

2021 A4LE LEsolutions Awards

# North Middlesex Regional High School

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## **Executive Summary**

The North Middlesex Regional School District, made up of three member towns, sought to transform its educational vision to support 21st century teaching and learning techniques. Originally constructed in 1959, the North Middlesex Regional High School (NMRHS) building – with its sprawling double-loaded corridor layout, dated and failing infrastructure, and high maintenance and operational costs – was incapable of supporting next generation education.

The new NMRHS reflects the goals of key stakeholders as developed through community-based visioning and planning at the project's outset. The design is characterized by strategically located classrooms and learning environments, with an interdisciplinary floor plan configuration that enhances collaboration and communication between students and teachers across academic disciplines – a far cry from the double-loaded corridor environments of the previous facility.

The planning and design team led the all-important visioning and planning meetings, engaging with a broad range of users from across the school's community. These collaborative planning sessions involved all teachers and staff, as well as a significant number of students. The result was a plan for arranging classrooms that called for the design of two two-story flexible pods, forming interdisciplinary neighborhoods that foster program integration and authentic, collaborative learning opportunities.

Each pod includes a flexible teaching space, a large group instruction room, and transformational Science, Technology, Engineering, the Arts, and Math (STEAM) spaces. The new classrooms contain abundant natural light, making use of borrowed lights and collaboration spaces to maximize daylight and transparency. Specialty rooms use oversized doors and two-sided display cases, offering views into the rooms while showcasing students' work.





# Scope of Work & Budget

Site Size 20.2 acres

**Gross Area** 180,530 sf

Construction Cost 64,995,000

Cost per sf \$360



"The first time we let students into the new high school was to plant flowers for opening day. One of my favorite remarks was by a student who said, 'I knew we were getting a new building, but I didn't think we were getting this.' It was so inviting to students and now there are students staying after school in the commons area to do their homework. It's a beautiful building." JOAN LANDERS, FORMER SUPERINTENDENT

# School & Community Engagement

### The Community

The North Middlesex Regional School District is made up of three member towns adjacent to New Hampshire's southern border: Ashby (pop. 3,075); Pepperell (pop. 11,700); and Townsend (pop. 8,900). Part of the North Massachusetts Corridor, the area has long lagged behind the robust economy enjoyed by the rest of the state.

The school district faced deep-rooted issues with the organization and condition of the original high school facility – a sprawling, oversized junior high and high school with dated, failing systems and isolated wings and floors.

The planning process for the new school began in 2013. While the district understood the need for a new facility, most stakeholders – except for the forward-thinking Superintendent – were unaware of the key elements required for a truly 21st century school; the "future thinking" that facilitates next generation teaching and learning environments.

### The Stakeholders

The first steps involved a discussion about differentiated learning, followed by the visioning process. The planning team began a dialogue with all key stakeholders, from teachers and students to secretaries and custodians. This produced several agendas and outcomes, including:

» Differentiated Learning – Building Committee members, School Committee members, and other individuals were asked to take a Building Excellence Learning Styles Survey. We wanted key stakeholders to understand how different learning styles could impact the design of contemporary learning environments for their new school. The planning team led a discussion with participants about how varying modalities of learning could be manifested in the built environment, and how this might influence the design of classrooms and other areas of the school.



- » Visioning Process Three visioning sessions were held over a three-week period. These interactive sessions involved students, teachers, parents, committee members, first responders, town officials, and other constituents. Three overarching categories were explored: Teaching and Learning, Learning Environments and the Building, and Community Relationships with NMRHS. The agendas included:
  - Priority Goals and Guiding Principles focusing on interdisciplinary Project/ Problem Based Learning; Social Emotional Learning, Universal Design for Learning, the JOY of Learning, STEM & STEAM, and Sustainability.
  - 21st Century Design Patterns an exploration of nationwide trends in curriculum-responsive spaces, adjacencies, and design opportunities.

The resulting vision informed the new school layout and its focus on community-building and interdisciplinary knowledge sharing. The intent was to encourage interdisciplinary project/problem-based learning and STEM & STEAM functionalities in a project driven by sustainability.

