



NATURAL INTERIOR DAYLIGHT

A REPORT TO ADVOCATE FOR SOCIALLY RESPONSIBLE SUSTAINABLE DEVELOPMENT

ROOFING REPAIR PROGRAM BRINGS NATURAL LIGHT INTO MASSACHUSETTS SCHOOL

ENEREF INSTITUTE EXAMINES HOW A ROOFTOP REPAIR PROGRAM WAS EMPLOYED TO BRIGHTEN A MASSACHUSETTS MIDDLE SCHOOL

The Massachusetts School Building Authority optimized a rooftop repair program with a code-compliant, energy-saving natural interior daylight system that enhanced the school building's interior environment.

While for one middle school, roof replacement was the primary objective of the project, the program provided an opportunity to significantly upgrade the existing old-style dome-shaped skylights. With 1,750 schools to manage,

I WANT TO BUILD OUR SCHOOLS FOR HOW WE ARE GOING TO TEACH OVER THE NEXT FIFTY YEARS.

JACK MCCARTHY | *Executive Director, MSBA*

the Massachusetts School Building Authority (MSBA) has an extensive and complex infrastructure that the program's executive director views as an opportunity for sustainability.

"I don't want to retrofit educational facilities for the way we taught for the past fifty years. I want to build our schools for how we are going to teach over the next fifty years," said Jack McCarthy, Executive Director, Massachusetts School Building Authority.

FUNDING OVERVIEW

Over the summer of 2014, Massachusetts' Ashland Middle School replaced their existing skylights with spectrally selective glazed skylights.

The project was funded with a combination of school district funds from the town of Ashland and funds provided by the Massachusetts School Building Authority (MSBA) Accelerated Repair Program (ARP). The MSBA created the ARP in 2010 to facilitate the replacement of aging and out-of-date roofs, windows and boilers in

Massachusetts public schools. The town funds came from a measure voted on in the spring of 2014, to fund repair/renovation at three local schools.

As part of our Natural Interior Daylight Initiative, Enerref Institute examined the opportunities created by the MSBA ARP as well as the code requirements for projects funded under the program.

Enerref Institute interviewed key project stakeholders involved in the innovative skylight retrofit at Ashland Middle School. The participants interviewed include Jack McCarthy, Executive Director, Massachusetts School Building Authority; Phillip Williams, Energy Manager, Town of Ashland; David Vivat, President, Vivat Construction Sales, Inc.; Gene Raymond, Architect, Raymond Design Associates; and Adam Toogood, Marketing Technologist, Kingspan Light + Air, Light.

FUNDING FOR CODE-COMPLIANT ROOF REPAIR PROJECTS

The Accelerated Repair Program (ARP) seeks to extend the life of

existing buildings by providing funds for energy-efficient and cost-saving upgrades that result in direct operational savings for school districts.

"When the stimulus money became available, they wanted projects that were shovel ready," said Jack McCarthy, Executive Director, MSBA, whose program retrofits about thirty roof or window replacements each year. The program can fund 31% to 80% of a project's cost, based on a formula.

"We try to determine the most needy and drew a line in the sand, if you will—not just replacing roofs that are five or ten years old," explained McCarthy. Rooftops less than twenty years old were not eligible.

Out of 107 applications from schools in the 2014-2015 school year, fifty projects were selected.

The skylights need to meet a minimum standard for efficiency to receive MSBA funds. The ARP requires skylights to meet the energy efficiency standard set by the Massachusetts Stretch Energy Code. Stretch is based on energy requirements established by the International Energy Conservation Code, 2009 (IECC 2009).

In addition to energy efficiency requirements, code requirements also dictate that



COOLLITE SKYLIGHTS

Twenty-five skylights were installed throughout the Ashland Middle School building.

classrooms incorporate natural interior daylight.

“We were familiar with what the code requires, and the specification indicates what values have to be met, and we just match them up,” said David Vivat, President, Vivat Construction. “Coollite met all these new codes at an affordable cost.”

The Kingspan Coollite skylights incorporate a proprietary coating to meet building codes nationwide, explained Vivat.

DECISION PROCESS TO INCLUDE DAYLIGHTING

“We’re all about natural light, and we will pay for skylights that meet the requirements, but that’s a decision that the architect and the district makes,” said McCarthy.

Building ownership and utility bills are the responsibility of each school district.

“There was a discussion about cost-benefit analysis, adding skylights or not adding them to our schools,” said McCarthy.

“The architects design to the education plan,” continued

McCarthy, “based on how we’re going to use the building. We struggle with that everyday because—what should a classroom look like?”

