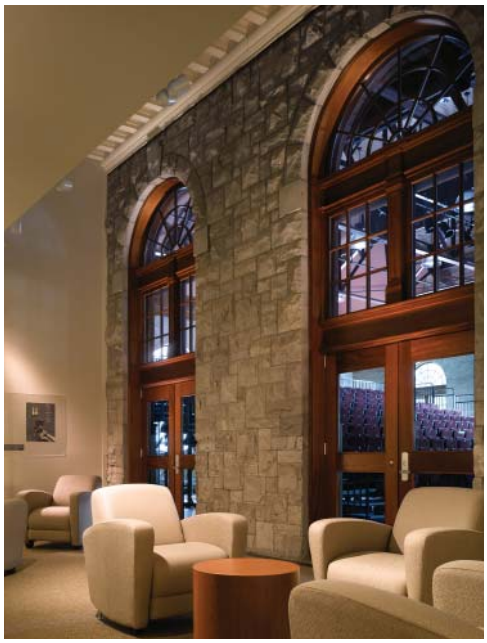


Middlebury College's McCullough Student Center is comprised of multiple elements, including the original 1911, hipped roof, large volume structure; a 1963 addition to the south, and a 1993 addition of two octagonal wings and connecting flat-roof structures. The resulting series of parts lacked a coherent sense of place and identity prior to the renovation.

The 2009 renovation sought to clarify the organization and accessibility of the building and increase the usability of the existing spaces. Upstairs, the renovation focused on returning the Social Space/Performance Hall — a grand, double-height room fronting the campus's Main Quad to the north that had been initially designed as a combination gymnasium / theatrical space — back to its original character while adding modern amenities such as an elevator and new telescoping seating.

Downstairs, the labyrinthian circulation system and disparate programmatic elements were simplified and clarified while at the same time improving accessibility to multiple levels.

Along with sustainable features such as FSC certified wood flooring and paneling, and the reuse of the existing structural steel from the removed mezzanine, a detailed analysis of the building envelope revealed significant areas of energy loss due to air infiltration, particularly in the roof above the grille attic. These were addressed as part of a comprehensive upgrade to the building envelope.

Architect: Michael Dennis & Associates

Andrew M. Brockway
Project Manager & Project Architect

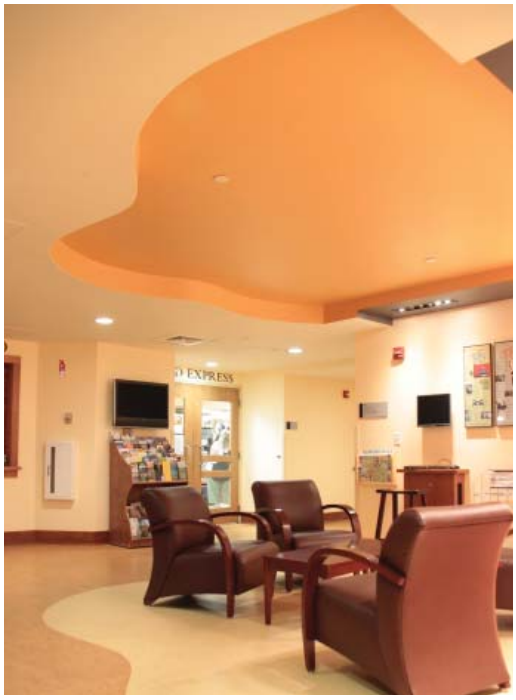
Award: Assoc. of General Contractors of Vermont
2009 Renovation of the Year