#### Value of Project to Community at Large

Moving away from the poor learning environment that characterized the old school, the new NMRHS pushes the limits of what a typical high school education offers. The school fully accommodates the community's future needs, such as the potential for student population growth and a shift of educational delivery. It also provides students with facilities for heightened engagement and collaboration. New curricula have been (and continue to be) developed based on the opportunities the building provides. The flexible learning environments and podbased adjacencies both accommodate and enhance changing pedagogies and student behaviors.



## Challenges

At first glance the site appears expansive. However, the challenge of building near the existing structure while respecting the rural setback zones and protecting play fields and wetlands required careful consideration of the site.



## **Educational Environment**

#### **Educational Vision and Goals**

The three visioning sessions with stakeholders produced multiple priorities for the project. These included:

- » 21st century and next generation skills overlaid on the core curriculum
- » Student-centric learning environments
- » Flexibility and choices in learning what, where, and how impacting students' agency
- » Integration of technology, STEM, and the arts (STEAM)
- » Interdisciplinary teacher planning spaces that facilitate a collaborative curriculum
- » Co-location of classes to allow for integrated and applied learning, as well as collaboration
- » A safe, energy efficient, technologically adaptive design that supports the future needs of students, staff, and citizens
- » A school building that fits in with the appearance and architecture of the three towns
- » Enhancement of the towns' social infrastructure by incorporating public and academic spaces that can be used for public networking and community activities
- » A library/media center that accommodates both the existing collection and the transition to media-based literature
- » Exterior learning environments, including classrooms and gardens
- » The joy of learning



## An Aging Facility

The pre-existing school was a sprawling, oversized junior high and high school building with dated, failing systems and isolated wings and floors.

#### EXISTING ENVIRONMENT





### Supporting the Curriculum

The planning and design team developed a design that facilitates next generation learning. It replaces the old double-loaded classroom wings with academic "pod" layouts, including Large Group Instruction (LGI) areas and STEAM programs. Music and Arts sit adjacent to academic programs that help support theater functions. Interdisciplinary classroom pods are organized to provide smaller learning communities. Additionally, all classrooms provide four teaching walls to allow multiple zones for peer-to-peer work and flexible, ergonomic furniture.

The school harnesses 3:1 user technology, with all learning environments designed to an average 35 dBA in background noise level. Other areas feature operable glass walls that allow for reconfiguration of spaces for circulation, gathering, and teaching areas.

Other new features include:

- » Two-sided student display cases that showcase exciting programs taking place within classrooms, labs, and specialty spaces
- » Areas where the building and site acts as a teaching opportunity in of itself – "The Third Teacher"
- » A drop-down screen and projection system in the Commons for learning, announcements, or other purposes
- » A raised-bed garden for growing food to be donated to the local food bank





#### FIRST FLOOR

- 1 Administration
- 2 Student Dining Commons with Stair & Stage
- 3 Small Commons w/ Operable glazed wall – Large Group
- 4 Gymnasium, Dance & Fitness
- 5 Humanities, Arts, and Sciences Classroom Pod
- 6 STEAM Pod
- 7 Project Based Learning & Maker Spaces

- 8 Covered Outdoor Classrooms
- 9 Outdoor Dining and Community Service Gardens
- 10 Teacher Planning
- 11 TV Studio and Lab
- 12 600 Seat Auditorium Fine Arts & Music Suite
- 13 School Store



#### SECOND FLOOR

- 1 Student Dining Commons with Stair & Stage Below
- 2 Small Commons w/ Operable glazed wall– Large Group Below
- 3 Gymnasium, Dance & Fitness Below
- 4 Humanities, Arts, and Sciences Classroom Pod
- 5 STEAM Pod

- 6 Science Labs
- 7 Project Based Learning & Maker Spaces Below
- 8 Teacher Planning
- 9 600 Seat Auditorium
  - Fine Arts & Music Suite below
- 10 Media Center

#### **Configured for Collaboration**

On the second floor, a glassy open media center overlooks the Commons. Science labs are centered between two academic pods, rather than being isolated or associated solely with traditional STEM programs. This allows ethics and environmental advocacy values to connect with the broader humanities.



## **Planning Module**



A building section showing how programs connect both vertically and horizontally. Ample circulation breakout areas allow for student-centric and collaborative work to happen spontaneously throughout the school.

