

Attachment N – Excerpt From the Federal Transit Administration Noise Impact Assessment (2018)

The following is an excerpt from the Federal Transit Administration's 2018 Transit Noise and Vibration Assessment Manual. The FIRM shall use the most recent version of this Manual for their assessment and provide acknowledgement within the report which version was used and the date on which it was verified by the FIRM.

7.1 Construction Noise Assessment

Noise impacts from construction may vary greatly depending on the duration and complexity of the project. The key elements of the Construction Noise Assessment procedure and recommended workflow are as follows.

Step 1: Determine Level of Construction Noise Assessment

Step 2: Use a Qualitative Construction Noise Assessment to Estimate Construction Noise

Step 3: Use a Quantitative Construction Noise Assessment to Estimate Construction Noise

Step 4: Assess Construction Noise Impact

Step 5: Determine Construction Noise Mitigation Measures

If there is uncertainty in how to determine the appropriate level of assessment, contact the FTA Regional office.

Step 1: Determine Level of Construction Noise Assessment

Determine the appropriate level of assessment based on the scale and type of the project and depending on the stage of environmental review.

Consider the following factors:

- Scale of the project
- Proximity of noise-sensitive sites to the construction zones
- Number of noise-sensitive receivers in the project area
- Duration of construction activities near noise-sensitive receivers
- Schedule, including the construction days, hours, and time periods
- Method (e.g., cut-and-cover vs. bored tunneling)
- Concern about construction noise expressed in comments by the general public (e.g., through scoping or public meetings)

Ia. Determine if an assessment is required – Construction Noise

Assessments are not required for many small projects including:

- Installation of safety features like grade-crossing signals;
- Track improvements within the ROW; or
- Erecting small buildings and facilities which are similar in scale to the surrounding development.

For small projects like these, include descriptions in the environmental document of the length of construction, the loudest equipment to be used, the expected truck access routes, the avoidance of nighttime activity, and any other relevant planned construction method.

Ib. Determine whether a qualitative or quantitative assessment is required

- **Qualitative Construction Noise Assessment** – Qualitative Construction Noise Assessments may be required for projects with less than a month of construction time in a noise-sensitive area. See Step 2 for more information on Qualitative Construction Noise Assessments.

- **Quantitative Construction Noise Assessments** – Quantitative Construction Noise Assessments may be required for projects with a month or more of construction in noise-sensitive areas or if particularly noisy equipment will be involved. See Step 3 for more information on Quantitative Construction Noise Assessments.

Step 2: Use a Qualitative Construction Noise Assessment to Estimate Construction Noise

Use a qualitative construction noise assessment to estimate construction noise for appropriate projects per Section 7.1, Step 1b.

Provide qualitative descriptions in the environmental document of the following elements:

- Duration of construction (both overall and at specific locations)
- Equipment expected to be used (e.g., noisiest equipment)
- Schedule with limits on times of operation (e.g., daytime use only)
- Monitoring of noise
- Forum for communicating with the public
- Commitments to limit noise levels to certain levels, including any local ordinances that apply
- Consideration of application of noise control treatments used successfully in other projects

Effective community outreach and relations are important for these projects. Disseminate information to the public early regarding the kinds of construction equipment, expected noise levels, and durations to forewarn potentially affected neighbors about the temporary inconvenience. Including a general description of the variation of noise levels during a typical construction day may also be helpful.

Note that the construction criteria in Step 4 do not apply to qualitative assessments.

Step 3: Use a Quantitative Construction Noise Assessment to Estimate Construction Noise

Use a quantitative construction noise assessment to estimate construction noise for appropriate projects per Section 7.1, Step 1b.

For Quantitative Construction Noise Assessments, follow the recommended procedure in this step and include a description of the planned construction methods and any basic measures that have been identified to reduce the potential impact, such as prohibiting the noisiest construction activities during the nighttime, in the environmental document. It may be prudent, however, to defer final decisions on noise control measures until the project and construction plans are defined in greater detail during the engineering phase.

- **Noise Source Levels from Typical Construction Equipment and Operations** – The noise levels generated by construction

equipment vary greatly on factors such as the type of equipment, the equipment model, the operation being performed, and the condition of the equipment. Typically, the dominant source of noise from most construction equipment is the engine, often a diesel engine, which usually does not have sufficient muffling. In other cases, such as impact pile-driving or pavement-breaking, noise generated by the process dominates. Construction equipment can be considered to operate in the following two modes for Construction Noise Assessments:

- **Stationary** – Stationary equipment operates in one location for one or more days at a time, with either a fixed power operation (pumps, generators, compressors) or a variable noise operation (pile drivers, pavement breakers).
- **Mobile** – Mobile equipment moves around the construction site with power applied in cyclic fashion (bulldozers, loaders), or to and from the site (trucks). Movement around the site is considered in the construction noise prediction procedure.

