

COMPREHENSIVE REVIEW OF COLLECTED NOISE INFORMATION AT BARRIER SITES

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. Two previous studies (BB852 and BC355-02) investigated several barrier sites to test the effectiveness of the design models (STAMINA and TNM) and of the barriers themselves. The present study continued those investigations.

OBJECTIVES

The goals of this project included the following:

1. Compare the 1/3 octave band data to that in TNM to gain further insight into the narrowband capabilities of TNM. A special version of TNM that reports 1/3 octave band results will be used for this project.
2. Continue development of a 'shadow zone length' model that determines the extent of the shadow zone behind a barrier, given site specific parameters.
3. Evaluate TNM prediction accuracy when using actual meteorological site conditions rather than default FHWA values.

FINDINGS AND CONCLUSIONS

This project describes the results of a detailed analysis of in-situ measurements of 19 noise barriers in Florida. This project resulted in and populated a substantial database, which was valuable to the study. Researchers evaluated spectral differences of predicted and measured ground effects, and high frequency deviations between federal prediction methods and measured data. This research also produced custom software that provided a visualization of the formation of shadow zones behind existing barriers.

Other important results of this research include the following:

- A new empirical method of predicting shadow zone length behind barriers was developed, which requires information readily available to a DOT planner. This method provides a convenient way to estimate shadow zone length based on actual measurements that include background sound level contribution.
- A new method of background source allocation was developed and used in the development of the shadow zone length model.
- TNM predicted reference spectra, above the barrier, were similar to measured spectra.
- An average error of 1 dB(A) was observed in the TNM predicted 'ground dip.' The source of the error is unclear but thought to be due to the angle of the sound wave and the ground plane. A value of about 10 cgs Rayls provided a better fit with measured results than did the default 'lawn' ground type (300 cgs Rayls).
- High frequency effects caused by refraction (meteorological effects) are not considered in most traffic noise prediction models, which leads to differences between predicted and measured high frequency spectra. However, the effects are small and would seem not to be a primary concern for calm winds and short distances at this time.
- Software was developed to allow visualization of the soundscape and shadow zone behind barriers. This software is being provided to FDOT for use in design of highway noise barriers in Florida.

BENEFITS

This research will permit better evaluation of barriers during the design phase and allow a better estimation of benefited residents. This is extremely important because whether a barrier is built depends on cost and the number of benefited dwelling units. Until now, models have over-predicted this benefit, leading to inaccurate decisions. Consequently, future decision-making will result in better use of resources for maximal effect.

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