What are the advantages of using Quiet Islands in place of designing a 'Quiet' building?

The world's most sensitive instruments for highly advanced research are increasingly installed in less than ideal environments facing many environmental and building vibration sources.

Ultra-precision instruments, including SEM, cryo-TEM, AFM, STM, and E-Beam Lithography are exploring the sub-nanometer and even the sub-angstrom scale and are required to achieve extremely high resolution and precise measurements. Building floor vibration jeopardizes high-resolution performance and prevents such tools from meeting their design specifications.

There are two approaches to overcome this: Designing a facility to meet the stringent vibration criteria of extremely precise nanotech equipment (Quiet Building approach) or choosing only a point-of-use vibration cancellation under the sensitive equipment (Quiet Island).

Quiet Buildings

Architects can design whole buildings to meet moderate floor vibration levels without too much difficulty. However, designing buildings to meet the extremely low vibration levels required for nanotech research facilities requires exponentially more cost with diminishing returns. According to Colin Gordon & Associates, vibration levels can increase over time as a building is populated with equipment, personnel, and activity. Levels should be expected to increase >15 dB in the first 17 months [Colin Gordon & Associates. "Maturation" of the vibration environment in advanced technology facilities (2004)].

Furthermore, a common approach which relies on pneumatically supported concrete plinths is often not compatible with the tool internal vibration isolation systems and plinths amplify vibration up to 10x in the critical frequency range.

Concrete plinths are inflexible, and the demolition of plinths is expensive and messy.

All in all, designing buildings to ever quieter specifications becomes impractical due to cost, and at quietest levels, may not even be possible. Building vibration levels will not be less than earth below the foundation.

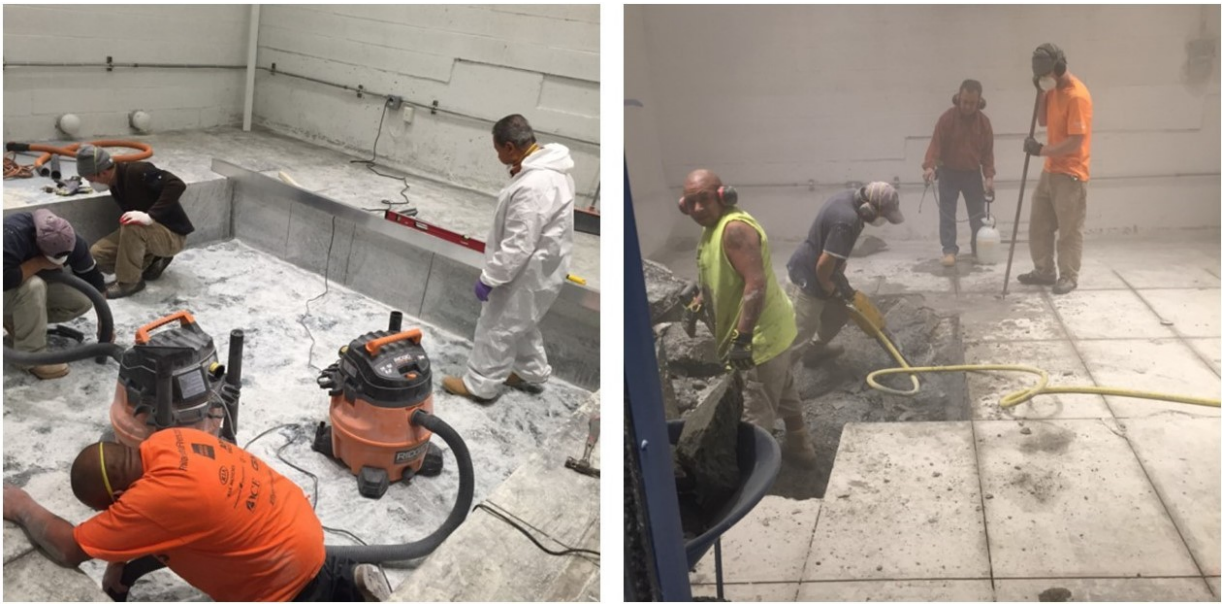

Image 1 Plinth removal at NY Structural Biology Center, Photo courtesy of New York Structural Biology Center

Why freeze the house if all you want is a cold beer? – The Quiet Island Concept

“The [STACIS Quiet Island] seems to be working as expected. A bridge next to us opened…and there are trains, buses, and also street cars passing all day and we haven’t experienced any problems. This is fantastic.” – *Claudia López, PhD, Multi-Scale Microscope Core Manager, Oregon Health & Science University*

The more cost effective and successful approach for achieving the stringent requirements of vibration sensitive tools is to employ point-of-use active vibration control with serial piezoelectric technology, particularly to mitigate challenging low frequency (less than 5 Hz) vibration.

