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noise and vibration control • sound quality • test facility design • instruction

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EXECUTIVE SUMMARY

Nelson Acoustics performed acoustical measurements along I-30 in Dallas TX on November 30, December 1, 21 and 30, 2010. The purpose of the measurements was to demonstrate a method for assessing the *in situ* reflectivity of the retaining wall opposite the Kessler Park neighborhood, prior to a proposed installation of sound absorbing material. Several sessions were necessary to adapt the method to the geometry, sound-absorptive road surface, traffic patterns, and physical access.

The measurement setup designated “K” is depicted below in Figure 1 (page 3). Sound sources were located on a plywood reflecting plane (“dance floor”) in the northernmost westbound lane near the point marked *1052 K Source*. Our microphone was located 12 feet above on the Edgefield Ave. bridge near the point marked *1052 G,K Receptor*.

The test signal was a “maximum length sequence” approximately 1.2 seconds in duration, which was repeated approximately 300 times. The maximum length sequence is completely uncorrelated with any other noise signal, which allows it to be reliably detected in the presence of noises that are even louder than the signal. (See Figure 2, page 3).

By comparing the energy in the reflected and un-reflected sound fields it is possible to establish the relative magnitude ρ of the reflection off of the wall. The sound absorption coefficient α of the wall is $1-\rho^2$. The additional sound energy due to the reflection at a particular frequency is equal to $10 \cdot log_{10}(1+\rho^2)$. Converting a perfectly reflecting wall to a perfectly anechoic (i.e., non-reflecting) wall would decrease the sound level 3 dB.

Test “K” benchmarked the pre-treatment retaining wall reflection. The potential dB reduction for each band is calculated and then applied to a traffic noise spectrum measured at the site.

Table 1 shows that the wall is a nearly perfect reflector, and that eliminating the reflection would lower sound pressure levels by *81.2 – 78.4 = 2.8 dBA*. This demonstrates that it is at least theoretically possible to achieve the goal of 2.0 dBA reduction recommended by UT CTR.

Table I: Reflection and Potential Reduction

	250 Hz	500 Hz	1000 Hz	2000 Hz	A
Reflection Coefficient [1]	0.91	0.97	0.99	0.77	---
Max. SPL Reduction [dB]	2.6	2.9	3.0	2.0	---
Initial A-wtd. SPL [dB]	67.8	75.7	79.2	68.3	81.2
Minimum SPL [dB]	65.2	72.8	76.2	66.3	78.4

Nelson Acoustics recommends that the performance of the sound absorption treatment be assessed according to the following equations:

$$\Delta dB_i = 10\log(1+\rho_i^{\,2})$$
$$L_{P,i} = 65.2 \quad 72.8 \quad 76.2 \quad 66.3$$
$$\Delta dBA = 81.24 - \sum_i 10^{0.1\left(L_{P,i}+\Delta dB_i\right)}$$

where *i* refers to the four principal octave bands 250, 500, 1000, and 2000 Hz.

CONCLUSION

A more detailed description of the methods and details of the test setup is available under separate cover in Report 1052-02.

Sincerely,

NELSON ACOUSTICS (TX F-3001)

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Figure 1: Measurement Location with Kessler Park and Kessler Court neighborhoods

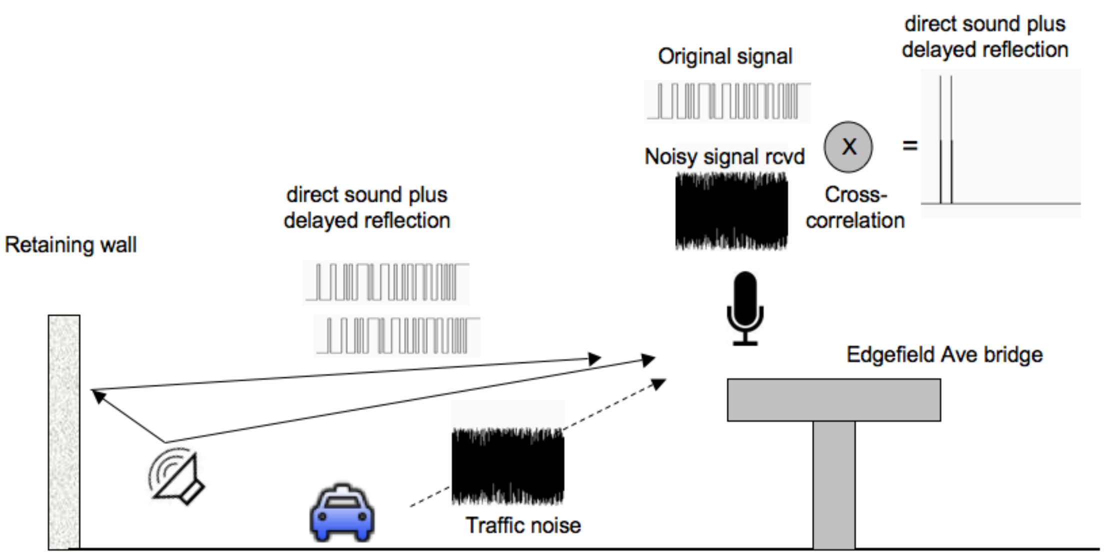

Figure 2: Schematic Diagram of Measurement Method