#### ORIGINAL SCHOOL



### **Daylighting Strategies**

The design brings abundant daylight deep into the two-story pod, making the space welcoming and functional. The use of top lighting with clerestories and borrowed light is an effective and efficient solution.





### Project/Problem Based Learning

Learning environments are arranged in two flexible pods, each across two floors. This creates interchangeable classroom neighborhoods that help to foster program integration and interdisciplinary learning opportunities. The Humanities Pod brings fine arts and performing arts into a single neighborhood, while the STEM Pod houses the technical arts: a TV studio, robotics lab, and physics and chemistry labs that expand on traditional STEM programming. Science labs are distributed across all four pods.

Specialty rooms feature oversized doors and two-sided display cases. These display cases provide a window into the life and activity of each learning environment, showcasing students' wares and accomplishments and inviting students to sign up for the next semester of handson learning and joy.















#### A Place for Gathering

On the first floor, three public spaces provide the school and town community with venues for gatherings, dining, performances, and recreation. These spaces are the communal heart of the school community. The student dining commons, auditorium, and gymnasium are linked openly and share visual connections to the main entrance, library and learning commons, and learning pod. The open central stair and seating is used throughout the day as an important social space. Each of these spaces can double as a learning environment.

The dining commons is inherently flexible. Its smaller café and quiet dining area, separable by a folding glass wall, can be used as an additional large group instruction space; an intimate dining area for functions; or as a refuge for students more wary of larger spaces and crowds.

These community gathering spaces serve in traditional ways for performances, large meetings, celebratory functions, and evening and weekend recreation. Along with the school building itself, these spaces help bolster community focus, identity, and pride.





#### Large Group Instruction

Accommodating up to 200 people, this open and transparent teaching space fosters interdisciplinary learning and collaboration. The space often hosts multiple classes at a time for activities and guest speakers. It is also set up like an art gallery, intended to showcase students' work. The room's overlooks can be automatically screened when darkening or privacy is needed. The space is also in high-demand for use by the greater community.

#### Multipurpose by Design

Student voices contributed to the design during the visioning and programming phases. As a result, the building's circulation is designed to offer informal learning environments as well as several spaces for students' social gatherings. These spaces contribute to the flexible nature of the student-centric, active learning environments in each pod.

Skylights in the circulation areas provide natural light to the two-story Large Group Instruction space, as well as the STEAM and Fabrication Labs below, while enlivening the circulation itself.





**ORIGINAL SCHOOL** 



#### Arts at the Heart

This new 600-seat venue is acoustically optimized for musical performance, theater, and the spoken word. The theater includes a full fly stage to serve the school's popular and award- winning music and theater programs. It also serves as a public amenity for the district communities.









## Physical Environment

#### **Expression through Materiality**

The new school physically expresses the goals and aspirations of the three district communities. Highquality materials, such as granite and porcelain wall panels, serve to illustrate the towns' long-term investment. Meanwhile, a continuous plinth of darker, textured brick and a granite water table inspired by local stone walls helps to situate the building in its rural landscape.













#### Mirroring the Landscape

The civic importance of the community use spaces is reflected in their dramatic roof forms, which imitate the foothills of the nearby Monadnock Range. The roof designs add volume to reflect the daylighting and acoustical properties that support their use.

#### **Rural Roots**

Five distinct outdoor learning classrooms are strategically located around the school. NMRHS remains rooted in both an active farming community and the natural environment. Families have a strong affinity with the outdoors, and the building seeks to not only bring the outside in but to extend the learning environment outward.





#### **Charitable Hearts**

In addition to the four outdoor classrooms, the new school has a vegetable garden and aquatic hydroponic pool and greenhouse for use by the school's active service club. These students donate over 10,000 lbs of food every year to local shelters. In the previous school, the program was secluded in an out-of-the-way courtyard. Now it is clearly visible from the student dining commons and more closely aligned with the sciences and STEAM programs. This important location celebrates the students' contribution to their communities and has significantly increased student interest and participation.





# **Results of the Process and Project**

### **Community Goals Met and Exceeded**

The district saw an increase in the number of returning choice-out students as a result of the new school's opening. The community visioning and planning processes had brought together the three communities to develop ambitious goals that sought to create far more than just a replacement high school:

**Embrace an educational future** that understands how individuals learn and how education is continually evolving. The new building accommodates students' wide-ranging educational goals and helps to greatly enhance the learning process for all.

