

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

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Introduction

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- **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

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- **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

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- **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

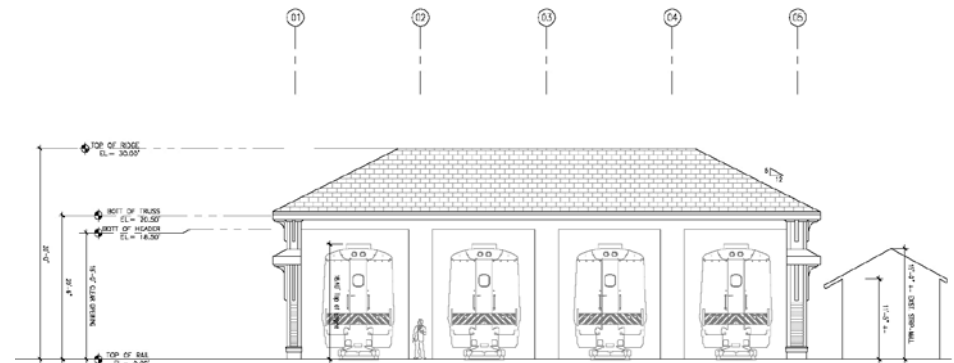
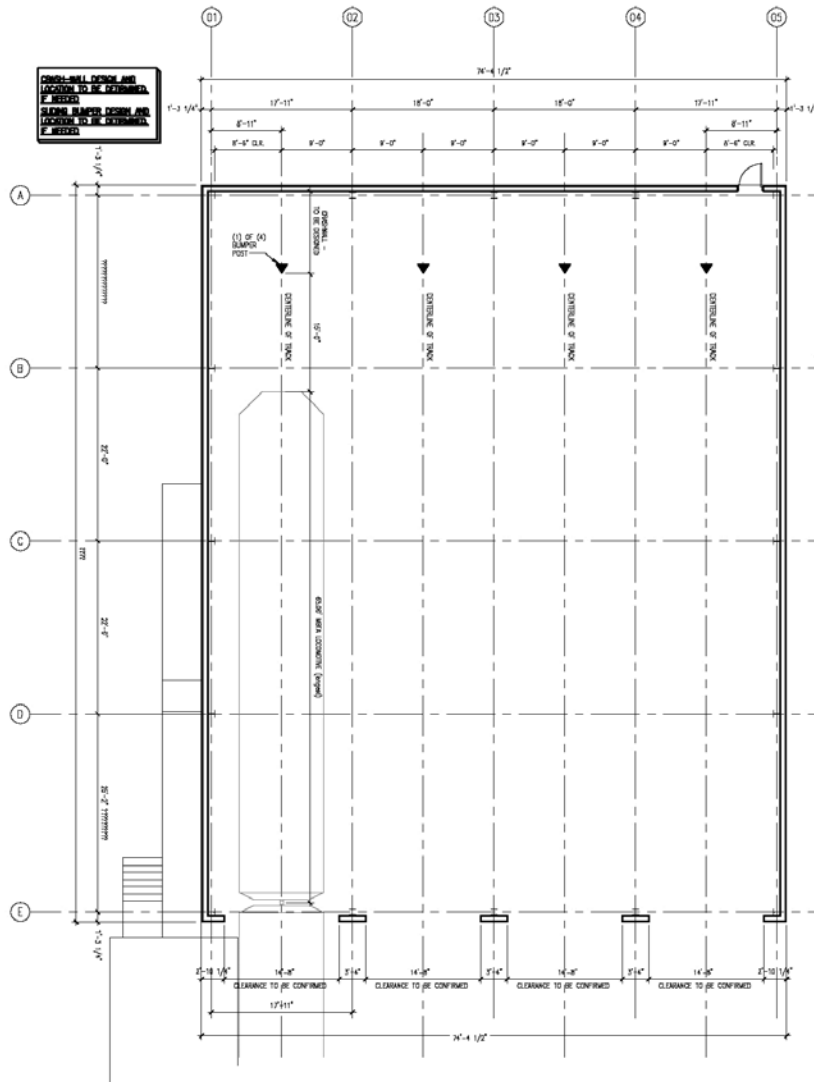
Example #1: Project Location

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Example #1: Enclosure Design

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Example #1: Acoustical Analysis

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- 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

