Highway Noise Analysis Using the FHWA Draft TNM 3.0

2018 Louisiana Transportation Conference

Tuesday, February 27
Development of Federally Funded Highway Projects

- Planning
- Preliminary Design
- NEPA Analysis
- Final Design
- Right-of-Way Acquisition
- Construction
- Operations and Maintenance

FHWA’s Traffic Noise Model
Federal Highway Administration’s Traffic Noise Model

- Noise levels at receptor locations based on:
  - Vehicle Type, Volume and Speed
  - Pavement Type
  - Barrier Location and Design
  - Site Geometry
  - Ground Type
  - Presence of Dense Foliage

- Noise levels for different barrier heights
- Costs of barrier designs
- Present and Future Noise Conditions

https://www.fhwa.dot.gov/environment/noise/noise_barriers/design_construction/design/design04.cfm
Noise Impact and Analysis in the Environmental Review (NEPA) Process

- Comply with federal noise requirements
  - National Environmental Policy Act of 1969 (NEPA)
  - 23 USC § 109 – Standards
  - 23 CFR Part 771 – Environmental Impact and Related Procedures
  - 23 CFR Part 772 – Procedures for Noise Abatement

- Identify potential noise impacts to environment
  - Determine Type of Project (I, II, III)
  - Determine (Existing and Design Year) Noise Levels
  - Determine Impacts

- Consider noise abatement for impacts

- Weigh noise impacts vs. benefits

- Include public in decision-making process

- Additional state and tribal noise requirements may apply
Overview of Highway Noise Regulation 23 CFR 772

PROCEDURES FOR ABATEMENT OF HIGHWAY TRAFFIC NOISE AND CONSTRUCTION NOISE

- Official Federal Noise Standard
- Applicable if Project:
  - Uses federal-aid highway funds
  - Requires FHWA approval
- Traffic Noise Prediction
  - Use FHWA TNM, or model consistent with FHWA TNM methodology (as determined by FHWA)
  - Average pavement used for future noise level predictions
  - Model worst traffic noise impact

- Analysis of Traffic Noise Impacts
  - Each alternative under study
  - Each activity category present in study area
  - Evaluate using Table 1 to Part 772 – Noise Abatement Criteria

- Analysis of Noise Abatement
  - If traffic noise impacts are identified, noise abatement must be considered
  - Evaluated for feasibility & reasonableness
  - Analyze alternative noise abatement measures by giving weight to benefits and costs
  - At a minimum must consider noise barriers for abatement
Determine Noise Levels

- Existing Noise Levels
  - Field measurement (new alignment)
  - Use traffic noise model (existing alignment)
  - Traffic yielding worst traffic noise

- Future / Design Year Noise Levels
  - Predict with FHWA TNM or model consistent with FHWA TNM methodology (as determined by FHWA)
  - Validate using measured levels

- New Alignment
  - Measure existing noise levels
  - Predict future / design year noise levels

- Existing Alignment
  - Predict existing noise levels
  - Validate predictions
  - Predict future / design year noise levels
Traffic Noise Impact Analysis

- Unacceptably High Absolute Levels
  - Type I: Future (design year) noise levels
  - Type II: Existing noise levels

- Substantial Increase of Noise Levels
  - Predicted future levels substantially exceed existing noise level
  - Type I: States must define substantial increase between 5 and 15 dB(A) increase over existing

**Table 1 to Part 772—Noise Abatement Criteria**

<table>
<thead>
<tr>
<th>Activity category</th>
<th>Activity Leq(h)</th>
<th>Criteria(^1) L10(h)</th>
<th>Evaluation location</th>
<th>Activity description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>57</td>
<td>60</td>
<td>Exterior ...........</td>
<td>Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. Residential.</td>
</tr>
<tr>
<td>B(^3)</td>
<td>67</td>
<td>70</td>
<td>Exterior ...........</td>
<td>Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.</td>
</tr>
<tr>
<td>C(^3)</td>
<td>67</td>
<td>70</td>
<td>Exterior ...........</td>
<td>Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.</td>
</tr>
<tr>
<td>D</td>
<td>52</td>
<td>55</td>
<td>Interior ...........</td>
<td>Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A–D or F.</td>
</tr>
<tr>
<td>E(^3)</td>
<td>72</td>
<td>75</td>
<td>Exterior ...........</td>
<td>Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing. Undeveloped lands that are not permitted.</td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Either Leq(h) or L10(h) (but not both) may be used on a project.
\(^2\) The Leq(h) and L10(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.
\(^3\) Includes undeveloped lands permitted for this activity category.
Feasible and Reasonable Noise Abatement Measures

- Feasible Relates to Objective Engineering Considerations
  - can a barrier be built
  - can a substantial noise reduction be achieved

- Noise barriers must be acoustically feasible
  - The minimal substantial reduction allowed is 5 dB(A). States define the number of impacted receptors that must achieve a 5 dB(A) reduction. A State must then apply these standards uniformly and consistently statewide.