Many of the school’s older existing dome skylights had been damaged by vandalism. In the past, the Ashland Middle School facility managers had covered over the aging skylights on the roof and installed drop ceilings on the interior, underneath them.

“If you were in the school interior, you couldn’t even see that the skylights were up there,” said Phillip Williams,

THERE IS A VALID AND PREDICTABLE EFFECT OF DAYLIGHTING ON STUDENT PERFORMANCE.

A compelling statistical correlation exists between the amount of daylighting in elementary school classrooms and the positive performance of students on standardized math and reading tests according to a report by daylighting expert, Heschong Mahone Group, Inc.

Energy Manager, Town of Ashland.

“Kids were getting up there, smashing them with rocks,” said Williams. “That was definitely something we had struggled with; we put up a 25-foot fence, but the kids found another way up.”

When used in skylights, polycarbonate lenses offer excellent impact resistance while also providing good light transmission and low flammability.

Ashland made the decision to replace the skylights with new, spectrally selective glazed skylights, according to Williams.

“It was ultimately up to us,” said Energy Manager Williams. “We are part of the Massachusetts Green Community, committed to a 20% energy reduction before 2017, so we wanted to take advantage of natural light or anything where we could gain on efficiency.”

REDUCING UNWANTED HEAT FROM ENTERING THE BUILDING

To reduce heat gain, Coollite skylights incorporate a low thermal emissivity (low-e) coating that prevents infrared radiation—radiant heat—from entering the skylight, while allowing in the full visible spectrum of natural daylight.

“Coollite skylights have about 54% visible light transmittance, with a solar heat gain of 0.26 and a U-factor of 0.45,” said Adam Toogood, Kingspan Marketing Technologist. “The Coollite skylights block 85% of IR and nearly 99.9% of UV light,” said Toogood.

The portion of the new Massachusetts code specific to skylights requires a U-value of 0.45, which equates to an R-value of 2.22, and limits skylights to 3% of the roof surface area.

A thermal break (the barrier to reduce the outside air temperature from affecting the interior space) incorporated into the skylight frame further increased the skylight’s efficiency.

“These new Kingspan Coollite skylights incorporate both the thermal break and the new glazing, which meets the energy code,” said Vivat of Vivat Construction.

LESS THAN ONE PERCENT OF THE BUDGET WAS NEEDED FOR SKYLIGHTS

The budget for the Ashland Middle School reroof project was \$2.9 million; the cost for the skylights was only \$18,000. The Massachusetts School Building Authority plans to complete as many as fifty projects each year through the Accelerated Repair Program, according to McCarthy.

“We monitor the project at every phase,” McCarthy explained.

“We do a feasibility study to make sure that the design is in line with the budget, then we closely monitor at every stage to see that the cost matches the original cost that we agreed to. Then in the final audit, we look at all the dollars and check that they are spent appropriately.”



HEAT-REDUCING SKYLIGHTS

The skylights incorporate a low thermal emissivity coating that prevents heat from entering the skylight.

A SUCCESSFUL ROOFTOP SKYLIGHT INSTALLATION

Twenty-five skylights were installed throughout the Ashland Middle School building, providing natural interior daylight for the cafeterias, corridors and classrooms. The reroof was completed in just one month, over the summer. The project's crew worked extended hours, as well as Saturdays, to ensure completion before the start of the school year.

Kingspan fabricated the skylights using measurements provided by Vivat Construction, and then shipped the units

fully assembled and ready for installation. The skylights were hoisted onto the roof via crane and installed by Gibson Roof. The skylights were mounted on industry-standard structural curbs.

“The hardest part of the project is getting the material up on the roof,” said Vivat.

“I’m always in favor of using natural light when you can,” said Phillip Williams, Energy Manager, Town of Ashland. “You definitely get that feeling of daylight in the hallways and the classrooms.”

Research and reporting compiled and provided by Eneref Institute. Additional information generously provided by Massachusetts School Building Authority, the Town of Ashland, Vivat Construction Sales, Inc, Raymond Design Associates and Kingspan Light + Air, Light.



LEAD BY EXAMPLE.

THE NATURAL INTERIOR DAYLIGHT INITIATIVE IS A CAMPAIGN TO PRESERVE OUR NATURAL RESOURCES AND PROMOTE NICER LIGHTING IN OUR HOMES AND BUILDINGS.

ENEREF INSTITUTE launched the Natural Interior Daylight Initiative to champion solutions in line with our mission that deliver sound ideas to significant market influencers. The initiative is designed to encourage responsible behavior within public and private organizations, municipalities and corporations by offering common-sense solutions that achieve effective results.

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