June 3, 2014

White Paper:

Contribution of Floor Treatment Characteristics to Noise Levels in Health Care Facilities (Part 1)

by Adam Paul and David Arena
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Background:

When it comes to interior room acoustics, much time and research has been invested into developing acoustically absorptive materials suitable for use on walls and ceilings, but what about the floors? It is widely accepted that the only "quiet" floor finish is carpet, so unless hygiene is a non-factor, we've all but abandoned hope of having an acoustically beneficial hard-surface flooring.

Except ECORE.

While anyone has yet to create a smooth surface flooring that is as *absorptive* as carpet, ECORE has successfully created smooth surface flooring that is as *quiet as carpet*.

What's the difference?

Imagine dropping a stack of magazines onto a hard surface flooring and the sound it creates. The *absorption* in the room will affect the rate at which that sound and all of its reflections die down. In very reflective rooms with little absorption, the sound can reverberate for a few seconds- lingering and resulting in echoes. In rooms with more absorption, the sound can die down within a few tenths of a second- like what you might experience in a library. In either case the initial sound power generated by the impact between the falling object and the hard flooring remains the same.

Now imagine dropping that same stack of magazines onto carpet. How different does that sound to you? This is the problem that ECORE has solved.

ECORE has invested 5 years into the development of a new, patented technology branded *itstru* that allows a wear layer to be fused to a 97% post-consumer recycled rubber backing. The fruit of this labor: a smooth floor finish that is as quiet as carpet. (Oh and it also has anti-fatigue capabilities and meets and exceeds all standards for low VOC emissions.)

The Study:

This new technology was chosen as the focal point of a semester-long research project conducted by the University of Hartford's Acoustics program which has recently focused on hospital noise in light of the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey. While there are many noise sources within a hospital, one potentially significant source can come from the hallways and corridors where regular traffic can include both footfall from staff and visitors and rolling noises from medical carts and stretchers. The University of Hartford recognized that addressing these noise sources could positively affect the acoustic environment in patient rooms.

Two senior acoustical engineering students, Adam Paul and David Arena, chose to undertake this topic for their final project. They "aimed to quantify the influence different flooring materials could have on hospital corridor noise." In order to do this, they conducted 3 different tests on each test material: an absorption test (ASTM C423), a tapping machine test, and a rolling cart test.

Recall the example used in the introduction of this paper to illustrate the difference between how *absorptive* a material might be versus how *quiet* one might be. The absorption test would obviously correspond to the absorptiveness of a material, whereas the tapping machine and rolling cart tests would correspond to how quiet a material is.

Five different products were included in this study:

1. *Pinnacle rubber-backed carpet tiles.* This would provide a reference point of how absorptive and how quiet a standard commercial carpet might be.
2. *Forest FX sheet vinyl.* A standard 2mm sheet vinyl with no rubber backing.
3. *Forest RX rubber-backed sheet vinyl.* The standard 2mm sheet vinyl above fused to our recycled rubber backing.
4. *Virgin rubber.* A standard virgin rubber flooring product with no rubber backing.
5. *Rubber-backed virgin rubber.* The standard virgin rubber above fused to our recycled rubber backing.