- Reasonable Considerations:
  - Cost effectiveness based on construction cost
  - Meeting noise reduction design goal
  - Viewpoints of benefited owners and residents
  - States may include optional reasonableness factors
Noise Abatement Measures Eligible for Federal-aid Funding

- Traffic management measures
  - Prohibition of certain vehicle types
  - Time use restrictions
  - Modified speed limits
  - Exclusive lane designations
- Alteration of horizontal and vertical alignments.
- Construction of noise barriers
- Acquisition of real property to serve as a buffer zone (Type I projects only)

FHWA’s Traffic Noise Model
Status of FHWA’s Draft TNM 3.0

- TNM 3.0 is currently in a draft release state that has all intended features but is still undergoing updates to address user comments obtained during a 6-month comment period.
- The final release version will not be available until comments have been addressed.
- The final release version is expected in late 2018.

<table>
<thead>
<tr>
<th>Development Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>January – February 2017</td>
</tr>
<tr>
<td>July – August 2017</td>
</tr>
<tr>
<td>Fall 2017</td>
</tr>
<tr>
<td>Winter 2017 – Spring 2018</td>
</tr>
<tr>
<td>Late 2018</td>
</tr>
<tr>
<td>General</td>
</tr>
<tr>
<td>---------</td>
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</tbody>
</table>

### General Information

- **Points**: Details such as point names, point sequence, and comments.
- **Segments**: Contains information about road segments including start point number, comments, and other relevant details.
- **Structure**: Includes structural elements like wall area cost and additional unit cost.
- **Reflections**: Reflective properties of the road and surrounding areas.

### Calculation Results

- Results are displayed in tables showing various parameters such as start point name, point sequence, and other calculation details.
### Traffic Noise Model Results

**Sound Levels**

**REPORT:**
- TNM VERSION: 3.0
- CALCULATED WITH: 3.0
- CASE: Sample
- PATH: 
- CALCULATION SEQUENCE NUMBER: 
- DEFAULT GROUND TYPE: Custom
- ATMOSPHERICS: 68°F, 50%

**ATMOSPHERICS:**
- Average pavement type shall be used unless a state highway agency substantiates the use of a different type with approval of FHWA.

**Results for:**

<table>
<thead>
<tr>
<th>DUP Type</th>
<th>Min</th>
<th>Avg</th>
<th>Max</th>
<th>Area/Volume</th>
<th>Lineal</th>
<th>Total</th>
<th>Total/DUs</th>
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<tbody>
<tr>
<td>Receivers in the Barrier Design:</td>
<td>27</td>
<td>0.0</td>
<td>0.6</td>
<td>1.0</td>
<td>389,996</td>
<td>22,285</td>
<td>412,281</td>
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<tr>
<td>All Impactors</td>
<td>6</td>
<td>0.8</td>
<td>0.7</td>
<td>1.0</td>
<td>389,996</td>
<td>22,285</td>
<td>412,281</td>
</tr>
<tr>
<td>Meeting Noise Reduction Goal:</td>
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<td></td>
<td></td>
<td></td>
<td>389,996</td>
<td>22,285</td>
<td></td>
</tr>
<tr>
<td>All Impactors</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>389,996</td>
<td>22,285</td>
<td></td>
</tr>
</tbody>
</table>

### Receiver Details

**Modeled Traffic Noise Levels**

<table>
<thead>
<tr>
<th>Name</th>
<th>No.</th>
<th>DUPs</th>
<th>Existing LAeq</th>
<th>Increase over Existing LAeq</th>
<th>Type of Impact</th>
<th>Calc. LAeq</th>
<th>Noise Reduction</th>
<th>Calc. Minus Goal</th>
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</thead>
<tbody>
<tr>
<td>Receiver-1</td>
<td>1</td>
<td>1</td>
<td>28.5</td>
<td>67.0</td>
<td>None</td>
<td>27.6</td>
<td>9.8</td>
<td>-7.1</td>
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<tr>
<td>Receiver-2</td>
<td>2</td>
<td>1</td>
<td>29.1</td>
<td>67.0</td>
<td>None</td>
<td>28.3</td>
<td>8.0</td>
<td>-7.1</td>
</tr>
<tr>
<td>Receiver-3</td>
<td>3</td>
<td>1</td>
<td>30.8</td>
<td>67.0</td>
<td>None</td>
<td>30.1</td>
<td>8.0</td>
<td>-7.1</td>
</tr>
<tr>
<td>Receiver-4</td>
<td>4</td>
<td>1</td>
<td>32.2</td>
<td>67.0</td>
<td>None</td>
<td>31.4</td>
<td>8.0</td>
<td>-7.1</td>
</tr>
<tr>
<td>Receiver-5</td>
<td>3</td>
<td>1</td>
<td>28.8</td>
<td>67.0</td>
<td>None</td>
<td>27.6</td>
<td>8.0</td>
<td>-7.2</td>
</tr>
</tbody>
</table>
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  617-494-3220

- **Environment**
  [https://www fhwa dot gov/environment/noise](https://www.fhwa.dot.gov/environment/noise)

- **FHWA Resource Center**
  [https://www fhwa dot gov/resourcecenter/](https://www.fhwa.dot.gov/resourcecenter/)

- **Volpe Center**