

# **Traffic Noise Study Report Format Guide for Arizona Department of Transportation Projects**

## **Introduction**

The Arizona Department of Transportation (ADOT) seeks uniformity and standardization in terms of quality and completeness in all Noise Study Reports submitted by consultants. These guidelines are intended to assist the consultants in achieving those goals, thereby saving time and effort by both ADOT staff and consultants.

It should be noted that these are guidelines and are not intended to discourage creativity by the consultant. However, it is imperative that all noise analyses be discussed in advance with ADOT Air and Noise Technical Team Staff.

In all cases, ADOT's goals for its Noise Study Reports are:

- Conformity with Federal Highway Administration (FHWA) and ADOT Policies and Practices;
- Accuracy;
- Comprehensiveness;
- Efficiency;
- Readability

## **Formatting Considerations**

The report should utilize a twelve-point Arial font and use left margin alignment. Each page should have one-inch margins, and include a left-justified, bold, eight point header denoting the project name followed by report status (see below) and the date of submission. All section headings should be a numbered and/or lettered.

Page numbers should be shown at the bottom center. Tables and figures should be utilized to the fullest extent possible, in order to minimize descriptive verbiage. All reports should include a cover page, title page, table of contents, list of tables, and list of figures, and should utilize the most current templates for the cover and title pages. These templates can be found at [www.adotenvironmental.gov](http://www.adotenvironmental.gov). The submittal number at the bottom of the cover and/or title page should only be used for Draft and Final Draft Noise Reports (see below), not on Final Noise Reports.

## **Report Status and Submission**

The report status indicates the stage of the report or addendum in the approval process, and should use the following classifications and submission processes:

- Draft Noise Report –has been submitted for review but not yet approved by the ADOT Air and Noise Team
- Final Draft Noise Report – has been approved by the ADOT Air and Noise Team and is being submitted for FHWA review and/or approval

- Final Noise Report – has been approved by both the ADOT Air and Noise Team and FHWA

Not every report will utilize each stage listed above. For example, many reports will proceed directly from Draft Noise Report to Final Noise Report status.

Each submittal of a noise report should include an electronic version of the document along with the requested number of hardcopies.

### **Report Sections**

The recommended sections for Noise Study Reports are:

1. Executive Summary
2. Project Introduction
3. Description of Traffic Noise and Study Procedures
4. Noise Sensitive Land Uses in the Study Area
5. Existing Noise Environment
6. Future Noise Environment and Impact Determination
7. Mitigation Analysis
8. Construction Noise
9. Coordination with Local Governments
10. Appendices

### **Section 1: Executive Summary**

This section should be no longer than two pages, and should include summary discussions of each section as well as a table summarizing any recommended noise abatement measures.

### **Section 2: Project Introduction**

This section should briefly describe the project, including type, purpose and need, limits, and authority. It should include an overview figure(s) denoting project limits. The project design year, number of lanes, and other design issues should be discussed, as appropriate.

Suggested wording for this section:

*This study addresses the effects of traffic and construction generated noise that can be expected to occur due to the re- construction [construction, widening, relocation, etc.] of [route] from [project terminus] to [project terminus] in [location], Arizona. [Include additional details as necessary]. The project limits are shown in Figure 1.*

*The analysis contained herein was performed in compliance with Regulation 23 CFR 772 and Federal Highway Administration guidelines for the assessment of highway traffic-generated noise. In addition, the analysis was performed and specific abatement considerations were made in accordance with the ADOT Noise Abatement Policy dated [insert NAP effective date].*

The study procedure as specified by 23 CFR 772 and the ADOT policy is a seven-step process:

1. Identify noise sensitive land uses.
2. Determine existing noise levels.
3. Predict future (design year) noise levels.
4. Determine traffic noise impacts at the sensitive receivers by comparing future (design year) noise levels for all build alternatives with the applicable Noise Abatement Criteria and with existing noise levels.
5. Identify any noise impacts from project construction activities.
6. Evaluate potential noise mitigation measures to address the identified impacts.
7. Provide information to Local Land Use Planning Agencies regarding predicted future (design year) noise levels for use in land development decisions.

The remainder of this noise study report is structured to follow the above procedure.