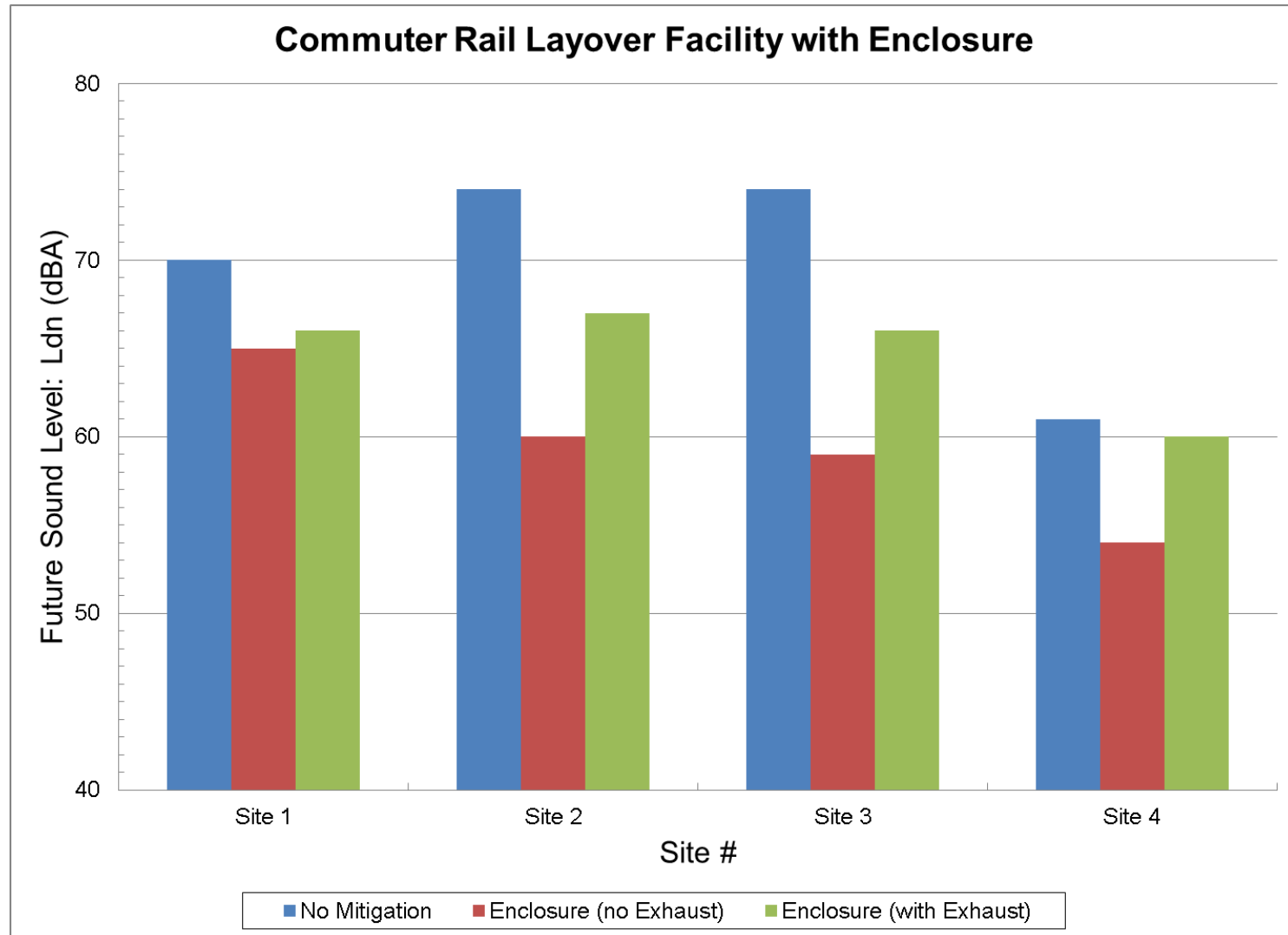
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■ Design features:

- 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

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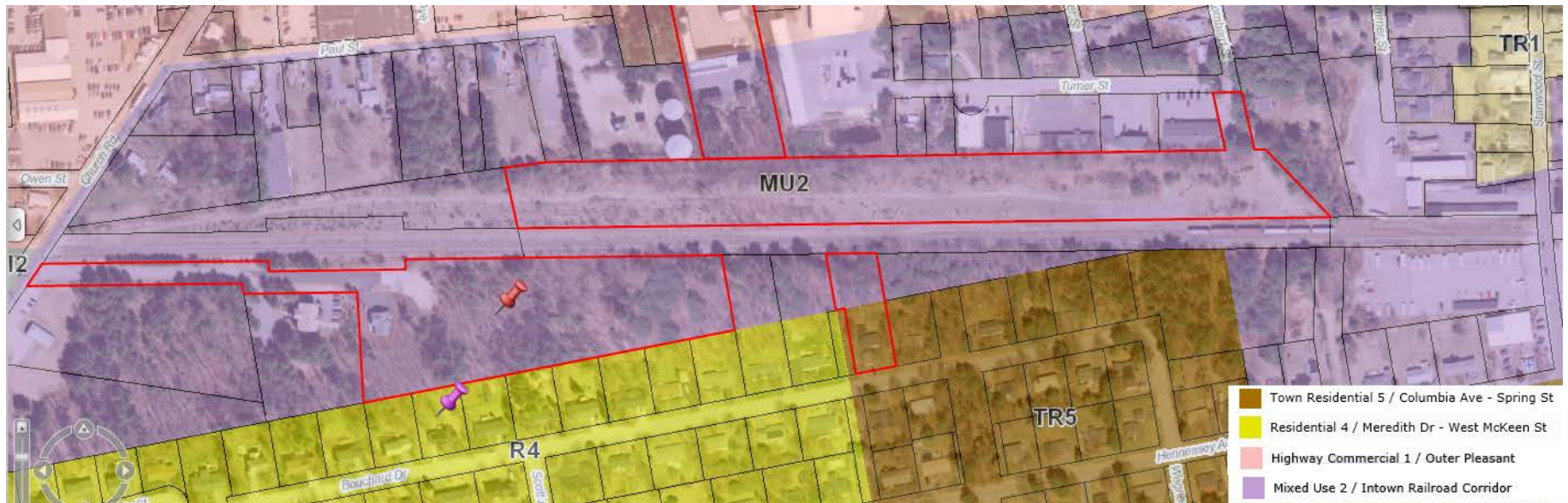
Example #2: Regional Rail Layover Facility

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- **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