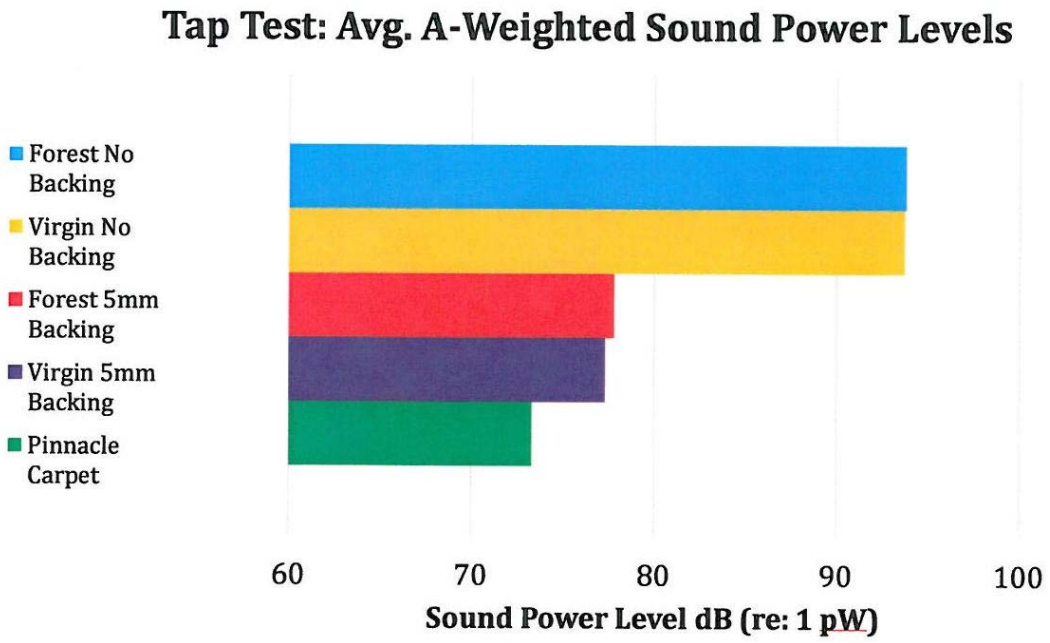
Results:

Absorption Tests

Results here all came out as expected. The carpet was the most absorptive (particularly in the higher frequencies) whereas the sheet vinyl and virgin rubber products were less absorptive, commensurate with standard sheet vinyl and other virgin rubber products.

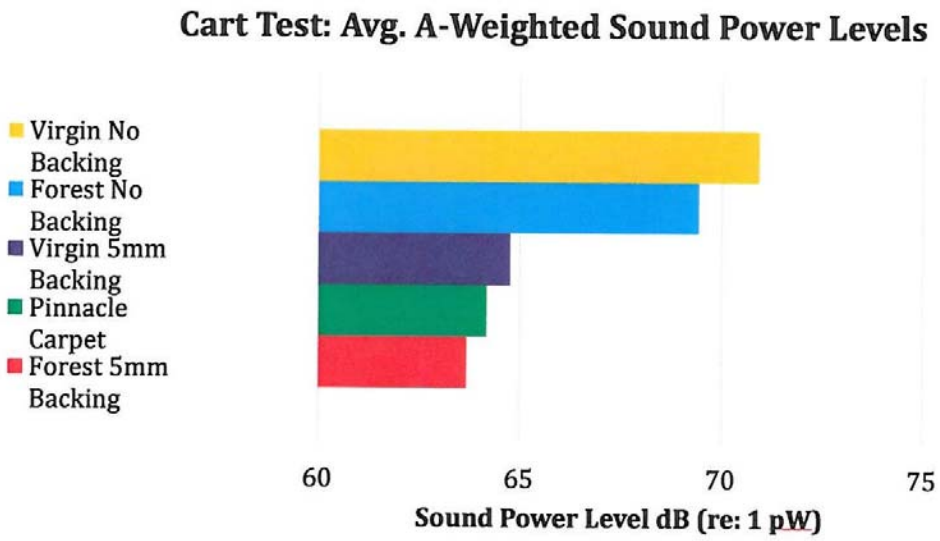
Tapping Tests

This testing involved the use of a standard tapping machine typically used by acoustical consultants when conducting field tests for Impact Insulation Class ratings. Normally, acoustical consultants would focus on measuring the level of sound *transmitted into the space below*, but in this case the point was to measure the amount of *sound generated by the surface*. The results confirmed that the fused rubber backing improved sound levels significantly, approaching those levels generated by carpet.

