

## **13. DOCUMENTATION OF NOISE AND VIBRATION ASSESSMENT**

To be effective, the noise and vibration analysis must be presented to the public in a clear, yet comprehensive manner. The mass of technical data and information necessary to withstand scrutiny in the environmental review process must be documented in a way that remains intelligible to the public. Justification for all assumptions used in the analysis, such as selection of representative measurement sites and all baseline conditions, must be presented for review. For large-scale projects, the environmental document contains a condensation of essential information in order to maintain a reasonable size. For these projects, separate technical reports are usually prepared as supplements to the environmental impact statement (EIS) or environmental assessment (EA). For smaller projects, or ones with minimal noise or vibration impact, all the technical information may be presented in the environmental document itself. This chapter gives guidance on how the necessary noise and vibration information should be included in the project's environmental documentation.

### **13.1 THE TECHNICAL REPORT ON NOISE AND VIBRATION**

A separate technical report is often prepared as a supplement to the environmental document (EIS or EA). A technical report is appropriate in cases when the wealth of data can not all be placed in the environmental document. The details of the analysis are important for establishing the basis for the assessment. Consequently, all the details in the technical report should be contained in a well-organized format for easy access to the information. While the technical report is not intended to be a primer on the subject, the technical data and descriptions should be presented in a manner that can be understood by the general public. All the necessary background information should be present in the technical report, including tables, maps, charts, drawings and references that may be too detailed for the environmental document, but which are important in helping to draw conclusions about the project's noise and vibration impacts and mitigation options.

### **13.1.1 Organization of Technical Report**

The technical report on noise/vibration should contain the following major subject headings, along with the key information content described below. If both noise and vibration have been analyzed, it is generally preferable to separate the noise and vibration sections; as shown in this guidance manual, the approaches to the two topics are quite different.

- **Overview:** This section contains a brief description of the project and an overview of the noise/vibration concerns. It sets forth the initial considerations in framing the scope of the study.
- **Inventory of Noise/Vibration-Sensitive Sites:** The approach for selecting noise- and vibration-sensitive sites should be described in sufficient detail to demonstrate completeness. Sites and site descriptions are to be included.
- **Measurements of Existing Noise/Vibration Conditions:** The basis for selecting measurement sites should be documented, along with tables of sites coordinated with maps showing locations of sites. If the measurement data are used to estimate existing conditions at other locations, the rationale and the method should be included. Measurement procedures should be fully described. Tables of measurement instruments should include manufacturer, type, serial number and date of most recent calibration by authorized testing laboratory. Measurement periods, including time of day and length of time at each site should be shown to demonstrate adequate representation of the ambient conditions. The measurement data should be presented in well organized form in tables and figures. A summary and interpretation of measured data should be included.
- **Special Measurements Related to the Project:** Some projects require specialized measurements at sensitive sites, such as outdoor-to-indoor noise level reduction of homes, or transmission of vibrations into concert halls and recording studios. Other projects may need special source-level characterization. Full description of the measurements and the results should be included.
- **Predictions of Noise/Vibration from the Project:** The prediction model used for estimating future project conditions should be fully described and referenced. Any changes or extensions to the models recommended in this manual should be fully described so that the validity of the adjustments can be confirmed. Specific data used as input to the models should be listed. Computed levels should be tabulated and illustrated by contours, cross-sections or shaded mapping. It is important to illustrate noise/vibration impacts with base maps at a scale with enough detail to provide location reference for the reader.
- **Noise/Vibration Criteria:** Impact criteria for the project should be fully described and referenced (refer to Chapters 3 and 8). In addition, any applicable local ordinances should be described. Tables specifying the criteria levels should also be included. If the project involves considerable construction, and a separate construction noise and vibration analysis will be included, then construction criteria should appear in a separate section with its own assessment.
- **Noise/Vibration Impact Assessment:** The impact assessment should be described according to the procedures outlined in this manual. A resulting impact inventory should be presented for each alternative mode or alignment in a format that allows ready comparison among alternatives. The

inventory should be tabulated according to the different types of land uses affected. The results of the assessment may be presented both before and after mitigation.

