

Story of a School Building Renovation

Bartlett High School

Webster, Massachusetts

Webster Public Schools

Massachusetts School Building Authority
Funding Affordable, Sustainable, and Efficient Schools in Partnership with Local Communities

MCPPO
Excellence in Public Procurement

FLANSBURGH

Webster Public Schools

Superintendent Ruthann Goguen, Ed. D.

Educational Vision

Nature



Culture







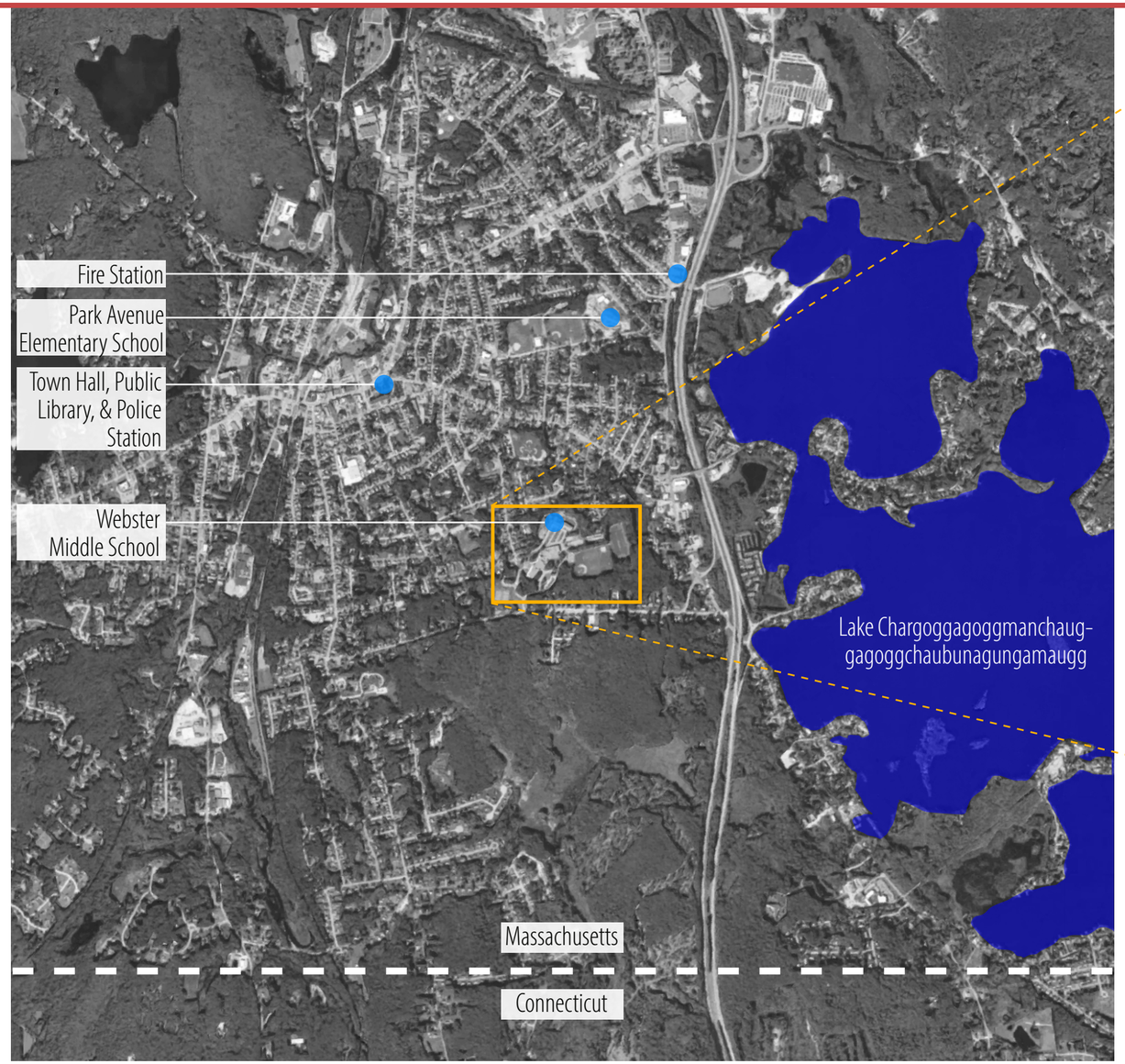


Heritage

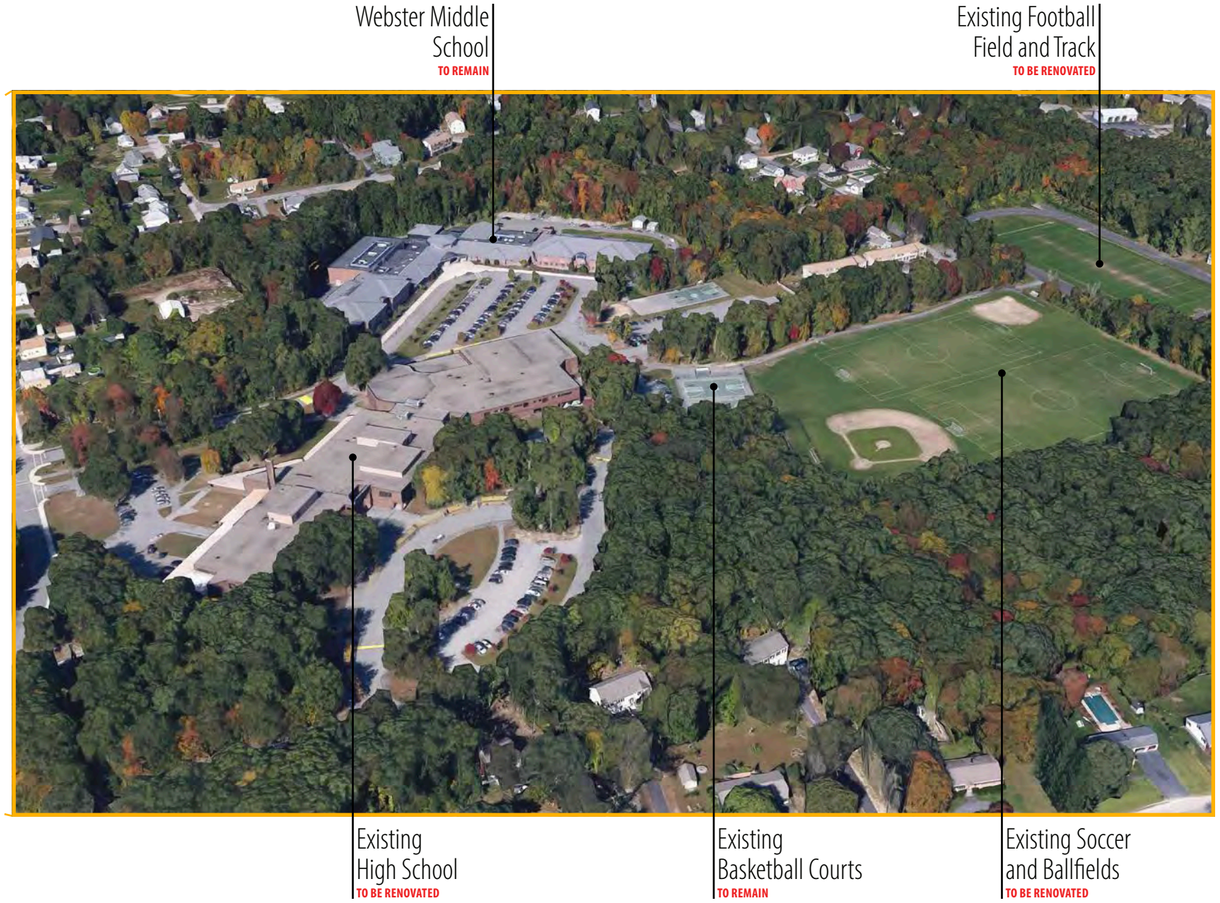




Educational Vision

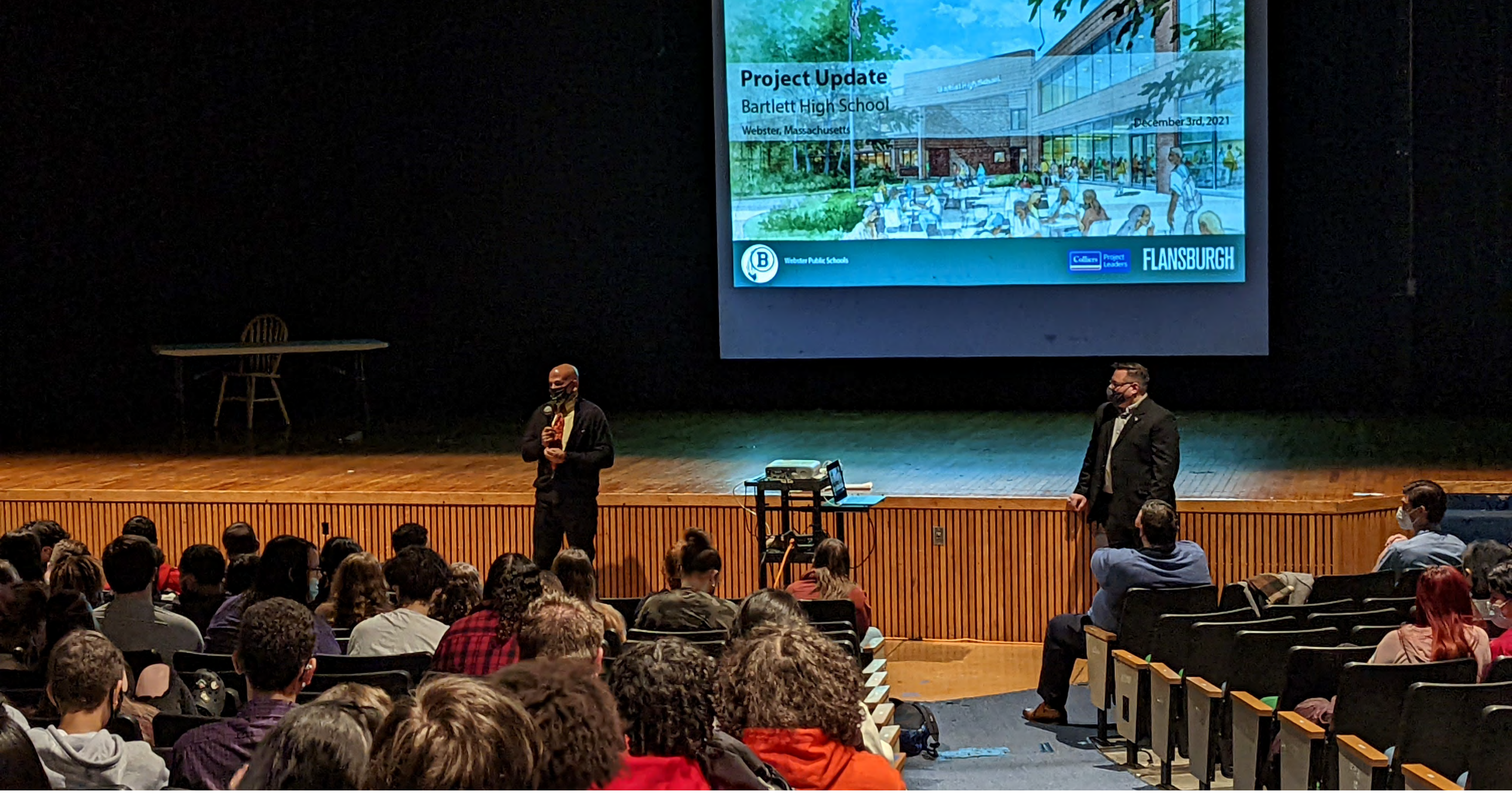


Site in Webster



The Bartlett High school shares a campus with the Webster Middle School to the north, which has its own designated parking lot and bus drop-off loop. The site is bounded to the north, south, east and west by single and multi-family residential properties. The school complex is surrounded by a matrix of native canopy trees, primarily mixed Oak, Maple, and White Pine. It appears at the time of the school's construction; large areas of existing woodland were preserved during construction. These areas of woodland enhance the character of the campus, shade the building, and should be preserved.

Enlarged Site View


Project Update
Bartlett High School
Webster, Massachusetts
December 3rd, 2021
Webster Public Schools
Colliers Project Leaders