Variation in power imposes additional complexity in characterizing the noise source level from mobile equipment. Describe the noise at a reference distance from the equipment operating at full power and adjusting it based on the duty cycle of the activity to determine the $L_{eq(t)}$ of the operation.

Typical noise levels from representative equipment are included in Table 7-1. The levels are based on an EPA Report,⁽⁶¹⁾ measured data from railroad construction equipment taken during the 1976 Northeast Corridor Improvement Project, the FHWA Roadway Construction Noise Model, and other measured data.

For equipment that is not represented in Table 7-1, measure the noise levels according to the standard procedures for measuring the exterior noise levels for the certification of mobile and stationary construction equipment by the Society of Automotive Engineers.⁽⁶²⁾⁽⁶³⁾

Table 7-1 Construction Equipment Noise Emission Levels

Equipment	Typical Noise Level 50 ft from Source, dBA
Air Compressor	80
Backhoe	80
Ballast Equalizer	82
Ballast Tamper	83
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane, Derrick	88
Crane, Mobile	83
Dozer	85
Generator	82
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	80
Paver	85
Pile-driver (Impact)	101
Pile-driver (Sonic)	95
Pneumatic Tool	85
Pump	77
Rail Saw	90
Rock Drill	95
Roller	85
Saw	76
Scarifier	83
Scraper	85
Shovel	82
Spike Driver	77
Tie Cutter	84
Tie Handler	80
Tie Inserter	85
Truck	84

3a. Use the metric $L_{eq(t)}$ to assess construction noise. This unit is appropriate because $L_{eq(t)}$ can be used to describe:

- Noise level from operation of each piece of equipment separately, and levels can be combined to represent the noise level from all equipment operating during a given period
- Noise level during an entire phase
- Average noise over all phases of the construction

3b. Use Eq. 7-1 to predict construction noise impact for major transit projects, considering the noise generated by the equipment and noise propagation due to distance. Calculate $L_{eq.equip}$ for all equipment individually, then use decibel addition to sum the $L_{Aeq.equip}$ for all equipment operating during the same time period. See Appendix B.1.1 for information on decibel addition.

$$L_{eq,eq\text{uip}} = L_{emission} + 10 \log(Adj_{Usage}) - 20 \log\left(\frac{D}{50}\right) - 10G \log\left(\frac{D}{50}\right) \quad \text{Eq. 7-1}$$

where:

- $L_{eq,eq\text{uip}}$ = $L_{eq(t)}$ at a receiver from the operation of a single piece of equipment over a specified time period, dBA
- $L_{emission}$ = noise emission level of the particular piece of equipment at the reference distance of 50 ft, dBA
- Adj_{Usage} = usage factor to account for the fraction of time that the equipment is in use over the specified time period
- D = distance from the receiver to the piece of equipment, ft
- G = a constant that accounts for topography and ground effects

Determine the quantities for Eq. 7-1 based on the level of assessment as described below.

- A general assessment of construction noise is warranted for projects in an early assessment stage when the equipment roster and schedule are undefined and only a rough estimate of construction noise levels is practical.
- A detailed analysis of construction noise is warranted when many noise-sensitive sites are adjacent to a construction project or where contractors are faced with stringent local ordinances or heightened public concerns expressed in early outreach efforts.

Complete the appropriate assessment for each phase of construction. Major construction projects are accomplished in several different phases. Each phase has a specific equipment mix, depending on the work to be accomplished during that phase. As a result of the equipment mix, each phase has its own noise characteristics; some phases have higher continuous noise levels than others, and some have higher impact noise levels than others.

Option A: General Assessment – Determine the quantities for Eq. 7-1 based on the following assumptions for a General Assessment of each phase of construction.

- **Noise emission level ($L_{emission}$)** – Determine the emission level at 50 ft according to noise from typical construction equipment described above and Table 7-1.
- **Usage factor (Adj_{Usage})** – Assume a usage factor of 1. This assumes a time period of one-hour with full power operation. Most construction equipment operates continuously for periods of one-hour or more during the construction period.

Therefore, $10 \log(Adj_{Usage}) = 0$ and can be omitted from the equation.

