SOUND TRANSMISSION LOSS AND SOUND TRANSMISSION CLASS (STC) ANALYSIS OF CHEMIR SAMPLE # 522699

Prepared for:

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1 INTRODUCTION

HGC Engineering was retained by Chemir Analytical Services to model the sound transmission loss characteristics of a sample (Chemir number 522699). Of the four material parameters required for the prediction of sound transmission loss, Chemir measured three parameters and provided them to HGC Engineering (bulk density, Young's Modulus, and Poisson's Ratio). The fourth necessary parameter, internal loss factor (or 'damping' factor) was measured by HGC Engineering. With these material parameters and the physical dimensions of the sample, established engineering prediction methods were used to estimate the sound insulation performance of the sample.

The result is an estimated Sound Transmission Class rating of STC-40.

2 TERMINOLOGY

The sound insulation of a material or assembly represents the difference between the sound incident on one side of the material and that transmitted through and emitted from the other side. Sound insulation is commonly quantified in terms of Transmission Loss (TL), which is defined as the difference in decibels [dB], between the incident and transmitted sound power. Because the sound insulation characteristics of a material vary with the frequency of the incident sound, TL values are typically provided in each of a set of 1/3-octave frequency bands spanning the frequency range of interest.

A standardized single-number descriptor of sound insulation is the Sound Transmission Class (STC) rating, as defined in ASTM Standard E413-87, "Classification for Rating Sound Insulation". This standard defines a calculation procedure in which the sixteen individual TL

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values in the 1/3-octave bands from 125 to 4000 Hz are evaluated against a reference curve to determine a single number rating.

Internal loss factor (a material parameter required for the predictive modelling of TL characteristics), is a dimensionless number representing the tendency of the material to dissipate internal vibratory-acoustic energy as heat, as defined in ASTM Standard E756-93, "Standard Test Method for Measuring Vibration Damping Properties of Materials."

3 MEASUREMENT AND ANALYSIS METHOD

Predictive analysis of the sound insulation characteristics of the material require that the internal loss factor be known. Thus, as a first step, measurements of loss factor were conducted by HGC Engineering. ASTM Standard E756-93 defines a method for measuring loss factor which uses a magnetic exciter, and is appropriate for thin, light strips of material. The geometry and weight of the subject sample were such that the standard method of dynamic excitation could not be used. Instead, a modified procedure was used, based on E756-93, but utilizing a force-impact hammer as a method of exciting the material.

In addition to the measured value of loss factor, Chemir provided the following material parameters to HGC Engineering for this sample: density = 1.0435 g/cm^3; Young's Modulus = 141,141 psi; Poisson's Ratio = 0.2428. These four material parameters and the physical dimensions of the sample were used as input to a predictive computer model, based on established engineering prediction methods for sound transmission through single-layer and multi-layer assemblies.

4 MEASUREMENT AND ANALYSIS RESULTS

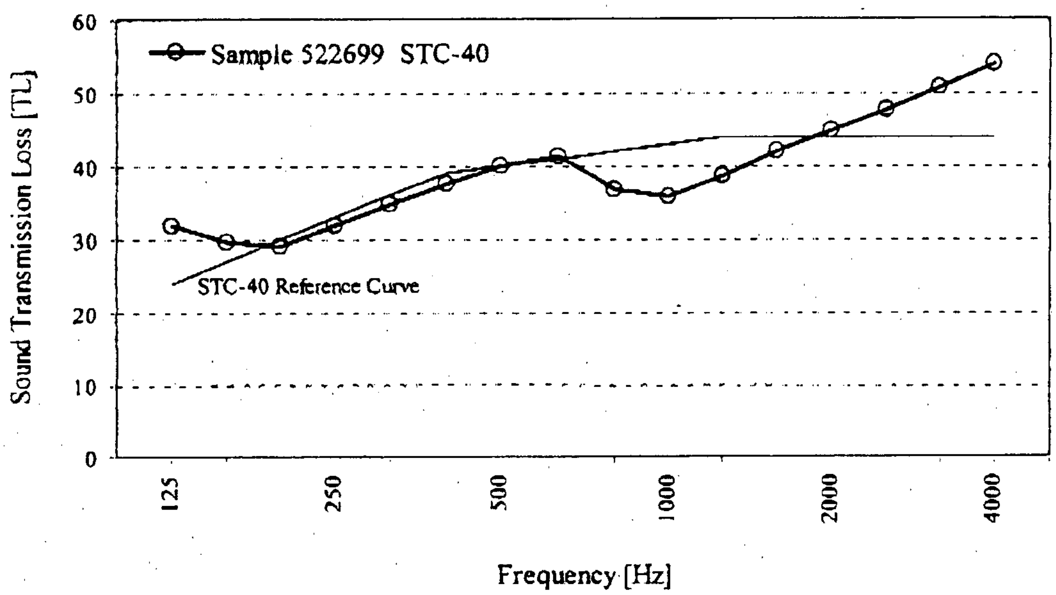
During the loss factor tests, it was possible to excite six natural modes of vibration in the sample, within the frequency range of concern, given its material properties and geometry. These natural frequencies ranged from 700 to 1570 Hz. The measured loss factor was found to be essentially constant over this frequency range, with an average value of 0.024.

The predicted TL results are shown in Figure 1, overlaid with the STC reference curve. These results indicate an overall sound insulation rating of STC-40.

It is important to note that the TL and STC results cited herein refer to the properties of the sample itself, neglecting any leakage that might occur in an actual installation where multiple units would be connected together to form a wall. Leakage at joints can significantly degrade the sound insulation properties of an assembly. To approach the predicted result in practice, it may be necessary to seal the joints between the various units assembled together.

In general, where test data is available, the established prediction methods are found to be accurate typically within 2 to 3 STC points. This accuracy range pertains to common assemblies such as single- or multi-layer gypsum board partitions, glass windows, and wood-frame floor assemblies, and concrete panel configurations. However, as the subject sample is novel and unique, HGC Engineering has no directly relevant test data on file upon which to base an estimate of prediction accuracy.

Figure 1: Predicted Sound Insulation Performance



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