Achieve equity and access for all members of the school community:

- » The variety of learning environments allow for differentiated and personalized learning that enhances opportunities for curricular Universal Design or Learning (UDL)
- » The three communities share in after-hours use of the building for educational, social, and civic activities

**Be fiscally responsible** to the three communities with a school that is built to lasts and runs efficiently, with a focus on sustainability and resilience

**Design a building** that is significantly influenced by student and teacher voices. Further details include:

- » Right-sizing the physical plant to meet the school population both as a financial benefit and a culture-building aspect
- » A cost-effective design that meets the stringent performance goals stipulated by the three communities.



## **Sustainability and Wellness**

The project had three core sustainability goals in mind:

- » Achieve an advanced standard of energy efficiency
- » Provide students with a healthy 21st century educational facility in all aspects
- » Foster environmental literacy

#### **LEED** Certification

North Middlesex Regional High School was awarded LEEDv3 2009 Gold Certification (63 points), achieved in part through the designers' expertise in sustainable design, as well as through a collaborative approach with the towns' constituents.

1	NORTH MI	DDLESEX HS	
	181,000 sf	Carbon Reduction	29.9%
		Incremental Costs	0.5 %
		Payback	2.9 yrs
	Solar PVs	Solar Photovoltaics	400kw-ppa
	LEED Gold	EUI(kBtu/sf)	42.8



#### **LEED** Certification Review Report

This report contains the results of the technical review of an application for LEED® certification submitted for the specified project. LEED certification is an official recognition that a project complex with the requirements prescribed within the LEED rating systems as created and maintained by the U.S. Green Building Council® (USGBC®). The LEED certification program is administered by Green Business Certification Inc. (GBCI®).

#### North Middlesex Regional High School



 Project ID
 1000042708

 Rating system & version
 LEED FOR SCHOOLS

 Project registration date
 05/27/2014

Construction Final Review Decision CERTIFIED: 40-49, SILVER: 50-59, GOLD: 60-79, PLATINUM: 80+

#### LEED 2009 SCHOOLS

ATTEMPTED: 72, DENIED: 1, PENDING: 8, AWARDED: 63 OF 110 POINTS

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Sp2 Environmental Site Assessment	0/1	MRc1.1Building Reuse, Maintain Existing Walls, Floors and Root MBr1.2Building Reuse, Maintain EXisting Walls, Floors and Root	0/
Sc1 Site Selection	0/1	MRc1.25040419 Redse, Maritan 50% of Interior RolP50 octoral Elements	2
Sc2 Development Density and Community Connectivity	1/1	MRc2 Construction Waste Hight	2/
Sc3 Drowniego Receverophient	1/1	MRc5 Materials Reuse	2
Sc4.2 Alternative Transportation Ricycle Storage and Changing Room	0/4	MRC4 Recycled Content	2/
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Sc4.3 Arternative transportation Edw-Enricting and rue-Enriclent Venil	2/2	MRco Rapidly Relevable Materials	1
Sc4.4 Arternative transportation Parking Capacity	2/2	MRC7 Certified Wood	1.
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Sc5.2 Site Development-Maximize Open Space	1/1	INDOOR ENVIRONMENTAL QUALITY 1	2 OF 1
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Sco.2 Stormwater Design Quality Control	1/1	IEQp2 Environmental Tobacco Smoke (ETS) Control	
SC/.1Heat Island Effect, Non-Root	0/1	IEOp3 Minimum Acoustical Performance	
Sc7.2Heat Island Effect-Roof	1/1	IEOc1 Outdoor Air Delivery Monitoring	1.
SCB Light Pollution Reduction	1/1	IEOc2 Increased Ventilation	0,
SC9 Site Master Plan	0/1	IEQc3.1Construction IAQ Mgmt Plan-During Construction	1.
Sc10 Joint Use of Facilities	1/1	EQc3.2Construction IAQ Mgmt Plan-Before Occupancy	0.
		EQc4 Low-Emitting Materials	4
VATER EFFICIENCY	8 OF 11	EOc5 Indoor Chemical and Pollutant Source Control	1
WEp1 Water Use Reduction-20% Reduction	Y	EOc6.1Controllability of Systems-Lighting	1
WEc1 Water Efficient Landscaping	4/4	EOc6.2Controllability of Systems-Thermal Comfort	0
WEc2 Innovative Wastewater Technologies	0/2	EOc7 1Thermal Comfort-Design	1
WEc3 Water Use Reduction	3/4	EOc7.2Thermal Comfort-Verification	1
WEc4 Process Water Use Reduction	1/1	EOc8.1Daylight and Views-Daylight	0
		EOc8.2Daylight and Views-Views	0
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NERGT AND ATMOSPHERE	17 OF 33	EQc10 Mold Prevention	1
Ap1 Fundamental Commissioning of the Building Energy Systems	Ŷ		
Ap2 Minimum Energy Performance	Ŷ		
Ap3 Fundamental Refrigerant Mgmt	Y	C INNOVATION IN DESIGN	5 01
Ac1 Optimize Energy Performance	14/19	<ul> <li>IDc1.1 Innovation: Green cleaning policy/program</li> </ul>	1
Acz On-Site Renewable Energy	0/7	IDc1.1 Innovation in Design	
Ac3 Enhanced Commissioning	2/2	IDCL2 IDCL2: Suscainable Purchasing - Reduced Mercury (Hg) in Lamps	1
Ac4 Enhanced Refrigerant Mgmt	0/1	IDc1 2 Exemplant Reformance: SSc5 2:Site Development Maximize Open	1
Ac5 Measurement and Verification	1/2	Space	
		IDc1 3 Innovation in Decian	
Ac6 Green Power	0/2	DCLD IIIIOVOUOIIIII DCDIMI	0
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#### **Energy Efficiency**