McCULLOUGH STUDENT CENTER RENOVATIONS

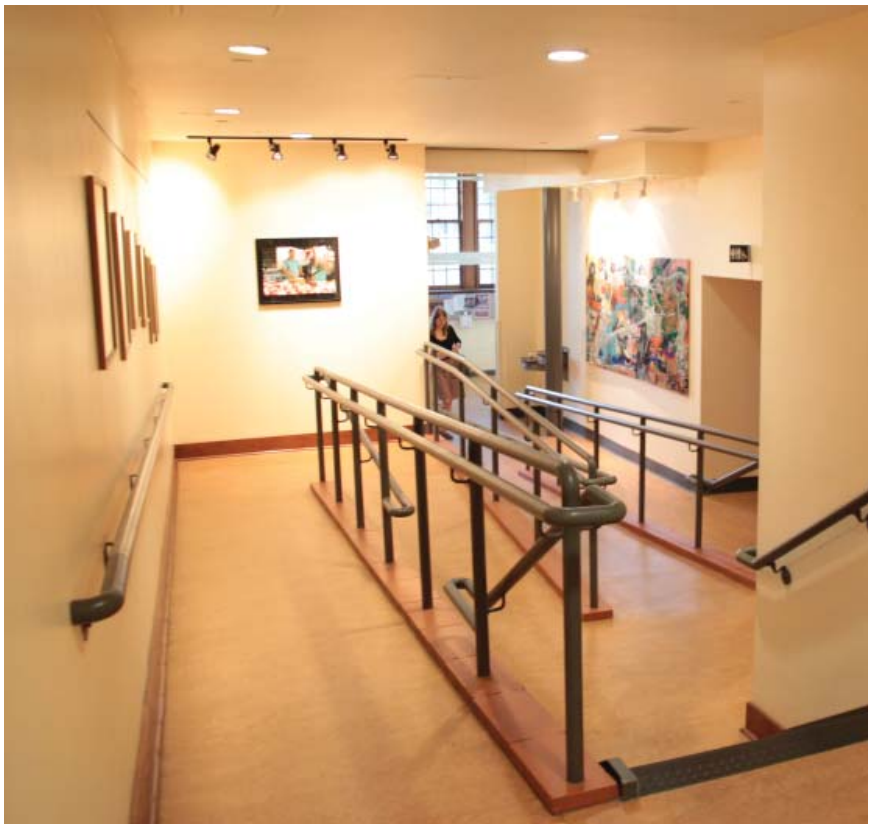
Middlebury College
Middlebury, VT

Size: *12,050 sf conditioned*
8,600 sf unconditioned

Completed: *2009*



Circulation with handicapped lift prior to renovation



Relatively inexpensive upgrades such as new flooring, new and "livelier" paint colors, and new lighting dramatically altered the feeling of the space.

"Simple" but important changes - such as removing unnecessary doors and creating a seating area directly on the circulation route - transformed a labyrinthian system of circulation into a place of gathering and exchange.

A new ramp in McCullough is integrated into the stair system dissolving the distinction between abled and disabled users. At the same time, lighting and track work is designed to support the display of art, further diminishing the "stigma" of the ramp and extending its meaning to the larger College community.

House seating with mezzanine prior to renovation

Building Envelope Energy Performance

A detailed empirical audit and analysis of the building envelope's thermal performance was conducted as part of an overall sustainable design effort. The analysis included infrared thermography to determine hot and cold spots within the envelope as well as a blower door test prior to construction to determine air infiltration rates. That data was used to write a performance specification for the envelope upgrades. A blower door test subsequent to installation ensured that the envelope upgrades met the specifications. Infrared thermography was used to detect specific remaining areas of leakage.

It is important to note that most of the energy savings comes via air infiltration reduction as opposed to an increase in the R-value of the walls and ceiling. Air infiltration is a significant factor in envelope performance and is often overlooked, or "misestimated" by energy modeling or a simple review of the drawings.

A data logger was placed in the grille attic post-occupancy. It recorded a narrow and consistent range of internal temperature and humidity in spite of the greatly varying outdoor conditions. This could not have been possible prior to the renovation.

Middlebury College McCullough Student Center Renovation
Building Envelope Upgrade

R-value Prior to Renovation

Area	R-value	Square Foot Skin Area		Weighted Average R-Value	
Grille Concrete Ceiling	14.0	8,200	assume 4" fiberglass	6.77	
Social Attic	27.3	1,449	assume 8" fiberglass	2.33	
Social Cathedral	27.3	4,500	assume 8" fiberglass	7.24	
Social Cathedral -Uninsul	1.0	1,295		0.08	
Vestibule Walls	3.5	795		0.16	
Vestibule Roof	1.0	240		0.01	
Social Wainscot	3.5	483		0.10	
Total		16,962		16.70	Sum Weighted Average

R-value After Renovation (with closed cell polyurethane foam insulation)

Area	R-value	Square Foot Skin Area	Weighted Average R-Value	
Grille Metal Roof	45	8,955	22.12	
Social Attic	45	1,953	4.82	
Social Cathedral	51	5,795	16.22	
Vestibule Walls	20.0	795	0.87	
Vestibule Roof	46.0	240	0.61	
Social Wainscot	13.5	483	0.36	
Total		18,221	45.00	Sum Weighted Average

CONDUCTION Savings

	Area in sf	R-value	U-value	HDD	Hours/day		BTUs/annual
Prior to Renovation	15,444	16.7	0.060	7554	24	=	167,704,316
After Renovation	16,703	45.00	0.022	7554	24	=	67,301,092

Annual Heating BTU Reduction: 100,403,225 BTUs

Annual Reduced #6 Oil Use: 810 Gallons

AIR LEAKAGE (per blower-door tests) Savings

	Building Leakage Rate in ACHnat	Building Volume (ft^3)	HDD	Hours/day		BTUs/annual
Prior to Renovation	0.40	688,437	7554	24	=	898,638,295
After Renovation	0.25	746,344	7554	24	=	608,891,046

Annual Heating BTU Reduction: 289,747,249 BTUs

Annual Reduced #6 Oil Use: 2,337 Gallons

TOTAL Annual Savings

Combined Conduction and Air Leakage BTUs Saved **390,150,474 BTU**

Combined Conduction and Air Leakage Gallons of #6 Oil Saved **3,146 gallons**