**Section 3: Description of Traffic Noise and Study Procedures**

This section should describe the basic elements of traffic noise analysis and mitigation, and should include Table 1 from 23 CFR 772

**Section 4: Noise Sensitive Land Uses**

This section should describe the noise sensitive land uses on the project that may be affected using the activity categories listed in Table 1 to 23 CFR 772. They should be both identified on either the project layout figure or a separate figure, and listed in a tabular format which includes their defined Activity Category.

**Section 5: Existing Noise Environment**

Section 5 should describe the current noise environment, including any potential noise sources, and should present the results of noise monitoring as well as the modeled existing sound levels. The results should be shown in a table such as this:

Site Number	Date	Start Time	End Time	Site Description	L <sub>eq</sub> (dBA)	L <sub>min</sub> (dBA)	L <sub>max</sub> (dBA)	Final L <sub>eq</sub> (dBA)	Modeled L <sub>eq</sub> (dBA)
1					70.2	60.3	81.3	70	71
					70.8	60.9	80.7		
					68.9	58.4	79.2		
2					69.0	60.3	78.4	69	68
					68.1	54.2	80.4		
					70.1	60.1	81.1		

The values shown in the table above are illustrative, to show when they should be rounded off to the nearest whole dBA. Also, Lmin and Lmax are not required, but can be helpful in interpreting the data. Weather and traffic conditions should be included as notes at the bottom of the table.

Results should also be discussed in general terms in the report. For example, the following discussion may be used as a guide:

*In order to document the existing noise environment, a series of field measurements was made in the study area from [month] to [month], 20xx. These measurements were made at [number] representative receiver locations throughout the project corridor. Measurements were made in the [time of day] and each site was measured [number] times ; the measured Leq values were then averaged and rounded off to the nearest whole dBA. In order to be acceptable, each of the [number] measurements must be within +/- 3 dBA of each other.*

*The equipment used to conduct the measurements included a Larson-Davis Integrating Sound Level Meter (SLM) Model 824 system [or other]. The procedures and protocols followed were in accordance with Section 4 of the FHWA report Measurement of Highway-Related Noise ( FHWA-PD-96-046/DOT-VNTC-FHWA-95-5). The measurement results are shown in Table [#]. The measurement locations and results are also shown on Figure [#].*

*Table # shows that measured Leq values in the corridor range from [number] to [number] dBA. These levels are to be expected near a busy interstate [or arterial, etc.] facility. The measured Leq values in the corridor are within 3 dBA of the modeled values of the existing corridor, thus validating the input parameters used for the TNM 2.5 modeling to predict future (design year) noise levels. [Additional discussion, as appropriate.]*

## **Section 6: Future Noise Environmental and Impact Identification**

Statements similar to the following should be included to describe the modeling process, the impact determination philosophy, and mitigation alternatives:

*Traffic-generated noise levels for the future build alternatives were calculated using TNM 2.5 for the design year (20xx). Input to the model includes future roadway alignments, traffic volumes, vehicle speed, and truck percentage. Results of the modeling effort are discussed below by analysis area. In general, however, it can be concluded that 20xx Leq(1)h values will range from [number] to [number] dBA for receivers within the project area..*

*Two methods are used for determining a noise impact. The first is a comparison of predicted noise levels with the Noise Abatement Criteria (NAC) established by 23 CFR Part 772. Any predicted noise level that "approaches or exceeds" the*

*applicable NAC is considered to cause an impact. The ADOT policy defines "approach" as three dBA below the appropriate NAC.*

*At Category D sites, the interior Noise Abatement Criterion of 52 dBA is to be used. In these cases, an outside-to-inside noise reduction factor should be applied.*

*The second method of predicting noise impacts involves comparing modeled existing noise levels in the project corridor with predicted levels for the future build condition. According to 23 CFR 772, an impact results if a "substantial increase" over existing levels occurs. The ADOT policy defines "substantial increase" as 15 dBA or more.*

*[Include a statement indicating whether or not a noise impact will occur based on either method of impact determination.]*

### **Section 7: Noise Abatement Analysis and Recommendations**

The ADOT Noise Abatement Policy requires an effort to obtain feasible and reasonable noise abatement measures; this effort must be reflected in the discussion of noise abatement recommendations. An example of this discussion is as follows:

*In accordance with 23 CFR Part 772, noise abatement measures along the proposed corridor were evaluated for all locations which were predicted to experience a noise impact. Several types of abatement were considered, including:*