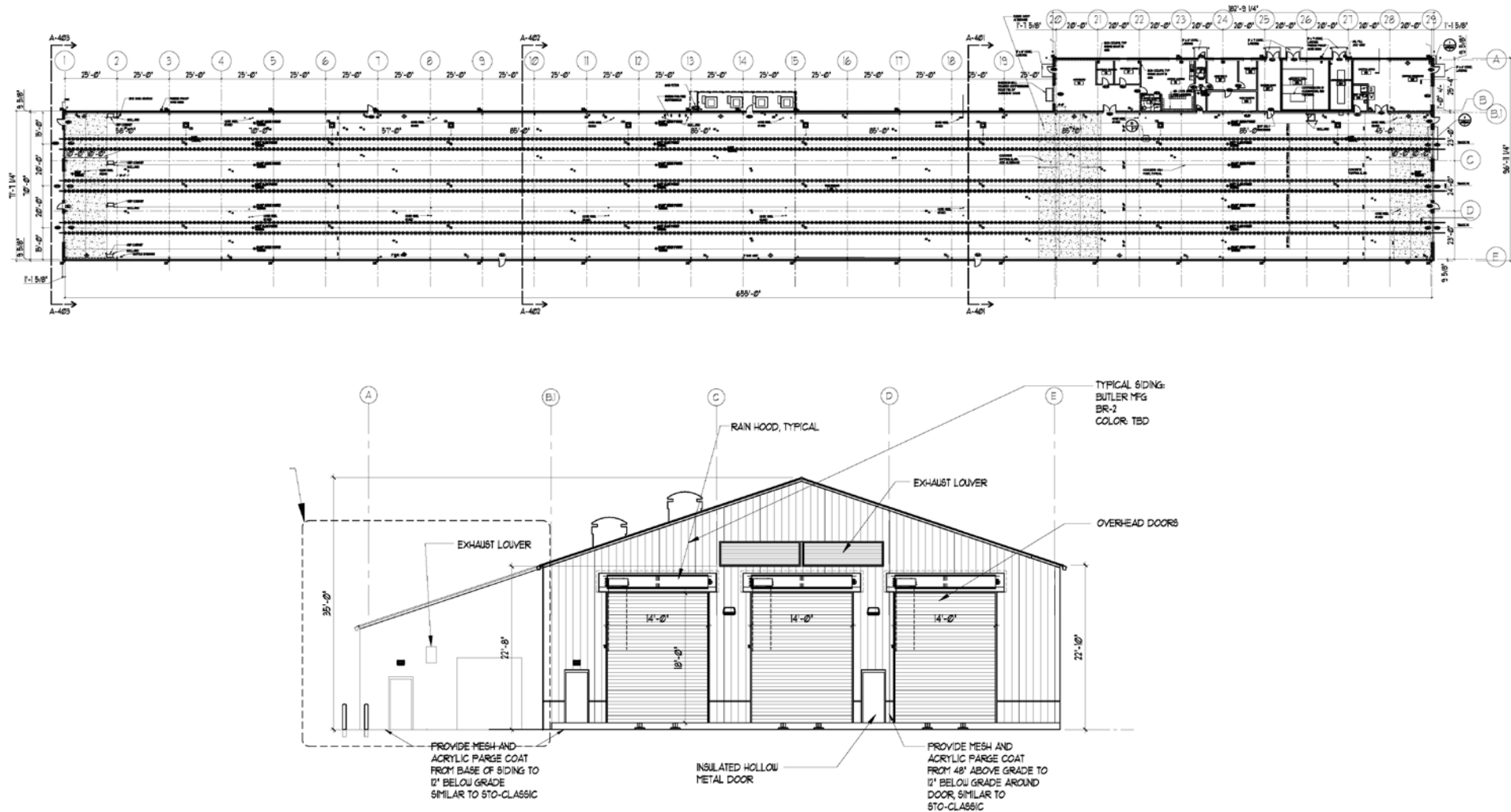
Example #2: Project Location

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Example #2: Enclosure Design

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Example #2: Acoustical Analysis

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- **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

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- **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

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- **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**

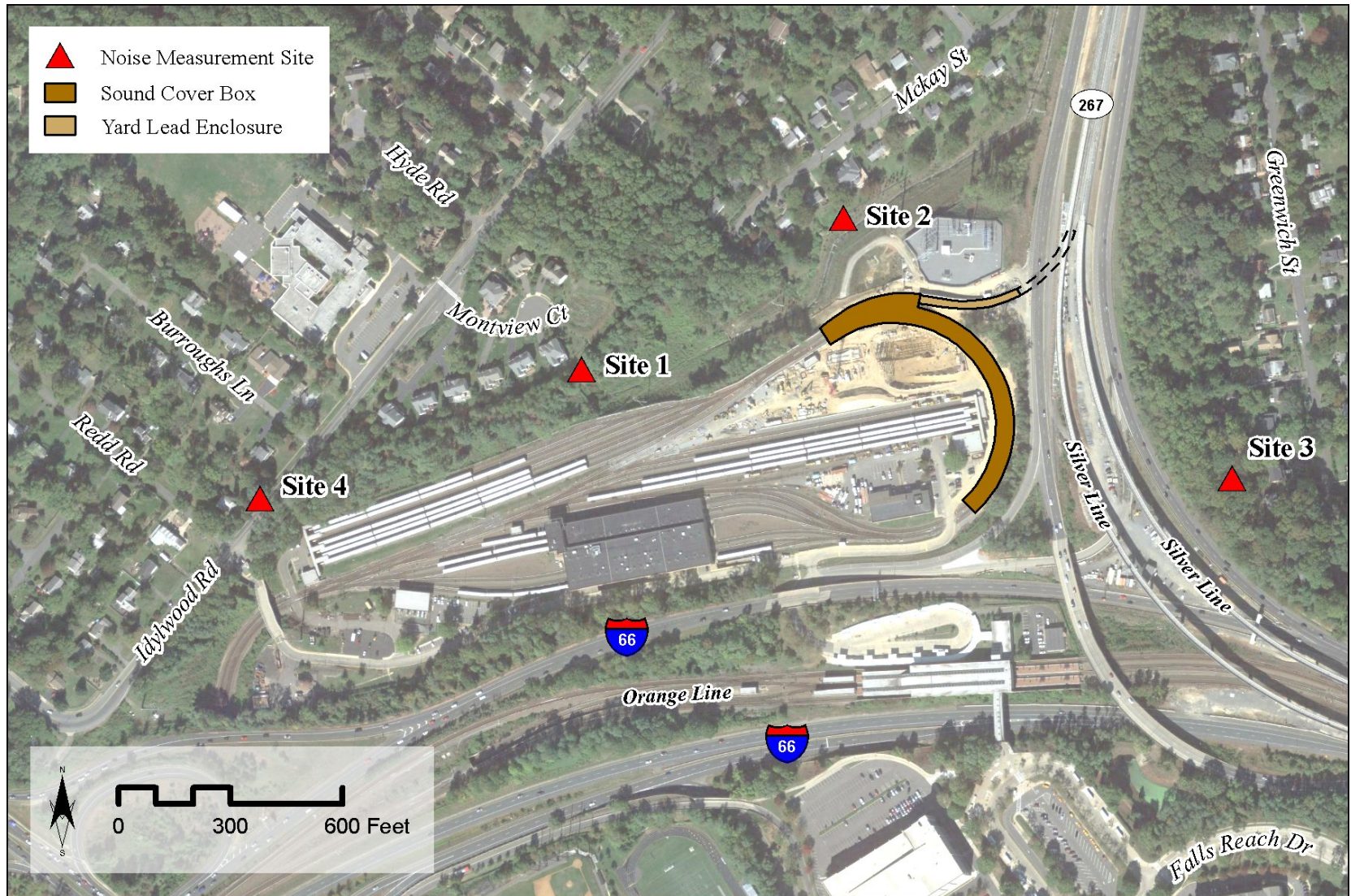
Example #3: Transit Maintenance and Storage Yard