The project achieved an energy performance exceeding the LEED baseline by 39% – equivalent to 14 LEED points. Several key design elements were used to maximize energy efficiency. These include a well-insulated building enclosure (with a 25% window-to-wall ratio), efficient HVAC equipment with heat recovery and advanced HVAC controls such as CO2 sensors, and efficient LED lighting and control systems for optimizing occupancy and daylighting controls. The roof utilizes a light-colored, highly reflective membrane to reduce heat island effect, as well as a 400 kW Solar Photovoltaic system that produces enough energy to operate up to 9,000 laptop computers. NMRHS's predicted energy use is 43 kBtu per square foot per year – equivalent to 30% operational carbon reduction over the MA Energy Code. These advanced energy performance milestones were achieved with minimal incremental costs of 0.5% and a payback of just 2.5 years.

#### **Durable and Green Materials**

The exterior materials were carefully chosen for their low maintenance, high durability, and long-life qualities. The exterior wall finishes are formed of a mix of Norman brick veneer, composite metal panel, formed metal panels, and porcelain tile rainscreen. The wall assemblies boast continuous insulation, which improves thermal performance throughout the whole building.

The interior design uses low-VOC (volatile organic compound) materials that offer a high level of resilience. This helps to address the health of occupants while ensuring a sustainably responsible school.

Areas subject to potential abuse, such as mechanical, custodial, and storage rooms, feature robust concrete masonry unit walls. High-traffic spaces also feature durable flooring and wall finishes: Stone and brick walls in the lobby, porcelain tile flooring in the cafeteria, and porcelain tile walls in the corridors and stairs. In student-occupied areas, the interior partitions consist of metal stud-framed walls sheathed with gypsum board and finished with a locationspecific material.





#### Healthy and Environmental Aspects

Ensuring the wellbeing of NMRHS's occupants – students, staff, and visitors – was a key part of the design and construction. As such, every classroom and learning space offers optimal daylight, access to views, and control of thermal comfort thanks to features such as operable windows, interior window shades, and individual temperature and lighting controls.

The construction phase followed a bespoke Indoor Air Quality Plan to minimize contamination and optimize materials, protection from the elements, and air quality. The building's ventilation was designed with a displacement ventilation system to greatly improve both indoor air quality and acoustics. The site design features several outdoor learning areas and a student garden that hosts a local program to help the community by providing fresh organic produce. These design elements, as well as many of the sustainable design features, help to enhance both the students' and the community's environmental literacy.