- **Noise/Vibration Mitigation:** The mitigation section of the technical report should begin with a summary of all treatments considered, even if some are not carried to final consideration. Final candidate mitigation treatments should be considered separately with description of the features of the treatment, costs, expected benefit in reducing impacts, locations where the benefit would be realized and discussion of practicality of implementing alternative treatments. With respect to noise impacts, enough information is to be included to allow the project sponsor and FTA to reach decisions on mitigation prior to issuance of the final environmental document.
- **Construction Noise/Vibration Impacts:** Criteria adopted for construction noise or vibration should be described, if appropriate. According to Chapter 12, these may be adopted on a project-specific basis. The method used for predicting construction noise or vibration should be described along with inputs to the models, such as equipment roster by construction phase, equipment source levels, assumed usage factors and other assumed site characteristics. The predicted levels should be shown for sensitive sites and short-term impacts should be identified. In cases where construction impacts appear to be problematic, feasible abatement methods should be discussed in enough detail such that construction contract documents could include mitigation measures.
- **References:** References should be provided for all criteria, approaches and data used in the analyses, including other reports related to the project which may be relied on for information, e.g., geotechnical reports.

## 13.2 THE ENVIRONMENTAL DOCUMENT

The environmental document typically includes noise and vibration information in three places: a section of the chapter on the affected environment (existing conditions) and two sections in the chapter on environmental consequences (the long-term impacts from operations and short-term impacts from construction activity). The noise and vibration information presented in the environmental document is a summary of the comprehensive information from the technical report with emphasis on presenting the salient points of the analysis in a format and style which affected property owners and other interested citizens can understand. Smaller projects may have all of the technical information contained within the environmental document, requiring special care in summarizing technical details to convey the information adequately.

The environmental document provides full disclosure of noise and vibration impacts, including identification of locations where impacts cannot be mitigated satisfactorily. An EIS describes significant impacts and tells what the Federal agency intends to do about them. For projects handled with EA's, completion of the environmental review with a finding of no significant impact (FONSI) may depend on mitigation being incorporated in the proposed project. The specific way mitigation is handled in the

environmental document depends on the type of impact (noise or vibration) and the stage of project development and environmental review.

In general, airborne noise impacts can be accurately predicted in the preliminary engineering stage. Since the environmental review for major investment projects is completed during preliminary engineering, it is possible to specify, and commit to implement, any needed noise mitigation measures in the final environmental document (Final EIS or FONSI). With major investments, as well as small projects like bus terminals and garages, it is expected that decisions on noise mitigation will be made before the final document is approved; thus timely development of design, feasibility and cost information needed to reach decisions on noise mitigation is essential. For major investments in the Alternatives Analysis/Draft EIS stage, the emphasis is not on mitigation but rather a broad comparison among the alternatives concerning the magnitude and extent of noise impacts. If it seems likely that mitigation would be required for at least some major investment alternatives, this can be discussed in a general way while touching on the remaining stages of project development and how decisions on mitigation fit in. Finally, there are other projects for which the preferred alternative is identified at the outset in the Draft EIS or EA. With the focus on a single alternative, noise impacts can be accurately identified in the draft document. If mitigation is needed, mitigation options should be explored in the draft; however firm decisions on mitigation can be deferred to the final document.

Predicting vibration impacts accurately is a more complex undertaking because ground-borne vibration may be strongly influenced by subsurface conditions. The geotechnical studies that reveal these conditions are normally undertaken during the final design stage after the NEPA process has been completed. Thus, for ground-borne vibration and noise, the final environmental document will usually not be able to state with certainty whether or not mitigation is needed. The final environmental document will rely on a General Assessment for ground-borne vibration and noise to identify potential problem areas. If there are such areas, there should be a commitment in the final document to conduct a Detailed Analysis during final design to complete the impact assessment and help determine the need for mitigation. The final environmental document should present a preliminary assessment using the vibration impact criteria for the General Assessment. If it appears the criteria cannot be met, the document would discuss various control measures that could be used and the likelihood that the criteria could be met through the use of one or more of the measures. It may be possible to state a commitment in the final environmental document to adhere to the impact criteria for the Detailed Analysis, while deferring the selection of specific vibration control measures until the completion of detailed studies in final design.

After a final environmental document is approved, the described mitigation measures are incorporated by reference in the actual grant agreements signed by FTA and the project sponsor. Thus, they become contractual conditions that must be adhered to by the project sponsor.