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Educational Vision

Our Vision for Educational Programming

Expansion of K-12 Programming ensures cohesiveness and alignment for student opportunities across the district.

- Emphasis on College and Career Readiness
- Moving away from a traditional high school model:
    - Innovation Pathways: Advanced Manufacturing & Healthcare and Human Assistance
- Expanding existing programs to provide students more hands-on and relevant learning experiences that they can build upon:
    - Dual Enrollment
    - Internships
    - Industry Credentialing
    - Project Lead the Way
    - Courses designed in collaboration with industry partners

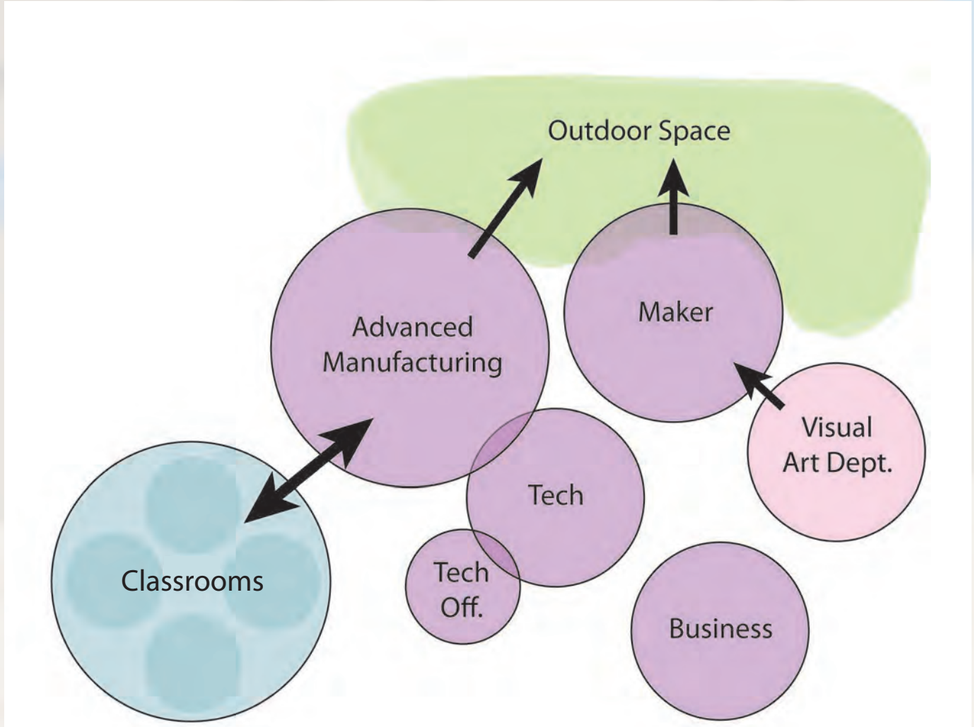


Educational Vision

Why We Need To Change Programming

- Education has changed
- Students have changed
- Job market has changed

- Students need industry experience prior to graduation in order to enter the workforce and earn a living wage.
- The traditional high school model of preparing students for the college experience is outdated.
- About 25% of BHS students go directly into the workforce and most do not go into high wage jobs.
- College costs are significant, and knowing your area of interest will maximize tuition dollars spent.
- If we change our programming, we will improve our student retention.