- **Distance (D)** – Assume that all equipment operates at the center of the project, or centerline for guideway or highway construction project.

- **Ground effect (G)** – $G = 0$ assuming free-field conditions and ignoring ground effects. If ground effects are of specific importance to the assessment, consider using the Detailed Analysis procedure.

Only determine the $L_{eq, equip}$ for the two noisiest pieces of equipment expected to be used in each phase of construction. Then, sum the levels for each phase of construction using decibel addition.

Option B: Detailed Analysis – Determine the quantities for Eq. 7-1 based on the following assumptions for a Detailed Analysis of each phase of construction. Alternatively, for detailed, long-term, and complex construction projects or projects near a particularly sensitive site, the FHWA’s Windows-based screening tool, “Roadway Construction Noise Model (RCNM),” can be used for the prediction of construction noise.⁽⁶⁴⁾

- **Noise emission level ($L_{emission}$)** – Measure or certify the noise emission level for each piece of equipment.
- **Usage factor (Adj_{Usage})** – Long-term construction project noise impact is based on a 30-day average L_{dn} , the times of day of construction activity (nighttime noise is penalized by 10 dB in residential areas), and the percentage of time the equipment is used during a period of time that will affect Adj_{Usage} .

For example, an 8-hour $L_{eq(t)}$ is determined by making Adj_{Usage} the percentage of time each individual piece of equipment operates under full power in that period. Similarly, the 30-day average L_{dn} is determined from the Adj_{Usage} expressed by the percentage of time the equipment is used during the daytime hours (7 a.m. to 10 p.m.) and nighttime (10 p.m. to 7 a.m.), separately, over a 30-day period. To account for increased sensitivity to nighttime noise, the nighttime noise levels are adjusted by 10 dB in the L_{dn} computation (see Appendix B.1.4.5).

- **Distance (D)** – Determine the location of each piece of equipment during operation and the distance to each receiver.
- **Ground effect (G)** – Use Table 4-26 in Section 4.5, Step 3 to calculate G to account for the site topography, natural and man-made barriers, and ground effects.

Compute the 8-hour $L_{eq(t)}$ ($L_{eq, equip(8hr)}$) and the 30-day average L_{dn} ($L_{dn, equip(30day)}$) for all equipment expected to be used in each phase of construction separately. Then, sum the levels for each phase of construction using Eq. 4-56 and Eq. 4-57 in Table 4-32.

Step 4: Assess Construction Noise Impact

Compare the predicted noise levels from the Quantitative Construction Noise Assessment with impact criteria to assess impact from construction noise for each phase of construction.

No standardized criteria have been developed for assessing construction noise impact. Consequently, criteria must be developed on a project-specific basis unless local ordinances apply. As stated earlier in this section, local noise ordinances are typically not very useful in evaluating construction noise. They usually relate to nuisance and hours of allowed activity, and sometimes specify limits in terms of maximum levels, but are generally not practical for assessing the impact of a construction project. Project construction noise criteria should account for the existing noise environment, the absolute noise levels during construction activities, the duration of the construction, and the adjacent land use. While it is not the purpose of this manual to specify standardized criteria for construction noise impact, the following guidelines can be considered reasonable criteria for assessment. If these criteria are exceeded, there may be adverse community reaction.

The construction impact guidelines are presented based on the level of quantitative assessment.

Option A: General Assessment – Compare the combined $L_{eq.equip(1hr)}$ for the two noisiest pieces of equipment for each phase of construction determined in Section 7.1, Step 3 to the criteria below. Then, identify locations where the level exceeds the criteria.

Table 7-2 General Assessment Construction Noise Criteria

Land Use	$L_{eq.equip(1hr)}$, dBA	
	Day	Night
Residential	90	80
Commercial	100	100
Industrial	100	100

Option B: Detailed Analysis – Compare the combined $L_{eq.equip(1hr)}$ and the combined $L_{dn.equip(30day)}$ for all equipment for each phase of construction determined in Section 7.1, Step 3 to the criteria below. Then, identify locations where the level exceeds the criteria.

Table 7-3 Detailed Analysis Construction Noise Criteria

Land Use	$L_{eq.equip(8hr)}$, dBA		$L_{dn.equip(30day)}$, dBA 30-day Average
	Day	Night	
Residential	80	70	75
Commercial	85	85	80*
Industrial	90	90	85*

*Use a 24-hour $L_{eq(24hr)}$ instead of $L_{dn.equip(30day)}$.