Source Level Determination
- Maximum Noise Level Computation

## **REFERENCES**

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1. U.S. Department of Transportation, Federal Transit Administration and Federal Highway Administration, "Environmental Impact and Related Procedures," Final Rule, 52 Federal Register 32646 -32669; August 28, 1987 (23 Code of Federal Regulations 771).
2. U.S. Department of Transportation, Federal Transit Administration, "Major Capital Investment Projects," Final Rule, 65 Federal Register 76863-76884; December 7, 2000 (49 CFR Part 611).