Innovation Cluster

Educational Vision

Teacher Planning and Development

- The district has updated curriculum and instructional materials with the most up to date resources and continues to provide ongoing support and professional development.
- The district is in the process of a Literacy Reset.
- Bartlett has redesigned all English courses.
- Bartlett was recently awarded the GLEAM grant (6-12).
- Bartlett has hired Literacy Coaches to provide adolescent literacy support to teachers.
- Statewide System of Support provides an additional layer of assistance.
- Bartlett teachers have a common planning period by department.

This Renovation Provides the Opportunity To:

- Maximize the effectiveness of ongoing curriculum enhancements and professional teacher development through the creation of proposed "Classroom Neighborhoods."
- Support more teacher collaboration by providing the learning spaces they need to create more project-based learning and interdisciplinary lessons, as well was examine student work and calibrate assessments.

Educational Vision

Teacher Planning and Development

Changes in our educational programming are already well underway:

- Teachers are enrolled in the Project Lead the Way Academies.
- We have budgeted for curriculum development with industry partners.
- We have hired an Innovation Pathways Project Manager.
- High quality professional development is focused on:
  - Ensuring equitable access to all students
  - College and career readiness
  - Using researched based curriculum resources
  - Using data to inform instructional practices



Educational Vision

Special Education Programming

Early childhood programming:

- Inclusive early learning opportunities for children ages 3-5
- Substantially separate programming for intensive special needs students
- Treatment area for related service providers and outside play/learning space
- Internship and training opportunities for high school students

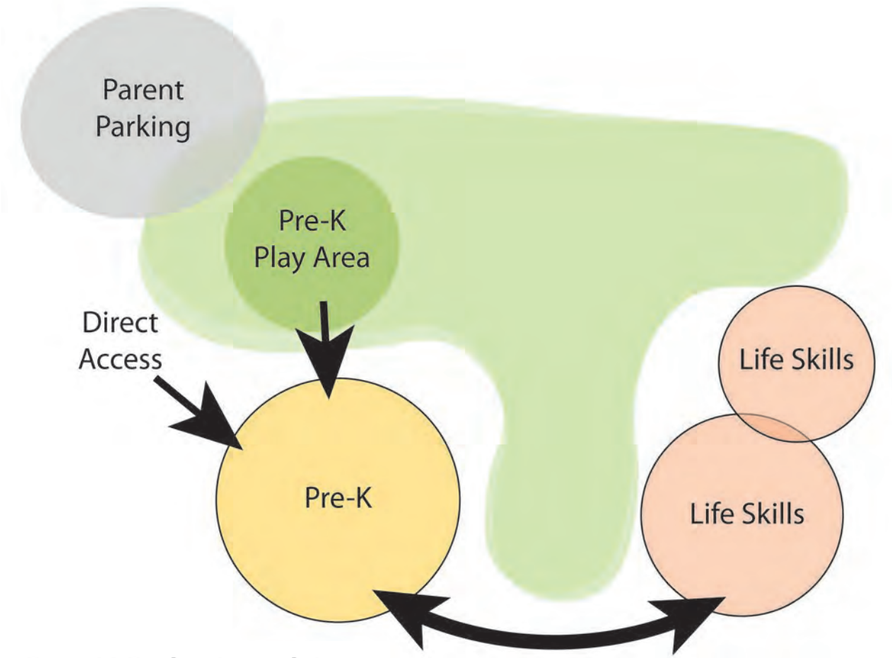
The district's commitment to maintaining students in their "home" school by providing specialized "in-house" programming:

- Post graduate vocational programming (18-22)
- Life Skills
- Quest (social-emotional / drop-out prevention)
- Resource Rooms and Academic Support Labs

Webster has different needs than the State Average:

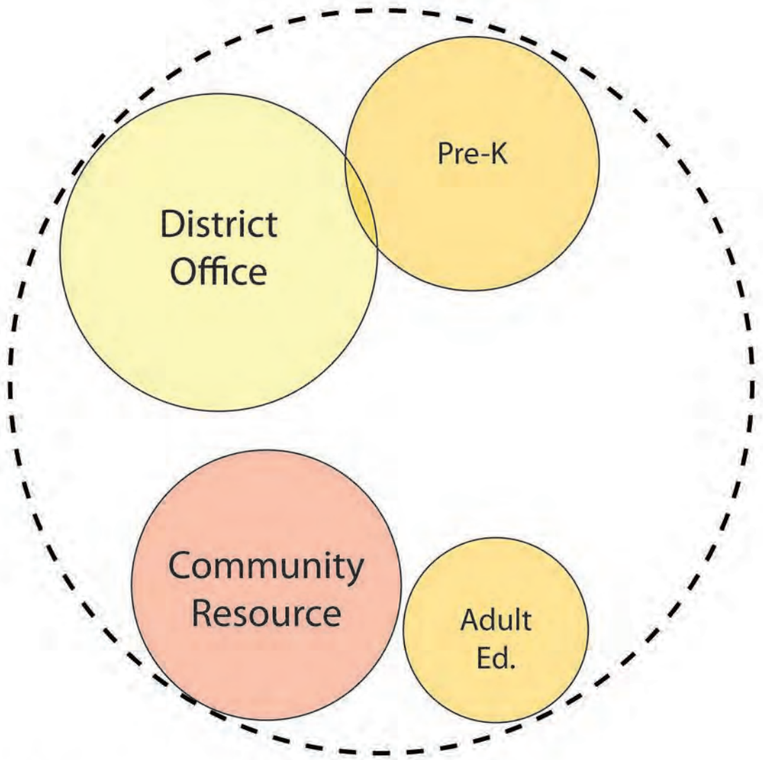
	% of District	% of State
First Language not English	16.2	23.4
English Language Learner	10.8	10.5
Students With Disabilities	22.8	18.7
High Needs	71.4	51.0
Economically Disadvantaged	62.4	36.6

Selected Population (2020-21)