A Quiet Island is a rigid, damped platform matching the footprint of the instrument supported by STACIS III active, piezoelectric vibration cancellation system. It has a wide active bandwidth from 0.6 Hz to 150 Hz and inertial active vibration cancellation with 90% reduction starting at 2 Hz.

The Quiet Island replaces a section of the raised access floor with an isolated foundation, mounted to the sub-floor and actively cancelling sub-floor vibration from reaching the instrument.

Placing quiet islands at the discrete locations where precision instruments, experiments, and research will be conducted also gives you more flexibility. Each platform is individually tailored to the customer's

application but can easily be reconfigured if the tool or the floor characteristics change, unlike concrete plinths.

Another benefit is that each Quiet Island is custom built to match the exact needs of the instrument layout, which results in a cleaner, more ergonomic, and acoustically better performing system. Tool facilities are more easily integrated in and around a Quiet Island's customized shape, and exposed isolated areas are minimized, to reduce the risk of additional vibration from mechanical flanking paths, user motion and acoustic coupling.

Last but not least, as vibration levels in the facility rise over time (due to more equipment, personnel, and activity in the building), a STACIS Quiet Island will provide additional assurance that vibration levels at the Quiet Island top will be attenuated to increase the likelihood of maintaining an in-spec environment.

Image 2 TMC Quiet Island Support System with STACIS® III Isolators. Photo courtesy of TMC

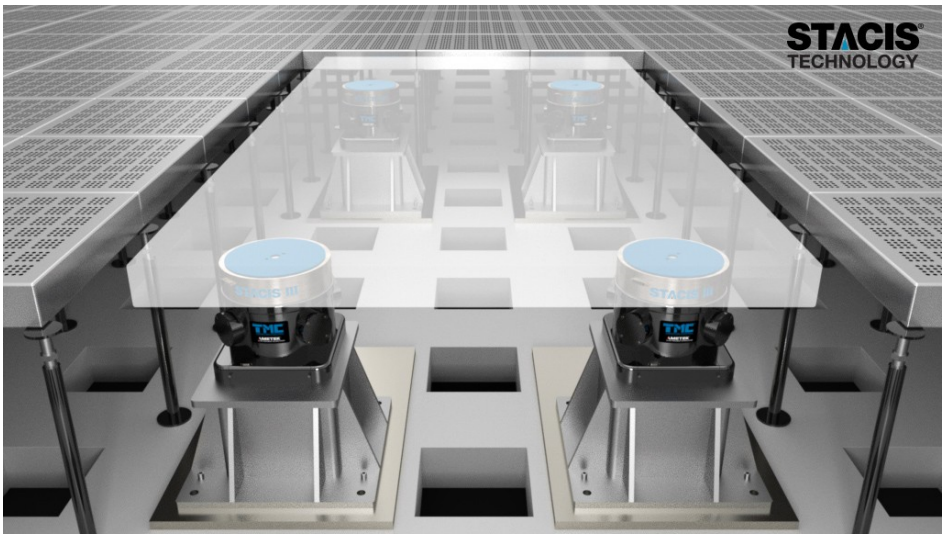

Image 3 TMC Quiet Island in raised floor environment. Photo courtesy of TMC

Image 4 TMC Quiet Island Enables High-Resolution Cryo TEM. Photo courtesy of Oregon Health & Science University (OHSU)

STACIS Compact Quiet Island

To match raised floor heights as low as 200mm, or to accommodate installations in rooms with low ceiling heights, TMC recently introduced STACIS Compact Quiet Island. The design incorporates a platform with “pockets” to lower the effective height. Similar to the standard STACIS Quiet Island, this Compact version provides excellent sub-Hertz active floor vibration cancellation for large instruments that typically weigh over 1134 kg.