### **13.2.1 Organization of Noise and Vibration Sections of Environmental Documents**

#### **Chapter on Affected Environment (Existing Conditions)**

This chapter describes the pre-project setting, including the existing noise and vibration conditions, that will likely be affected by one or more of the alternatives. The primary function of this chapter is to establish the focus and baseline conditions for later chapters discussing environmental impacts. Consequently, it is a good place to put basic information on noise and vibration descriptors and effects, as well as describing the characteristics in the vicinity of the project. Again, it is preferable to separate the noise and vibration sections.

- **Description of Noise/Vibration Descriptors, Effects and Typical Levels:** Information from Chapters 2 and 7 of this manual can be used to provide a background for the discussions of noise/vibration levels and characteristics to follow. Illustrative material to guide the reader in understanding typical levels is helpful.
- **Inventory of Noise/Vibration-Sensitive Sites:** The approach for selecting noise/vibration-sensitive sites should be described in sufficient detail to demonstrate completeness. Sites and site descriptions are to be included.
- **Noise/Vibration Measurements:** A summary of the site selection procedure should be included along with tables of sites coordinated with maps showing locations of sites. The measurement approach should be summarized with justification for the measurement procedures used. The measurement data should be presented in well organized form in tables and figures. To save space, the results are often included with the table of sites described above. In some cases, measurements may be supplemented or replaced by collected data relevant to the noise and vibration characteristics of the area. For example, soils information for estimating ground-borne vibration propagation characteristics may be available from other projects in the area. Fundamental to this section is a summary and interpretation of how the collected data define the project setting.

#### **Chapter on Environmental Consequences.**

The section on long-term impacts - the impacts due to operation of the project - should be organized according to the following order:

- **Overview of Approach:** A summary of the assessment procedure for determining noise/vibration impacts is provided as a framework for the following sections.
- **Estimated Noise/Vibration Levels:** A general description of prediction models used to estimate project noise/vibration levels should be provided. Any distinguishing features unique to the project, such as source levels associated with various technologies, should be described. The results of the predictions for various alternatives should be described in general terms first, followed by a detailed accounting of predicted noise levels. This information should be supplemented with tables and

illustrated by contours, cross-sections or shaded mapping. If contours are included in a technical report, then it is not necessary to repeat them here.

- **Criteria for Noise/Vibration Impact:** Impact criteria for the project should be fully described and referenced (refer to Chapters 3 and 8). In addition, any applicable local ordinances should be described. Tables listing the criterion levels should be included.
- **Impact Assessment:** The impact assessment can be a section by itself or can be combined with the section above. It is important to provide a description of locations where noise/vibration impact is expected to occur without implementation of mitigation measures, based on the predicted future levels, existing levels and application of the impact criteria. Inventory tables of impacted land uses should be used to quantify the impacts for comparisons among alternatives. The comprehensive list of noise/vibration-sensitive sites identified in the Affected Environment chapter should be included in this inventory table.
- **Noise/Vibration Mitigation Measures:** Perhaps the most significant difference between the technical report and the environmental document is in the area of mitigation. Whereas the technical report discusses options and may make recommendations, the environmental document provides the vehicle for reaching decisions on appropriate mitigation measures with consideration given to environmental benefits, feasibility and cost. This section should begin with a summary of the noise/vibration mitigation measures considered for the impacted locations. The specific measures selected for implementation should be fully described. Reasons for dismissing any abatement measures should also be clearly stated, especially if such non-implementation results in significant adverse effects. In cases where it is not possible to commit to a specific mitigation measure in the final environmental document, it may be possible to commit to a certain level of noise/vibration reduction, for example, adherence to the impact criteria specified in Chapters 3 and 8.
- **Unavoidable Adverse Environmental Effects:** If it is projected that adverse noise/vibration impacts will result after all reasonable abatement measures have been incorporated, these impacts are identified in this section.

### **Impacts During Construction**

The environmental document may have a separate section on short-term impacts due to project construction, depending on the scale of the project. For a major project there may be a special section on construction noise/vibration impacts; this section should be organized according to the comprehensive outline described above. For projects with relatively minor effects, a briefer format should be utilized, with a section included in the chapter on Environmental Consequences.