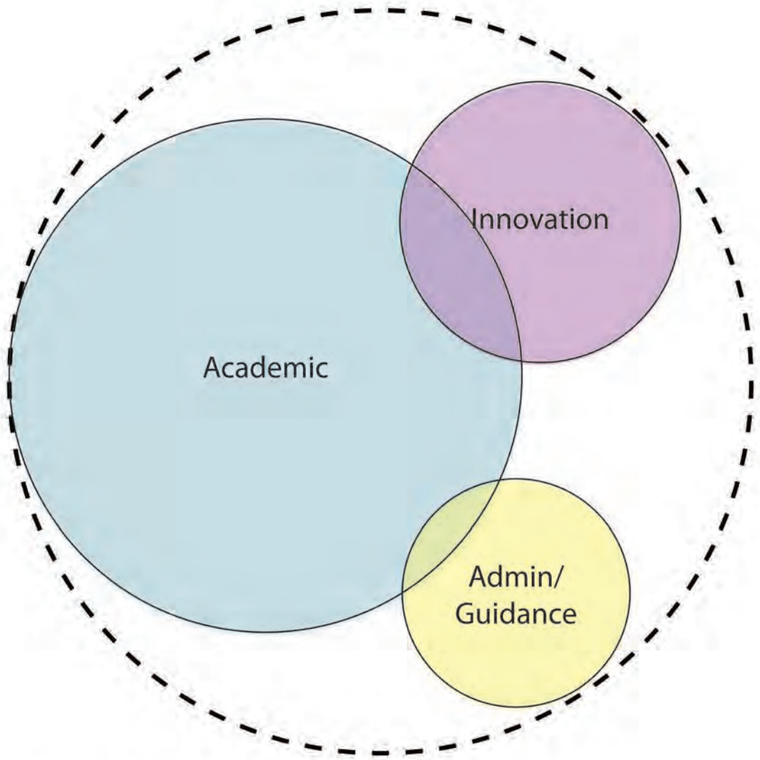
Pre-K Relationships

Educational Vision



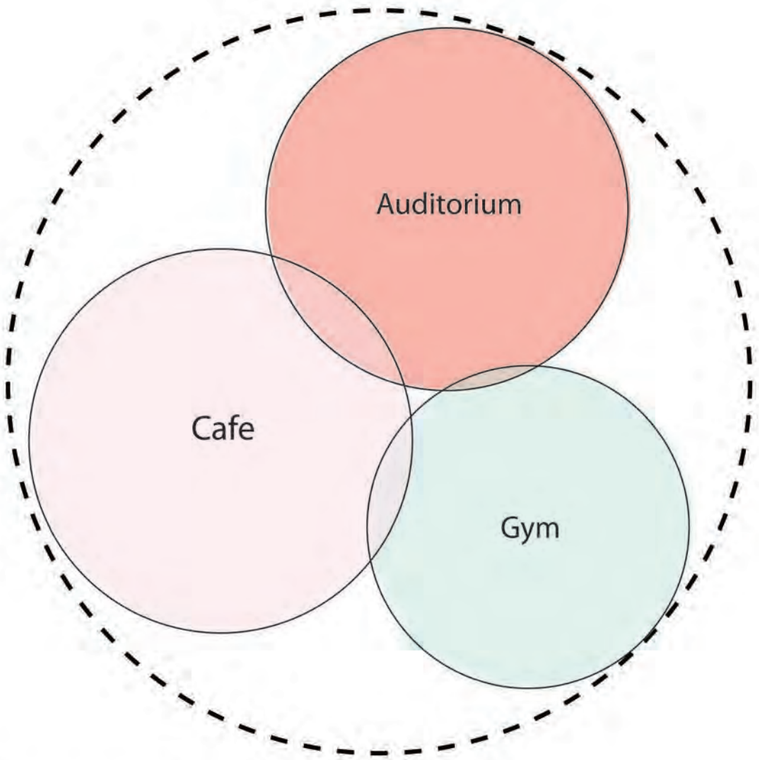
District

The district office and other additional program will be located near one another. This allows for a separate entrance for the community with ease of access to these programs.



Academic

The core academic spaces include dedicated instructional spaces, break-out spaces and special education space. The academic wing will be in close proximity to the administration and guidance while also maintaining a close relationship with innovation spaces.



Community

The community wing will cluster the auditorium, cafeteria and gym. This allows for a central community space that can remain separate from the rest of the school

