USING THE RAILWAY NOISE MODEL (RWNM) FOR DETAILED NOISE ANALYSES AT SOME INTERESTING RECEPTOR LOCATIONS

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OVERVIEW

- BACKGROUND
- METHODOLOGY
- NOISE ANALYSES
- RESULTS
- CONCLUSIONS AND DISCUSSIONS
BACKGROUND

- What is the Railway Noise Model (RWNM)?
- East Side Access - A Large Railway Project in the New York Metropolitan Region
- Noise Analyses Methods - FTA Manual Model and RWNM
- Comparison of Two Models in Noise Impact Analyses
- Evaluation of Rail Noise Results and Examination of the Implications of Modest Increases in Railway Service Using RWNM
RAILWAY NOISE PREDICTION MODELS

- AUSTRIA - ONORM S5011/OAL28
- DENMARK - BEREIGNING AF STØJ FRA JERNBANER
- FRANCE - GUIDE DU BRUIT/MITRA-FER
- GERMANY - SCHALL 03
- ITALY - RAILSIM
- THE NETHERLANDS - SRMIL
- NORWAY - NMT NORWEGIAN TRAINS
- SWEDEN - NMT SWEDISH TRAINS
- UK - ASDOWN/DEPARTMENT OF TRANSPORT
- US - RAILWAY NOISE MODEL
METHODOLOGY

- **NOISE MONITORING**
  - Noise-Sensitive Receptor Sites
  - Determine Existing Noise Levels

- **FTA MANUAL MODEL**
  - Noise Screening Procedure
  - General Noise Assessment
  - Detailed Noise Analyses

- **RAILWAY NOISE MODEL**
  - Simulate Existing Noise Levels
  - Model Project Noise Levels
NOISE MONITORING

- Noise-Sensitive Receptor Sites
  - Geographic Information System
  - Aerial Photographs
  - Field Studies

- Noise Measurements
  - B & K Noise Level Analyzer Type 4427
  - Equivalent Noise Level $L_{eq(1)}$ (24-hour)
  - Percentile Noise Levels $L_1$, $L_{10}$, $L_{50}$, and $L_{90}$
SITE 1 - HIGH-DENSITY RESIDENTIAL
SITE 2 - TWO-LEVEL TRACKS
SITE 3 - TRACKS AT GRADE
FTA MODEL
(Transit Noise and Impact Assessment)

- Noise Screening Procedure
  - Screening Distances for Noise Assessment
- General Noise Assessment
  - Estimation of Project Noise Levels
  - Evaluation of Noise Impact
- Detailed Noise Analyses
  - Noise Analysis of Specific Location Sites
  - Prediction of Noise Impact Assessments in great precision
DETAILED NOISE ANALYSES (FTA)

- Determination of Existing Rail Noise Levels at reference level at 50 feet
- Propagation and Summation of Existing Rail Noise at the Receptor Locations
- Existing Non-Rail Noise Levels
- Total Future Noise Levels
- Noise Impact Assessment Using FTA Noise Criteria (Impact and Severe Impact)
- Mitigation of Noise Impact
RAILWAY NOISE MODEL (RWNM)

- **Input data:** railway, geometry, and receptor location

- **Computation:** Algorithm, Propagation, Attenuation, Absorption, and Diffraction
  - \[ \text{SPL} = L_0 - A_s - A_g - A_e \]
    - \( L_0 \) = reference level at 50 feet
    - \( A_s \) = attenuation due to geometric spreading
    - \( A_g \) = attenuation due to ground absorption
    - \( A_e \) = diffraction effects due to barriers

- **Output data:** \( L_{dn} \) Noise Levels
- Category 1
  - Outdoor amphitheaters, historic landmarks, etc.
- Category 2
  - Residences, hospitals, hotels, etc.
- Category 3
  - Schools, libraries, churches, etc.

Note:
Noise exposure is in terms of $L_{eq(h)}$ for Category 1 and 3 land uses, $L_{dn}$ for Category 2 land uses.
### EXISTING NOISE LEVELS

<table>
<thead>
<tr>
<th>Site</th>
<th>Monitoring</th>
<th>RWNM</th>
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</thead>
<tbody>
<tr>
<td>Site 1</td>
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<td>70.0</td>
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<tr>
<td>Site 2</td>
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<td>78.2</td>
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<tr>
<td>Site 3</td>
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<td>Site 5</td>
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</table>

- **Site 1**: High-density residential
- **Site 2**: Two-level tracks
- **Site 3**: Tracks at grade
- **Site 4**: Warning horns
- **Site 5**: Housing shielding
Site 1. High-density residential
Site 2. Two-level tracks
Site 3. Tracks at grade
Site 4. Warning horns
Site 5. Housing shielding
## NOISE ANALYSIS RESULTS

Table 1

<table>
<thead>
<tr>
<th>Site</th>
<th>Method</th>
<th>Existing Noise Level</th>
<th>Allowable Project-Generated Noise level</th>
<th>Method</th>
<th>Project-Generated Increment Noise Level</th>
<th>Result</th>
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<td>60.0</td>
<td>RWNM</td>
<td>60.8</td>
<td>Impact</td>
</tr>
</tbody>
</table>

Note: Noise impact analyses calculated based on measured values.
CONCLUSIONS AND DISCUSSIONS

- RWNM provides the ability to assess typical railway projects for Noise Analysis
  - With the exception of the warning horn situation, existing RWNM values are very close to measured values
  - At all sites, project-generated noise levels are maximum 1.8 dBA of difference between RWNM and FTA model
  - RWNM can be easily used to create sources, receivers, barriers, etc.
  - RWNM provides accurate sound level values for most typical railway situations

- Discussions
  - Situations with warning horn noise need additional validation with measured sound levels
  - Importing DXF files and 3-D use need developing