Research Project Brief

Report 26-R47: Field Evaluation and Asset Management Planning for Noise Barriers

VTRC Virginia Transportation Research Council

Background

Noise barriers along high-volume roads reduce traffic noise through sound absorption or reflection. Although VDOT's concrete noise barriers have proven durable, some lightweight metal noise barriers have failed prematurely because of corrosion. Furthermore, VDOT does not have a formal statewide inspection and asset management program for noise barriers. Such a program would allow VDOT to quickly evaluate long-term performance and strategically allocate funding for replacements.

Research Objectives

The purpose of this research was to improve the life-cycle management of VDOT's noise barrier inventory. This project was conducted through (1) field evaluations of the condition and durability of VDOT's noise barriers, (2) developing a framework for VDOT noise barrier inspection and asset management programs, and (3) conducting trial inspections using unmanned aerial systems (UASs) to gauge their effectiveness of capturing condition data from both sides of noise barriers.

Approach

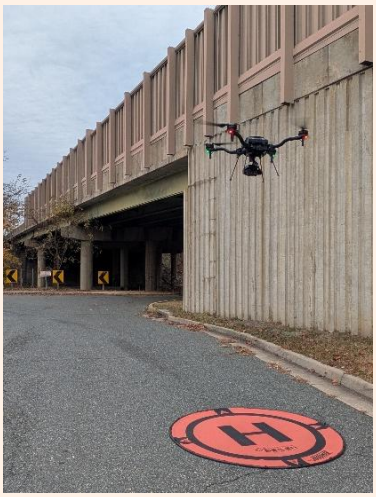
This research project included a literature review of previous noise barrier durability research and other state departments of transportation specifications and transportation asset management plans related to noise barriers, a review of databases containing data on VDOT's noise barrier inventory, field evalutions of 25 lightweight noise barriers across Virginia, development of frameworks for VDOT noise barrier inspection and asset management programs, and collaborative trial inspections of three noise barriers with a UAS consultant.

Outcomes

Lightweight metal noise barriers oriented horizontally exhibit poor durability, having an expected service life of 10 to 15 years. Other types of lightweight noise barriers have expected service lives of 50 or more years. The proposed inspection and asset management with an annual budget of $11 million can maintain VDOT's inventory with less than 10% of its noise barriers in poor or very poor condition over the next 20 years. UASs can successfully and safely be used for inspecting both sides of noise barriers.

Research Benefits

VDOT plans to implement guidance prohibiting the use of poor-performing noise barriers, which will decrease safety risks and increase available funding for other high-priority noise barrier projects. Implementing the proposed noise barrier inspection and asset management plans with rehabilitation and replacement treatments could yield a 23% return on investment and an annual savings of $2.5 million over 20 years.



Top: Front side of metal noise barrier showing corrosion damage.

Middle: Back side of metal noise barrier with collapsed panels.

Bottom: UAS trial inspection of noise barrier mounted on bridge.

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Research Findings

Lightweight Noise Barrier Panel Durability

Perforated metal panels oriented horizontally exhibit poor durability, with an expected service life of 10 to 15 years.

Other types of lightweight panel barriers, such as vertical metal, composite, fiberglass, and acrylic, exhibit good durability, with expected service lives of 50 or more years.

Anchor bolts connecting panels to posts or foundations can be susceptible to corrosion damage if not shielded from salt spray.

Top: Heavily corroded metal noise barrier panel. Bottom: Fractured anchor bolt due to corrosion.

Proposed Inspection and Asset Management Programs

The inspection program includes overall condition and element-level ratings of five element types and their associated defect types with inspection intervals ranging from 24 to 72 months.

The asset management program incorporates deterioration models for different materials, treatment types, and estimated costs. A Markov chain analysis can forecast inventory condition over the next 20 years.