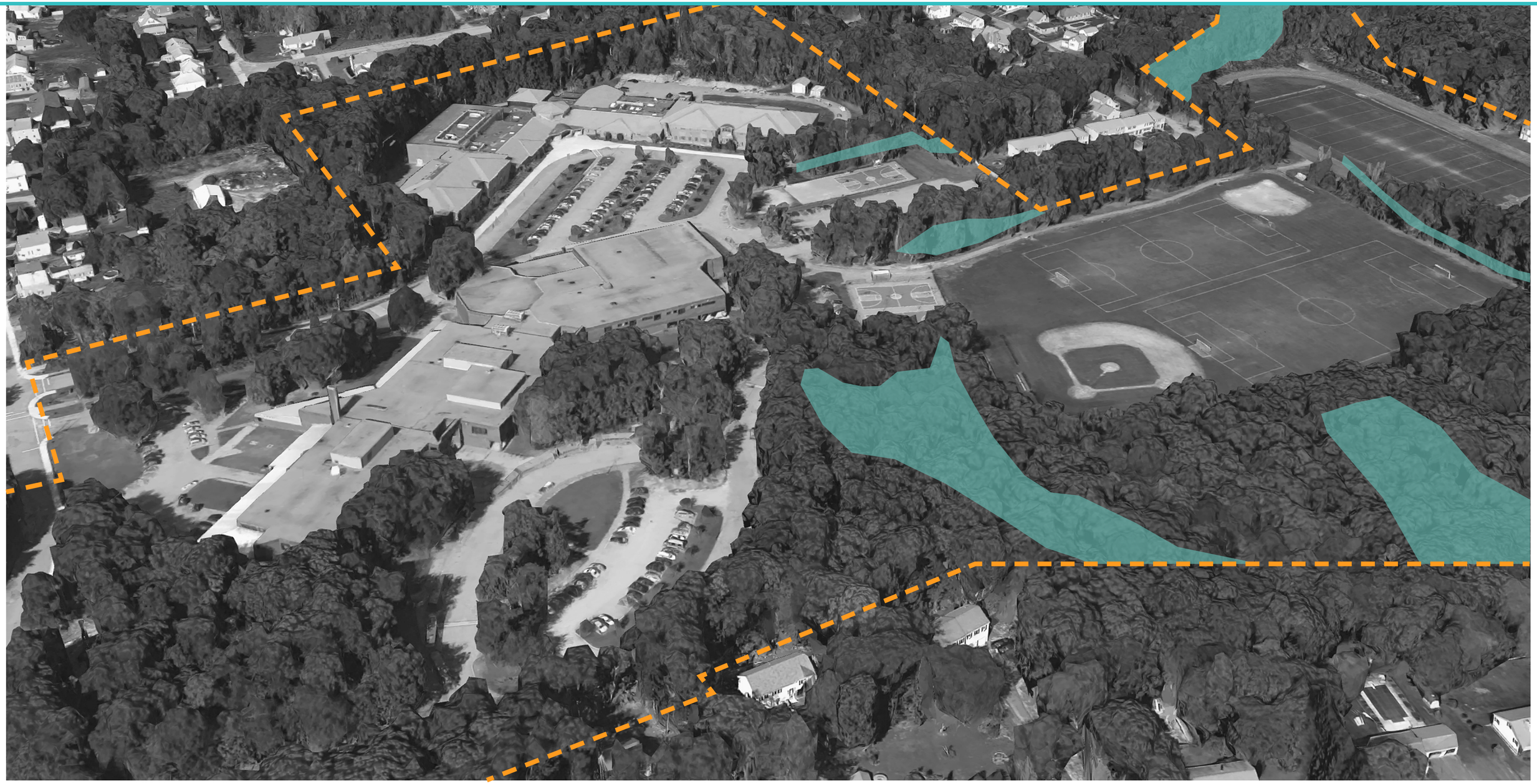
Flansburgh

Kent Kovacs, Vice President, AIA, LEED AP

Design Strategies



Design Strategies



Design Strategies

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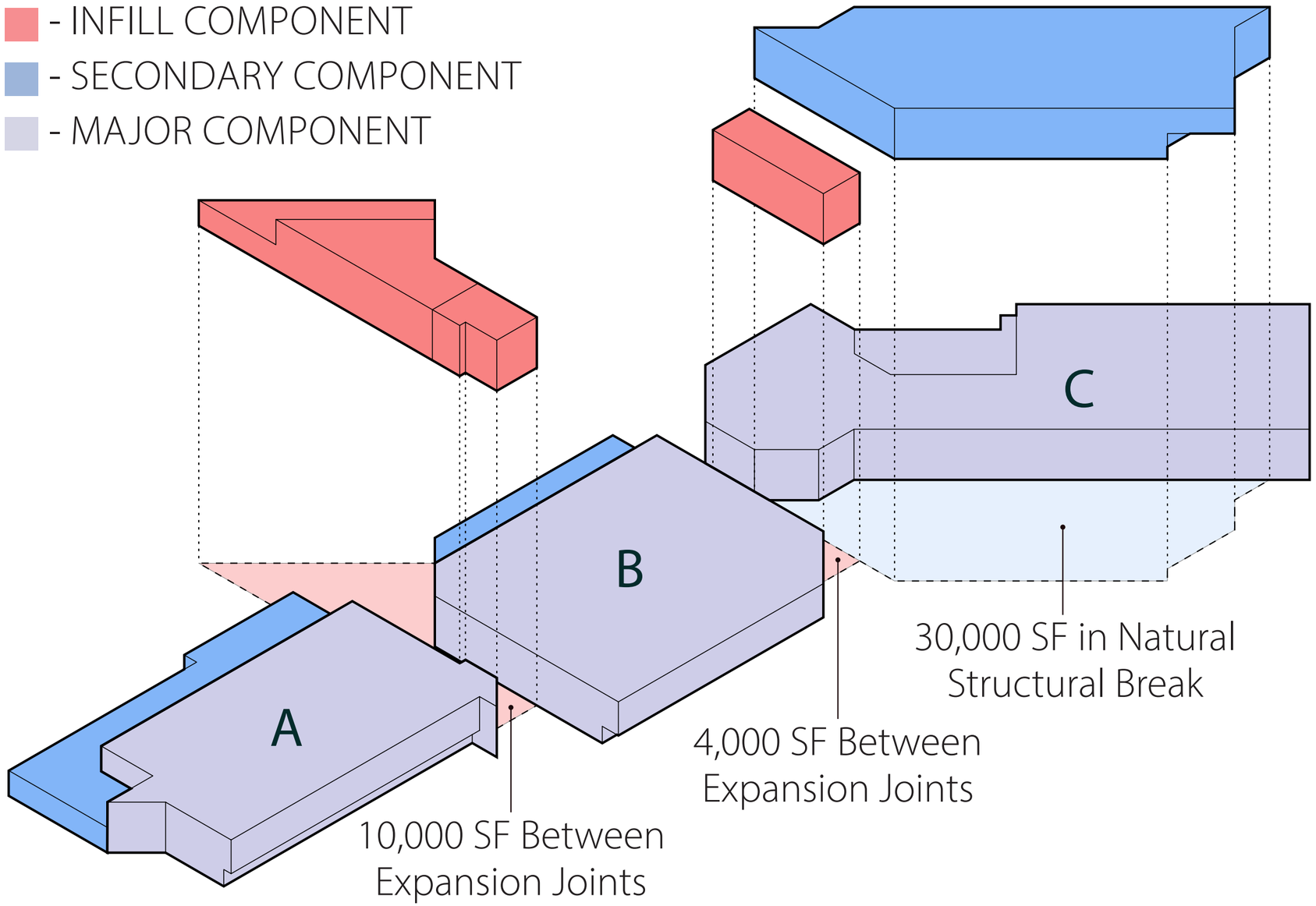


Overly Large Cafeteria



Land Locked Classrooms

Design Strategies



Benefits of Existing Structure

- The structure is steel framed and the typical lateral load resisting system is concentric braced frames. It is easier to modify the steel framed structure for the proposed renovations and reinforce the lateral load resisting system to resist seismic loads even though it was not originally designed to resist seismic loads.

- The existing foundations are shallow reinforced concrete footings and walls and it is easier to replace column footings or underpin these foundations if required.

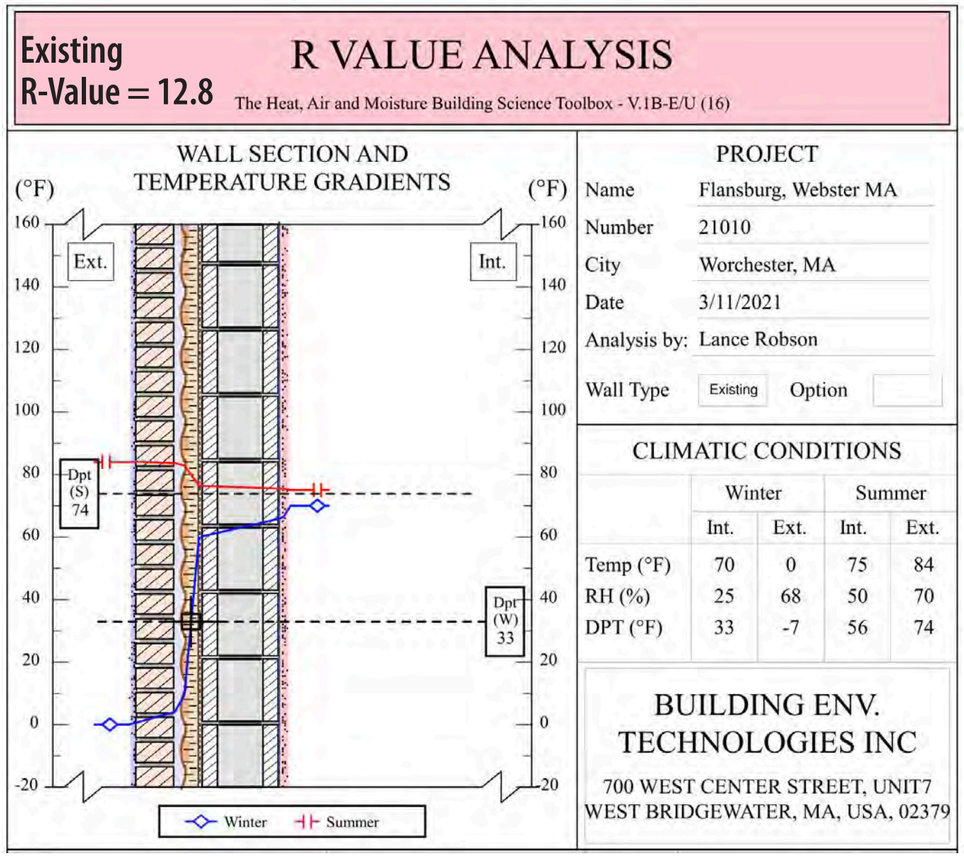
- Exterior wall and column foundations are lower than 4’-0” feet from existing finish grade at the proposed cafeteria location thus the existing slab on grade can be lowered without impacting the exterior wall foundations.

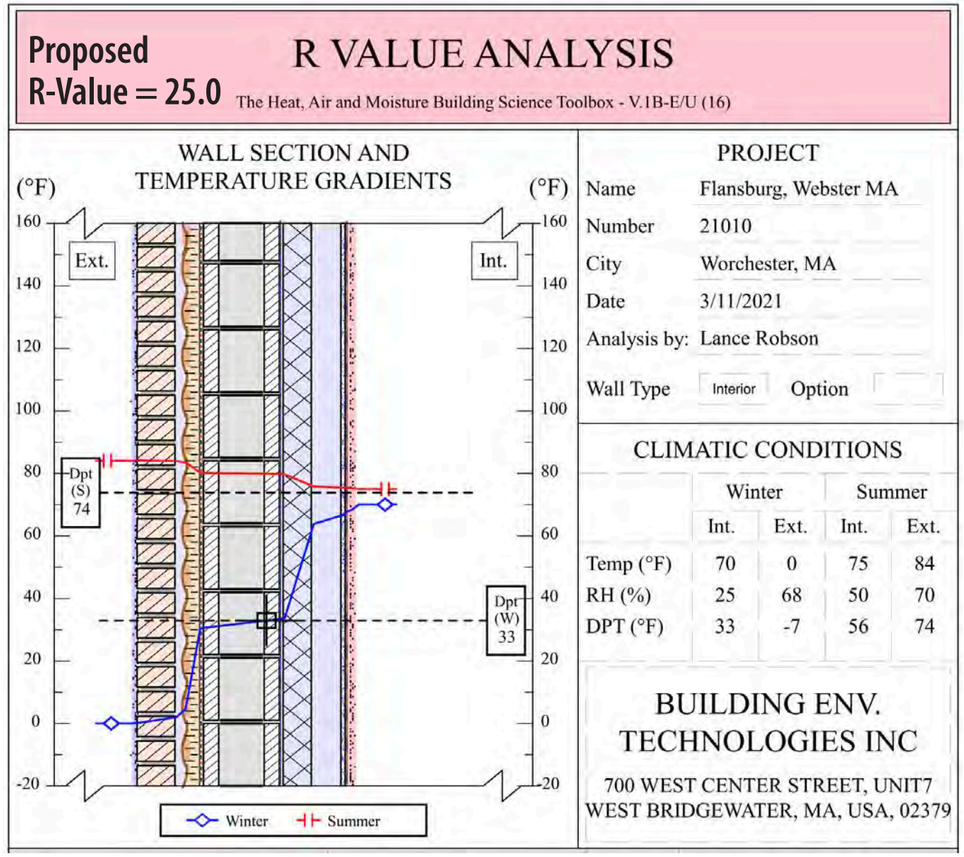
- Typical Existing column spacing is 25 to 28 feet which allows dunnage platforms to be constructed to supported roof top equipment and photovoltaic panels as the existing roof structure does not have adequate capacity to support the additional loads. The existing columns and footings have some reserve capacity to support additional loads.

