Summary of Final Report, BC355-02
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CONTINUED EVALUATION OF NOISE BARRIERS IN FLORIDA

PROBLEM STATEMENT

Noise barriers are often implemented but only occasionally verified with regard to their effectiveness. Barrier validation is important because (1) barriers are expensive to build and (2) their presence affects local residents. Therefore, to justify these investments and their value to the people whose quality of life they are intended to improve, it is important to investigate the effectiveness of the design models. A previous study (BB852) investigated several barrier sites to test the effectiveness of the design models (STAMINA and TNM) and of the barriers themselves. The present study continued that investigation.

OBJECTIVES

The overall goals of this phase of study are to measure sound levels at existing noise highway noise barrier locations and to evaluate the effectiveness of these barriers. Study tasks include the following:

- investigate the effectiveness of Florida highway noise barriers
- determine the edge of the shadow zone (the distance to the edge of the area providing noise mitigation)
- determine the accuracy of previous predictions for environmental documents
- determine the effectiveness of the Federal Highway Administration (FHWA) models for predicting sound levels behind noise barriers
- determine whether meteorology (refraction) has a significant impact on barrier performance

FINDINGS AND CONCLUSIONS

Most of the barriers where measurements were taken were effective (>5 dB:L_{Aeq} insertion loss at the first row of homes) and beneficial. In this analysis, the first row of homes was generally observed near the microphone positions 49.2 feet from the barrier. The single exception was at a site at which the noise levels from the highway were effectively reduced, but more by the roadbed fill than by a berm and barrier combination. The barrier extended the shadow zone created by the edge of the fill and, in so doing, provided benefits for receivers farther from the barrier. Accordingly, benefited receivers exist at this site, but the barrier on top of the berm does not add much additional attenuation for the close receiver locations. All other sites had at least 5 dB of insertion loss (that is, the level of noise reduction resulting from the barrier) for the first row.

At the second row of homes (98.4 feet from the barrier), only two sites were below a 5 dB insertion loss, one of which was a barrier of relatively short length while the other was the shortest barrier tested. Overall, however, the barriers are providing substantial noise reductions.

Three FDOT reports predicted insertion losses near the measurement sites. Each of the three sites received more insertion loss than predicted by the PD&E report (at two of the sites, the constructed barrier heights were different than as designed). This collected data indicated that past predictions have led to barrier designs that benefit the nearby residents, and, in at least 3 cases, more insertion loss (noise reduction) occurred than predicted.

A predictive equation was derived that allows the edge of the shadow zone to be determined based on modeling. Work is continuing to improve this methodology.

Refraction at the low wind speeds during measurement, and for the short distances, led to very low correlations and changes in attenuation generally less than one dB(A).

Finally, the FHWA models STAMINA 2.0, STAMINA 2.1 (with Florida specific reference energy mean emission levels), and TNM were evaluated. Additionally, the UCF Community Noise Model was evaluated. The STAMINA models proved to be slightly better in prediction accuracy due to better reference levels, but were not as good in predicting propagation effects. As such, the TNM model which is based much more on theory is thought to be a better building block.

BENEFITS

This research has demonstrated the effectiveness of noise barriers. Also, it has (1) provided a way to predict shadow zone length, (2) started the analysis on refraction effects, and (3) allowed a statistical evaluation of the noise models in use. This research is making available more tools for the analyst. Consequently, the resources invested in these structures are being effectively utilized to improve the quality of life for residents who are affected by nearby roadways.

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