Florida Department of Transportation
Summary of Final Report, BB-852
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BARRIER EFFECTIVENESS VALIDATION

PROBLEM STATEMENT

Noise barriers are often implemented. However, whether the insertion loss modeled is being provided to the residents is only occasionally verified. There are two key reasons for conducting post-installation investigations of barrier acoustic performance. First, barriers are quite expensive to build, so it is paramount to determine whether the barrier design models are performing well (i.e., good investments). Second, people are affected not only by traffic noise but by the very presence of these barriers (i.e., quality of life). Measuring the acoustic effectiveness of barriers would provide insight into how effectively the Department has reduced noise levels, improved living conditions, and utilized its resources.

OBJECTIVES

The primary objectives of this study were to determine whether:

1. Barriers provide adequate protection for highway neighbors.

2. Barriers that have been built in Florida are performing as predicted.

3. The new FHWA Traffic Noise Model (TNM) is significantly better than STAMINA2.0/2.1.

In order to meet these objectives, a detailed measurement program was used at twelve barrier locations around the state. The measurement program included the collection of overall sound levels, 1/3 octave band levels, location geometrics, traffic characteristics, and meteorological data. The sound measurement positions were determined by using the American National Standards Institute standard (methods for determining insertion loss of outdoor noise barriers, ANSI S12.8-1998), which required measurements to be taken at various heights and distances above and behind the noise barrier.

FINDINGS AND CONCLUSIONS

The results of the measurement program demonstrated that the highway neighbors are being protected, in accordance with FHWA/FDOT Noise Abatement Criteria. While the barriers could have been higher at four of the locations, significant decreases in the sound levels nevertheless occurred. Without the barriers, severe interference with communication and outdoor activities would have occurred as a result of traffic noise.

A review of the amount of protection actually provided by the barriers as compared to expectations derived from computer modeling demonstrated that the models used (STAMINA2.0/2.1) performed

adequately and in some cases better than the new TNM. However, statistical testing tended to show that when only the propagation algorithms in TNM were compared to STAMINA2.0/2.1, TNM performed significantly better because the propagation algorithms in the STAMINA models are not as complete as those in TNM.

Research also provided insights into shadow zones (the area of reduced noise levels behind the barrier). Researchers gained a better understanding of the shadow zone depth, effects due to interaction with the ground and sound wave, and how background levels change the actual shadow zone. This information will help FDOT analysts during the design process.

When the measured values were statistically compared to the predicted values, TNM was similar to STAMINA2.1 (the FDOT version of STAMINA). However, when the propagation components were explored by comparing the reference levels to those behind the barrier, TNM was significantly better. The absolute values, however, were not significantly better from TNM modeling, and at this time verification may be needed on a project by project basis. Therefore, researchers recommend that measurements be used to substantiate the accuracy of TNM before any barriers are implemented. The measurements would provide the *before* case that could be compared to the TNM *no barrier* predictions, thus allowing the barrier design process to be more accurate. Also, when existing structures are present, care should be taken in the prediction process. These structures may need to be added to the model in an appropriate fashion.

Researchers, thus, recommend that TNM be used for future projects based on (1) the improved propagation algorithms, (2) the graphical user interface that makes TNM easier to use, and (3) the fact that TNM will become the FHWA required model in 2002.

This research project was conducted by Roger L. Wayson, Ph.D, P.E., at the University of Central Florida. For more information, contact Win Lindeman, Project Manager, at (850) 488-2914, win.lindeman@dot.state.fl.us