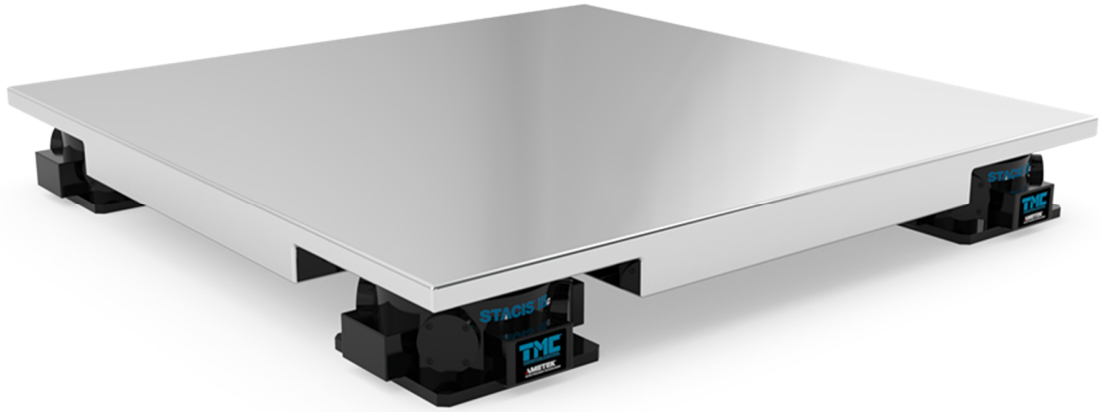

Image 5 STACIS Compact Quiet Island, Photo courtesy of TMC

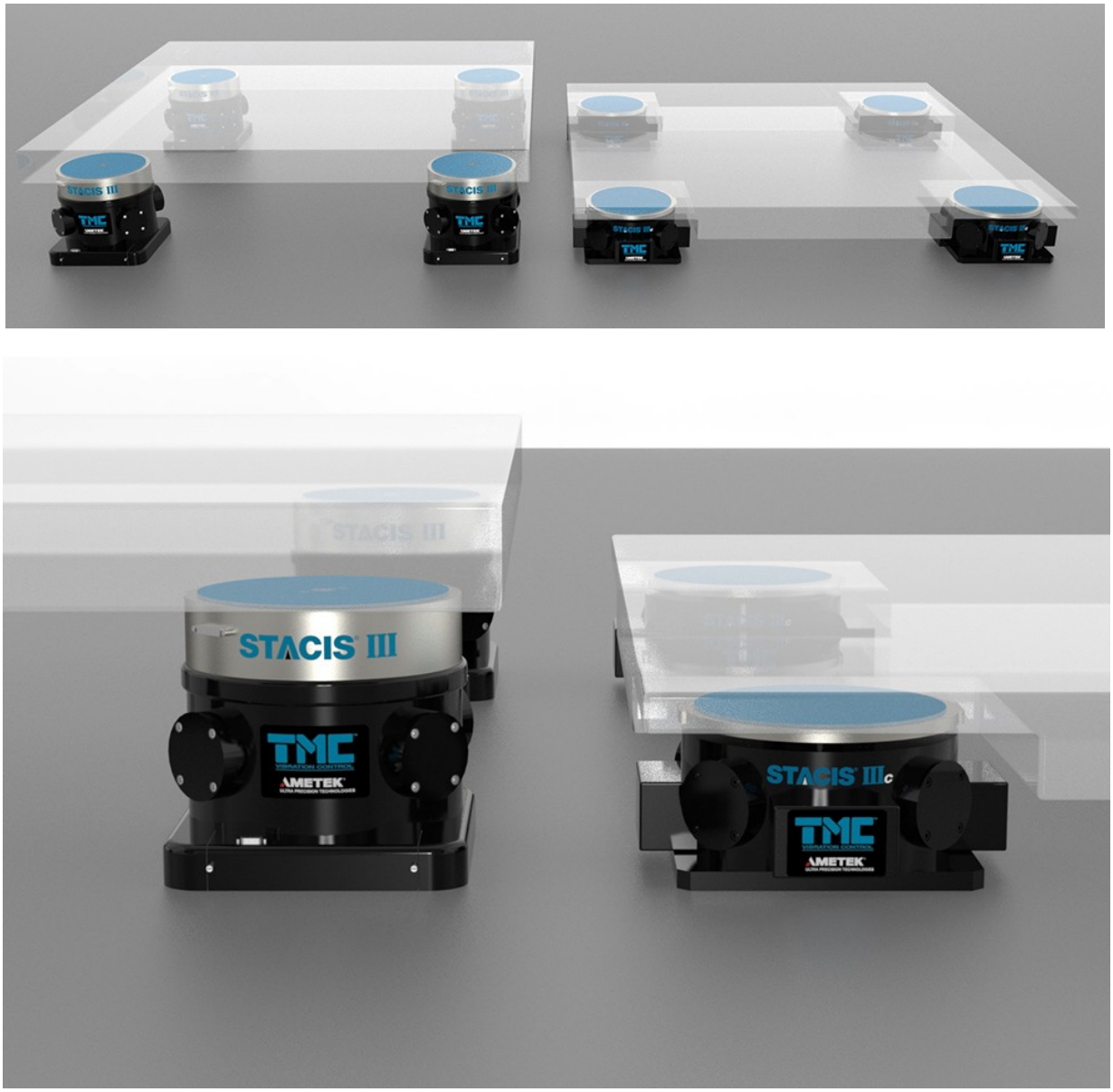

Image 6-7 The images illustrate the height comparison between the standard and Compact Quiet Island heights.