- It is easier in steel framed structures to accommodate new openings in the floors for mechanical shafts or light wells.

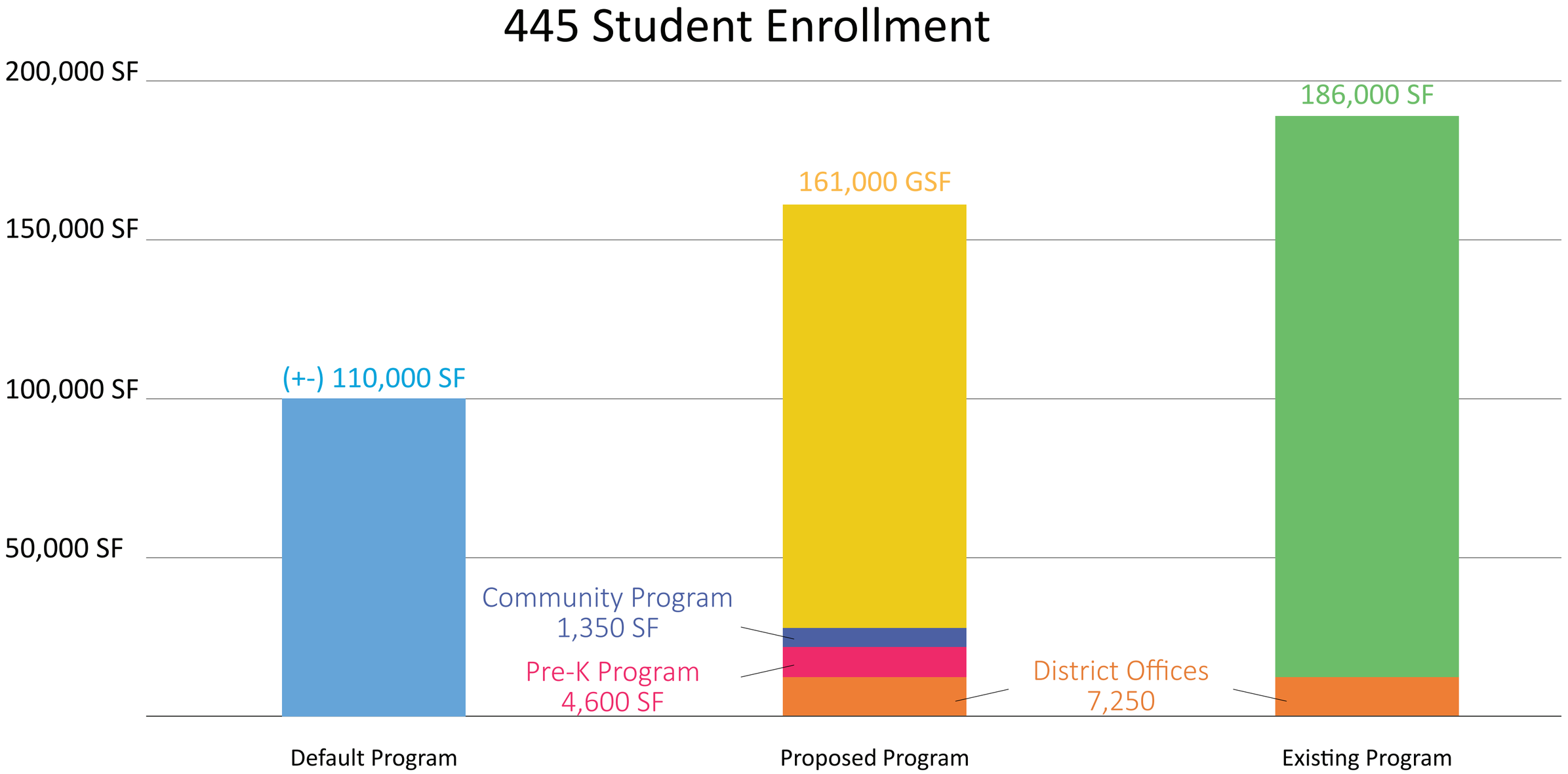
Design Strategies

- Existing brick veneer and exterior wall assembly will remain.
- 3" Mineral wool insulation will be added to inboard side of exterior walls to improve thermal performance.
- Existing windows will be replaced due to deteriorated condition and poor thermal performance.
- 6" Rigid foam insulation will be added to roof deck to improve thermal performance.
- 24.4% Glazing to total facade area ratio.





Design Strategies





Bartlett High School Building Project Webster, MA

Massachusetts School Building Authority
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Design Strategies