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- **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

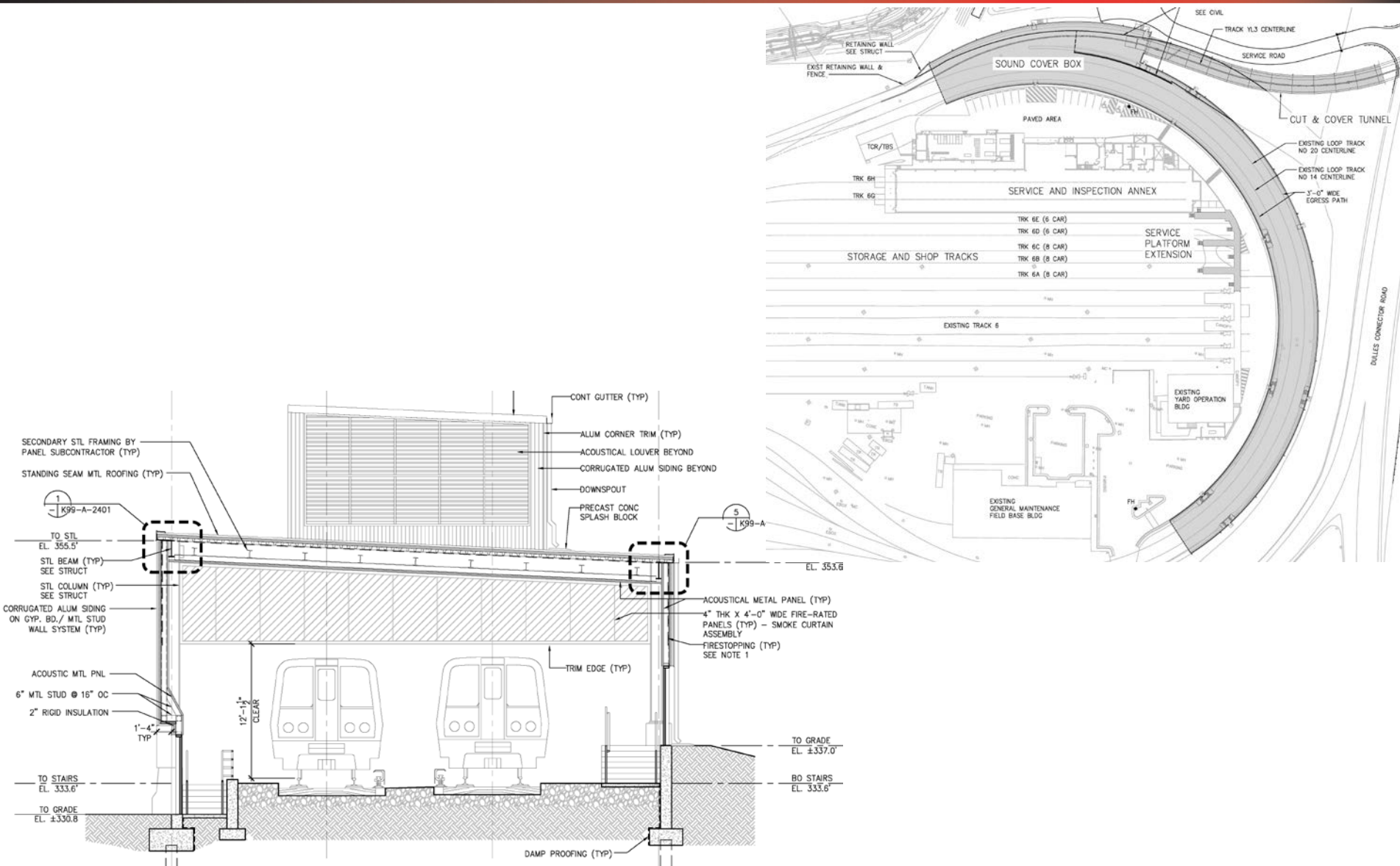
Example #3: Project Location

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Example #3: Enclosure Design

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Example #3: Enclosure Design



Example #3: Acoustical Analysis

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- 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

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- **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

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- **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