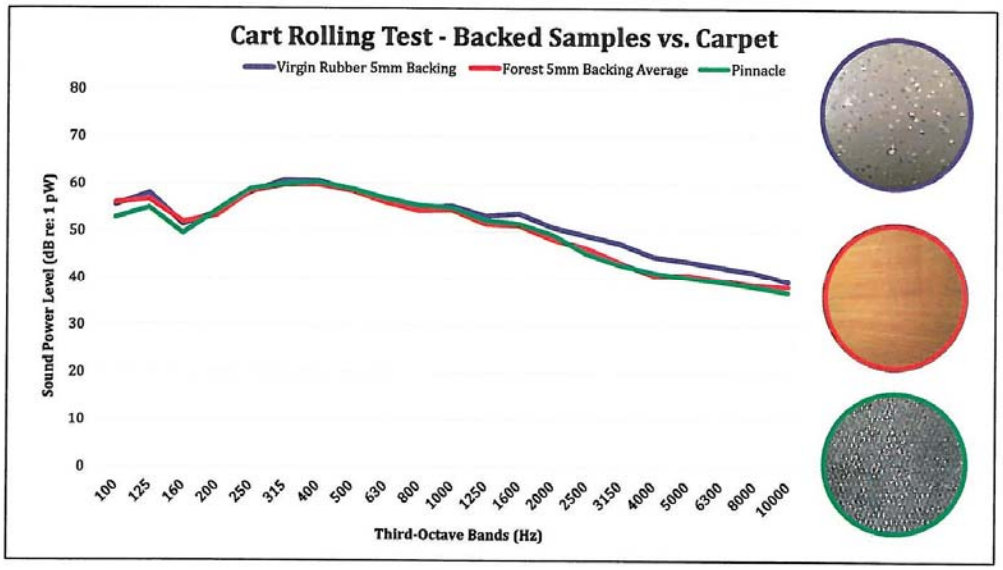


Rolling Cart Tests

This testing involved the use of a standard stainless steel hospital cart. The students figured out how to build a mechanism that would repeatedly and consistently roll the cart across the floor samples while they took their measurements. The results confirmed again that the fused rubber backing improved sound levels as it did with the tapping test. However, these improvements were much more significant and noticeable, such that the rubber-backed sheet vinyl, Forest rx, was technically even more quiet than the carpet.



I'll admit that's a bit of a loaded statement if I ever saw one, so let me clarify. The architectural acoustic community has gotten used to summarizing dozens of data points into a single number rating (IIC ratings, STC ratings, etc). This is a controversial topic as the single number rating can sometimes be misinterpreted or can be misleading, but for now, that's just how it goes. To give you the full picture, however, the chart below will show you just how close the rubber-backed samples performed to the carpet tile.



Summary and Recognition:

Adam Paul and David Arena's final report states that "the addition of the rubber backing resulted in an overall sound power level *reduction of 16 dBA during the tap test* and an overall *reduction of 5 dBA during the rolling cart test*… [and] *nearly identical sound power spectra as the Pinnacle Carpet* during the rolling cart test."

Lastly, we want to point out that Adam and David were presented with the Institute of Noise Control Engineering's (INCE) *2014 Leo Beranek Student Medal for Excellence in the Study of Noise Control* for this wonderful work and contribution to the acoustic industry. This award was established by INCE/USA and the INCE Foundation in 2010 to recognize excellence in the study of noise-control by undergraduate and graduate students at academic institutions in North America. Adam and David will be presenting these findings at the 168th Meeting of the Acoustical Society of America in Indianapolis, IN in October, 2014.

Adam Paul (center) and David Arena (right) pictured with Dr. Eoin King (left)

Adam has accepted a position with Shen Milsom & Wilke (New York) and David with Lewis S. Goodfriend & Associates (New Jersey).

Our most sincere congratulations go to them for their excellent work and well-deserved recognition.

Sincerely,

ECORE International

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Reference: A. Paul; D. Arena; E. King, Ph.D.; R. Celmer, Ph.D. "Contribution of Floor Treatment Characteristics to Noise Levels in Health Care Facilities Part 1," May 2014