Design Strategies



Design Strategies



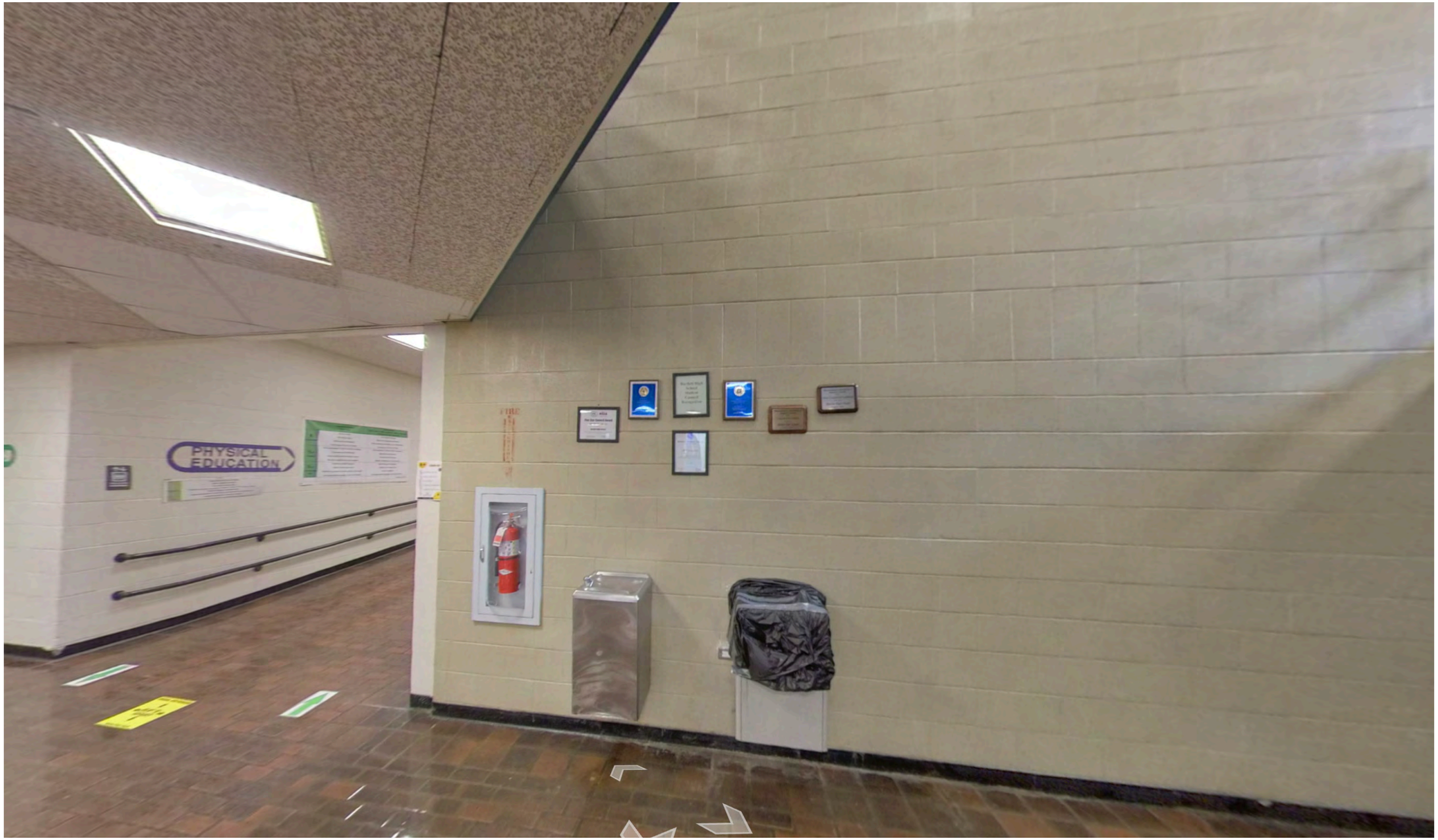
Design Strategies



Design Strategies



Design Strategies



Design Strategies



Design Strategies



Design Strategies



Design Strategies



Design Strategies



Video

Cost Effectiveness

Kent Kovacs, Vice President, AIA, LEED AP

Cost Effectiveness

Option	Total Gross SF	Square Feet of Renovated Space (cost*/sf)	Square Feet of New Construction (cost*/sf	Site, Building Takedown, Haz Mat. Cost*	**Estimated Total Construction** (cost*/sf)**
					Construction Cost Only
Base Repair: 1 (Renovation)	184,630 sf	184,630 sf ($255.53/sf)	N/A	$3,740,364	**$50,919,763 ($276/sf)**
2 (Renovation)	187,630 sf	187,630 sf ($346.86/sf)	N/A	$10,689,972	**$75,771,600 ($404/sf)**
3*** (Renovation)	161,000 sf	161,000.00 sf ($374.33/sf)	N/A	$10,947,610	**$71,215,208 ($442/sf)**
4 (Add/Reno)	161,000 sf	131,000.00 sf ($370.56/sf)	30,000 sf ($672.89/sf)	$12,123,910	**$80,854,898 ($502/sf)**
5 (New)	158,000 sf	N/A	158,000 sf ($461.39/sf)	$17,037,292	**$89,936,641 ($569/sf)**

* Marked up Construction Cost

**Does not include Construction Contingency

***District's Preferred Solution

All Costs Reflect 6/15/21 Cost Estimate Provided by PM&C

Cost Effectiveness

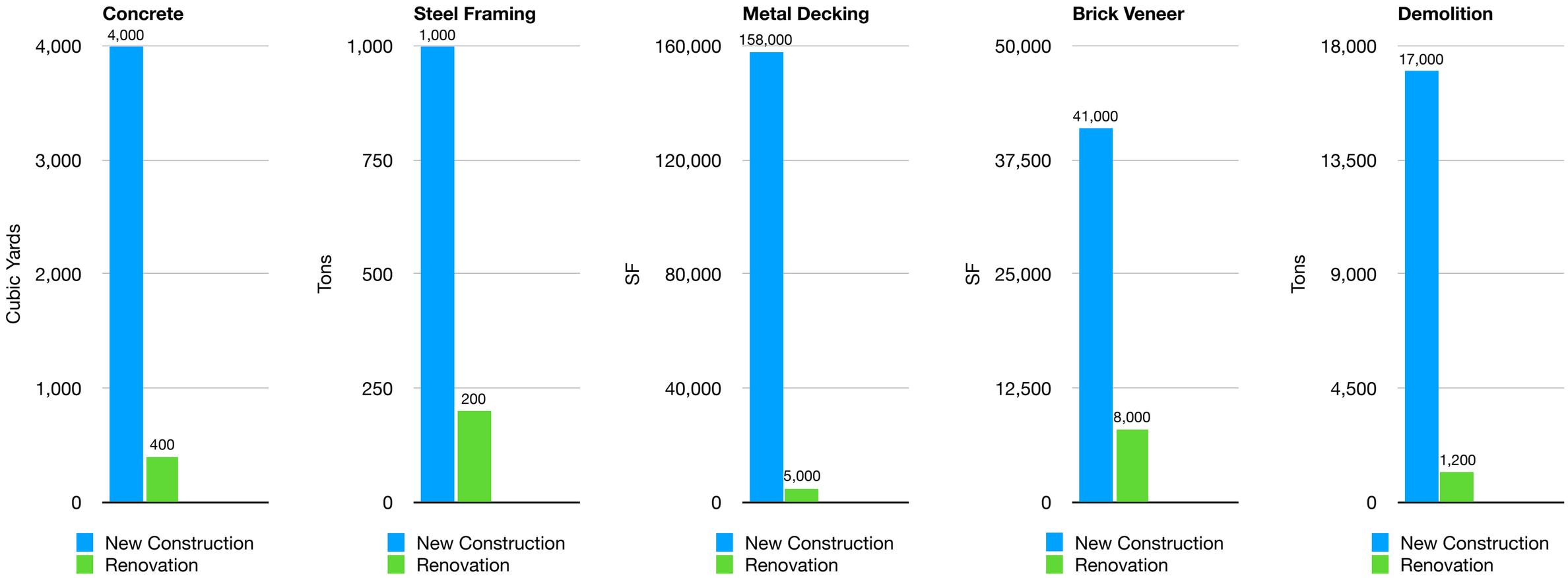
	SITE	DEMOLITION/ HAZMAT	BUILDING	TOTAL
Renovation (Option 3)	$8.5 M	$1.8 M	$60.9 M	$71.2 M
New Build (Option 5)	$12.8 M	$4.2 M	$72.9 M	$89.9 M
Cost Delta	$4.3 M	$2.4 M	$12 M	$18.7 M

$18.7 million in Construction Cost savings

Note: Modular Classrooms will be required for Option 3, costs are included in Project Costs

Cost Effectiveness

Construction Materials Comparison



Construction Materials Comparison -
Estimated Truck Trips and Trucking Distance Saved

