Reroofing to Reduce Noise Is Sound Choice for School Near Chicago Airport

By Todd Kuykendall

The rooftop of Ridgewood High School near Chicago is a noisy place. With an extensive reroofing project under way, two dozen workers scramble about the 120,000-sq.-ft. surface—some of them cutting out and removing the decades-old modified bitumen over polyisocyanurate roof, while others install its replacement, a highly specialized roofing system.

Soon, the construction noise will end. However, the blasting roar of engines from a steady stream of jets flying in and out of Chicago O'Hare International Airport, only four miles away, will remain.

Although Ridgewood High School has served the Chicago suburb of Norridge for over six decades, the airplane noise became a problem only a few years ago when flight patterns in and out of O'Hare changed. Due to glazing that was inadequate for sound isolation requirements, the presence of the original roof assembly, and a lack of air conditioning that occasionally requires open windows in some classrooms, the exterior envelope of the school was incapable of keeping aircraft noise out of the classrooms.

"The noise can be so bad the teachers sometimes have to stop in mid-sentence," said Arturo Benitez of DLA Architects, who is overseeing a Ridgewood High School construction project designed to keep noise from making its way into the classrooms serving Ridgewood's 900 students.

Increased flight volumes at airports across the U.S. prompted the federal government to fund a $220 million project dedicated to helping insulate high-impact facilities against sound interference.

Ridgewood qualified because octave band noise testing confirmed that measured noise levels exceeded the 45 dbA maximum acceptable level included in ANSI S12.60 for schools, LEED® for Schools 2009, and Federal Aviation Administration guidelines for Type 4 buildings (schools).

Thus, the school was included in the Chicago Department of Aviation's School Sound Insulation Program for communities surrounding O'Hare and became eligible for federal sound remediation construction funding to bring decibel levels within FAA guidelines.

After considering a variety of options, Benitez and his sound consultant, Laurie Kamper of Threshold Acoustics, determined that a roof assembly that featured alternating layers of Georgia-Pacific Gypsum's DensDeck® boards and Roxul's TopRock® DD Plus stone wool insulation would achieve the desired sound-attenuation levels.

Importantly, by changing the materials above the steel roof deck, the interior of the building's ceiling structure has remained intact, allowing for ongoing construction while classes were in session.

According to Kamper, the 2011 published results of third-party testing[1] of the assembly confirmed that the construction was ideal for the project. It was the first gypsum roof board assembly tested to contribute to sound transmission class (STC) ratings of up to 61 and outdoor/indoor transmission class (OITC) ratings of up to 49 in roofing assemblies for commercial framed construction. "The mass of the roof board, combined with the sound absorption

of the insulation in a sandwich-like configuration over the steel deck, yields the best performance in sound attenuation," Kamper explained.

STC and OITC ratings are measures of resistance of a building element (e.g., roof) to sound penetration based on different assumptions regarding the frequency content of the sound. Higher STC and OITC ratings indicate better sound resistance for the specific assumptions of the rating.

Fiberglass-mat gypsum roofing cover boards combine strength, dimensional stability, and ease of installation to enhance the performance and sustainability of roofing assemblies. The mass of the gypsum core acts as a barrier to sound transmission and has been tested to show superior sound mitigation properties. The cover boards are also noncombustible per ASTM E136, providing added fire resistance and safety to the building structure.

Stone wool insulation demonstrates superior sound reduction characteristics, as its nondirectional fiber orientation helps to trap and dissipate sound waves. The product used at Ridgewood also has a higher-density top layer, providing strong point-load resistance and effective load distribution. It also maintains a stable R-value over time and is dimensionally stable and won't shrink or off-gas blowing agents into the environment.

Combined with other sound remediation enhancements—such as enclosing the rooftop duct system and AV units; adding extensive amounts of batt insulation for interior stud walls and roof duct enclosures; adding laminated, tempered glass windows; and installing acoustically rated door systems in certain areas—the new roof at Ridgewood is already making a significant impact in the classroom.

"We were getting compliments even before we were finished with the roof," said Benitez. "The teachers say they have noticed a drastic improvement in noise levels from what they had previously."

"You can really tell a difference in the classrooms below the sections of the roof that are finished," added Kamper. "Those teachers are very happy."

REFERENCES

1. Testing of the assemblies was completed at Riverbank Acoustical Laboratories in 2011.

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Todd Kuykendall, director of product management and sustainability with Georgia-Pacific Gypsum, has nearly two decades of experience in product development and management. He is a member of SPRI, RCI, and RICOWI and is an executive board member of the Design Futures Council. Kuykendall has an MS degree in mechanical engineering from the University of Florida and an MBA from Carnegie Mellon.