Mitigating Noise at Rail Transit Maintenance and Layover Facilities by the Use of Enclosures

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Introduction

- Noise can be a significant issue at noise-sensitive receptors near rail transit maintenance and layover facilities

- Noise sources:
  - Idling locomotives
  - Wheel squeal
  - Car washers

- Mitigation options:
  - Noise barriers
  - Rail lubrication systems
  - Sound insulation
  - Enclosures
Three Project Examples

- Example #1: Commuter rail layover facility
  - Noise issue: Idling locomotives
- Example #2: Regional rail layover facility
  - Noise issue: Idling locomotives
- Example #3: Transit maintenance and storage yard
  - Noise issue: Wheel squeal from trains on curves
Example #1: Commuter Rail Layover Facility

- Located at the end of rail line
- Diesel locomotive hauled passenger trains
- Noise issues:
  - Train movements into and out of station
  - Locomotives continue to idle for period of time before shutdown for the night
  - Locomotives idle for period of time before they depart in the morning
  - Noise-sensitive receptors located close to idling locomotives
Example #1: Project Location
Example #1: Acoustical Analysis

- Existing noise measurements to determine impact criteria

- Impact assessment included the following:
  - Additional layover tracks at facility
  - Train movements into and out of facility
  - Idling locomotives

- Closest receptor < 200 feet from idling locomotives

- All four closest receptors impacted

- Recommended mitigation measure:
  - construct enclosure around idling locomotives
Example #1: Enclosure Design

- **Design features:**
  - **Walls:** SOUNDBLOX® Type Q 8-inch sound absorbing structural masonry units (optimum absorption at 125 Hz)
  - **Ceiling:** Pyrok Acoustement 40 acoustical surfacing material on ceiling surfaces
  - **Exhaust:**
    - Passive exhaust with large opening in roof
      - No added noise sources, but large opening in enclosure
    - Active exhaust with fans in the roof
      - Added noise sources
Example #1: Enclosure Effectiveness

Commuter Rail Layover Facility with Enclosure

Site #

Future Sound Level: Ldn (dBA)

- Site 1
- Site 2
- Site 3
- Site 4

No Mitigation
Enclosure (no Exhaust)
Enclosure (with Exhaust)
Example #2: Regional Rail Layover Facility

- Located near residential community
- Diesel locomotive hauled passenger trains
- Noise issues:
  - Train movements into and out of layover facility
  - Locomotives continue to idle for period of time before shutdown for the night
  - Locomotives idle for period of time before they depart in the morning
  - Noise-sensitive receptors located close to idling locomotives
Example #2: Project Location
Example #2: Enclosure Design
Example #2: Acoustical Analysis

- Impact assessment conducted to determine overall performance of enclosure
- Residential property line: < 100 feet from idling locomotives
- Acoustical design required composite Sound Transmission Class rating of STC-44 for entire enclosure
- Exhaust fan noise required to meet noise ordinance limit of 50 dBA
Example #2: Enclosure Design

- Calculated building STC based on design
  - Walls: Butler metal wall with Amvic ICF (insulated concrete form) Block
  - Doors: Double Thermiser Insulated Rolling Doors
  - Roof: Insulated metal roof
  - Exhaust: Intake and exhaust openings
  - Office Space

- Exhaust fan noise projections conducted at nearest property line locations
Example #2: Enclosure Effectiveness

- STC rating for total composite building was STC-47
- Projected sound levels from fan noise at nearby property line locations ranged from 44 – 49 dBA
Example #3: Transit Maintenance and Storage Yard

- Heavy rail trains – electrically powered
- Noise Issues:
  - Wheel squeal from trains traveling around curves in yard
  - Curve radius of 300 feet
  - Noise-sensitive receptors located close to curve in yard
Example #3: Project Location
Example #3: Enclosure Design
Example #3: Enclosure Design
Example #3: Acoustical Analysis

- 55 dBA Lmax criterion at property lines
- Residences located < 300 feet from curves
- Reference measurements of wheel squeal from curves
- Measurements in community
- Reverberant noise in enclosure
Example #3: Enclosure Design

- Design features:
  - Walls: Portions of CMU and metal panels
  - Ceiling: metal panels
  - Sound absorptive panels on all interior surfaces
  - Passive exhaust with louvered penthouses on top of enclosure
Example #3: Enclosure Effectiveness

- Post-construction noise measurement program
- Maximum sound levels at nearest residence (Site 2) ranged from 50 to 55 dBA
  - Background noise from nearby highways contributed to measured sound levels
- Average overall Lmax at Site 2 decreased from 64 dBA to 53 dBA (11 dBA improvement)
  - 18 dB reduction in 4,000 Hz octave-band
  - 19 dB reduction in 8,000 Hz octave-band