*Acquisition of Rights-of-Way-This abatement measure would serve to provide additional property alongside the proposed facility on which to construct noise barriers or to provide a buffer zone in which no noise sensitive land use would be permitted. [Add recommendation here.]*

*Alternation of Horizontal and Vertical Alignments-Alignment modification can serve to reduce noise impact by either moving the source of noise away from the receiver or by depressing the roadway to block sound. [Add recommendation here.]*

*Traffic Management-Measures such as traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, and modified speed limits can reduce noise impacts by reducing either the number of higher-impact vehicles or the overall vehicle speed within a project area. [Add recommendation here.]*

*Barrier System-Noise barriers located between the source of noise and any receivers can abate noise impacts by blocking/deflecting sound waves. [Add recommendation here.]*

To mitigate the design year 20xx noise impacts in the project area, [name recommended abatement measures] are proposed as part of the project. [If noise barriers, include] In estimating the cost of each barrier, a unit value of \$xx per square foot was used. [In some cases, this unit value may be adjusted due to specific engineering and construction considerations. If adjusted, include explanation of adjustment amount and reason.]

[If noise barriers, include] Once the engineering and acoustic feasibility of the proposed barrier is determined, the number of benefited receivers behind each barrier is determined. According to ADOT policy, a benefited receiver is defined as one that receives a 5 dBA or more insertion loss (i.e., a noise reduction of 5 dBA or more achieved by the barrier). Reasonableness is then determined by considering the preferences of owners and residents of the benefited receptors, the noise reduction provided by the barrier, and the cost effectiveness of the wall. This last criterion is determined by dividing the total cost of the barrier by the number of benefited receivers. If the result does not exceed \$xx,000, the barrier is considered to be cost effective. In order to meet the other two reasonableness criteria, the wall must be desired by the majority of benefited receivers and must provide at least 7 dBA noise reduction to the first-row of receivers.

Example of barrier recommendation:

**Area A: Maple Street to Elm Street, north side of I-17**

This site includes multiple single-family residences on the north side of I-17. The 20xx Leq values for these receivers range from yy-zz dBA, thus resulting in predicted traffic noise impacts. In order to mitigate these impacts, a barrier with the characteristics shown in Table x is needed. As the Cost per Benefited Receiver meets that allowed by the ADOT Noise Abatement Policy, the barrier meets the Noise Reduction Design Goal for at least half of the benefited first-row receptors, and as it is desired by the majority of benefited receivers, this barrier meets the reasonableness standards and is therefore recommended.

Analysis Area	A-north
Barrier length	3,405 feet
Height range and Reference Point	10-18 feet above pavement surface
Lateral Location	Shoulder
Predominant height	14 feet
Number of benefited receivers	16
Number of first-row receivers	7
Number of first-row receivers meeting design goal	4
Beginning station number	782+00
Ending station number	813+00
Leq range without barrier	71-73

<i>Leq range with barrier</i>	<i>62-63</i>
<i>Total cost @ \$25/square foot</i>	<i>\$677,296</i>
<i>Cost per benefited receiver</i>	<i>\$42,331</i>

Table x: Characteristics of the barrier needed to abate impacts in Area A

*The following locations will experience traffic noise impacts that have no feasible and reasonable noise abatement:*

[Insert a statement of likelihood here, discussing any expectations of further analysis due to potential changes in design or noise environment and indicating that final recommendations on the construction of abatement measures shall be determined during the completion of the project's final design and public involvement process.]

**Section 8: Construction Noise**

Sample wording to address the requirements to consider construction noise is as follows:

*Although temporary in nature, construction noise can, at times, interfere with day-to-day activities of noise sensitive receivers. [Add discussion of surrounding land uses, coordination with property owners, and results of analysis and community involvement.] Construction equipment should be required to have factory-installed mufflers or their equivalents in good working order during the life of the construction contracts. These provisions should be incorporated into plans, specifications, and estimates for the project.*

**Section 9: Coordination with Local Officials**

This section should detail any consultation that has occurred with local governments and land managing agencies during the noise analysis process. If no consultation was performed, this should also be documented in this section.

**Appendices**

Any additional information that was used in the project analysis should be included in the appendices. At a minimum, the appendices should include:

- A set of maps showing:
  - Roadways, receivers, and topographic information, including elevators, overlaid on digital mapping;
  - Recommended barrier locations, with section heights, as well as top elevators at key transition points. (Example figures are provided at the end of these guidelines.)
- TNM input and output files