Concrete

Renovation: 40 Truck Trips / 1,100 Miles

New Construction: 270 Truck Trips / 7,000 Miles

Renovation Savings: 230 Truck Trips / 5,900 Miles

Brick Veneer

Renovation: 20 Truck Trips / 2,100 Miles

New Construction: 110 Truck Trips / 11,200 Miles

Renovation Savings: 90 Truck Trips / 9,100 Miles

Steel Framing

Renovation: 10 Truck Trips / 9,300 Miles

New Construction: 50 Truck Trips / 44,700 Miles

Renovation Savings: 40 Truck Trips / 35,400 Miles

Demolition

Renovation: 60 Truck Trips / 4,800 Miles

New Construction: 840 Truck Trips / 67,000 Miles

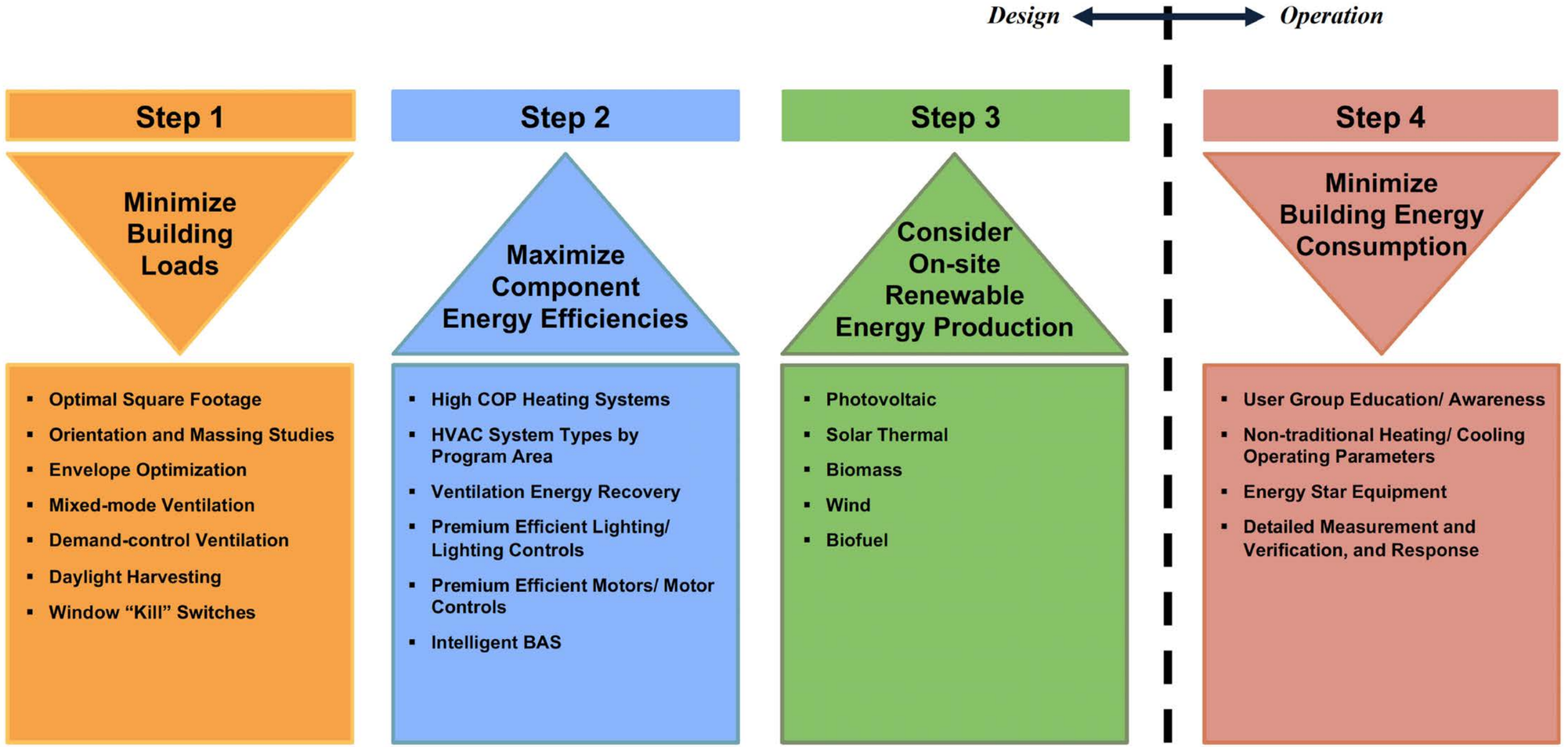
Renovation Savings: 780 Truck Trips / 62,200 Miles

RFS

Chad Monterose, Senior Project Manager

Building Systems Process

Building System Selection Process - Steps to a High Performance Building



Considerations When Analyzing Existing Buildings

1. Existing System / MEP Space Needs
    - Potential reuse of existing system
    - Are existing MEP spaces (e.g. penthouses, basement) adequate?
2. Existing Structural Constraints
    - Floor-to-floor heights
    - Space limitations
3. Existing Building Envelope
    - Energy code compliance
    - Thermal comfort of occupants
4. Fixed Solar Orientation
    - Existing building's solar orientation impacts HVAC requirements
5. Fire Rating / Code Compliance with MEP Distribution
6. Replacing Existing U/S Systems (Plumbing/Electrical)
7. Existing Utility/Service Limitations

Bartlett High School Existing MEP Conditions



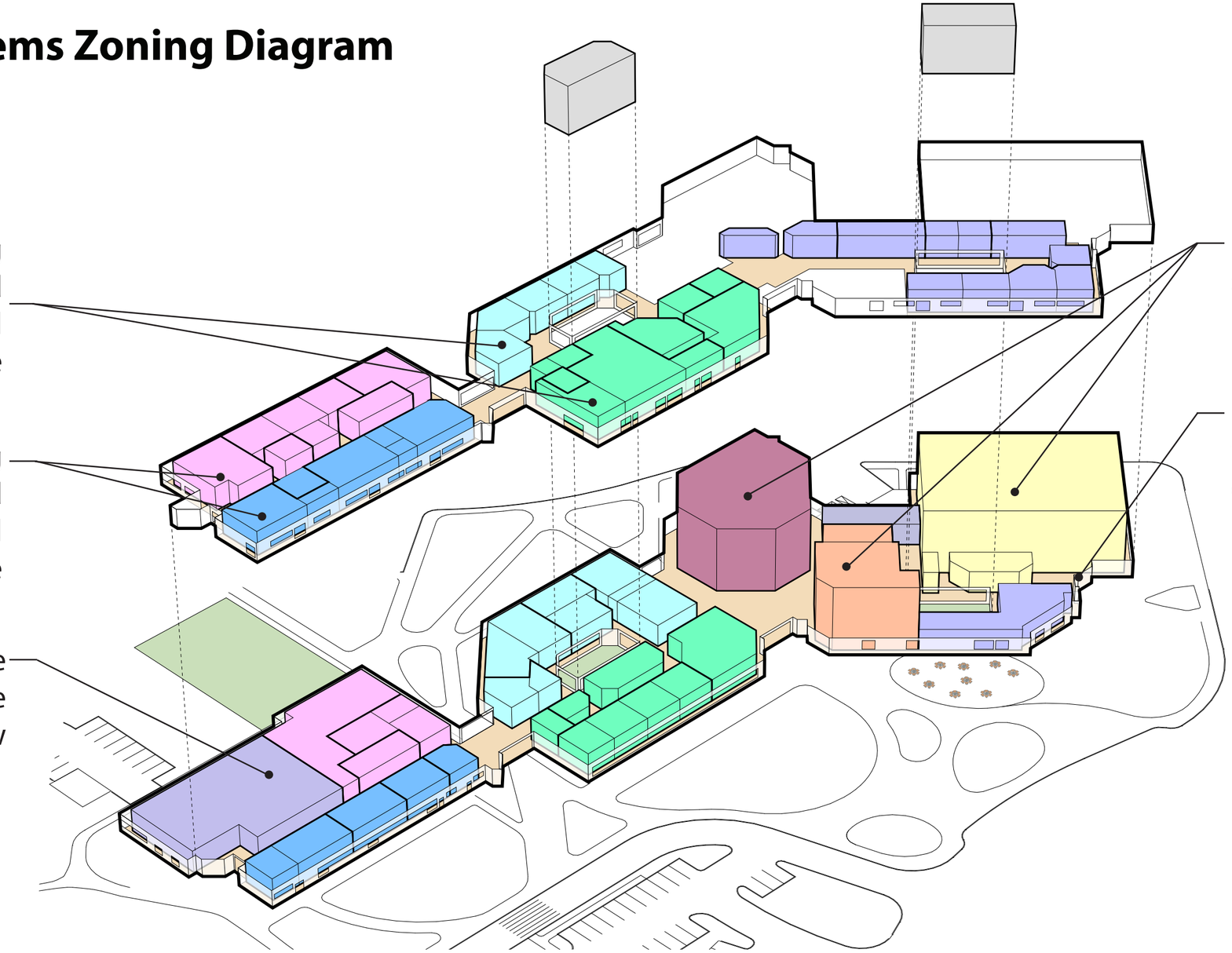
Bartlett High School Proposed MEP Systems Analysis

	Option	Description	Heating Source	Cooling Source
High Fossil Fuel Use*	~~A~~	~~Boilers and DX Units~~	~~Gas-Fired Condensing Boilers~~	~~Packaged and Split Air-Cooled DX Units~~
High Fossil Fuel Use*	~~B.1, B.2~~	~~Boilers and Chillers~~	~~Gas-Fired Condensing Boilers~~	~~B.1: Standard-Efficiency Air-Cooled Chillers~~ ~~B.2: High-Efficiency Air-Cooled Chillers~~
Minimal Fossil Fuel Use*	C.1	Air-Source Heat Pumps w/ Supplemental Boilers	VRF Air-Source Heat Pumps w/ Supplemental Gas-Fired Condensing Boilers	VRF Air-Source Heat Pumps
All Electric*	C.2 (All Electric)	Air-Source Heat Pumps w/ Supplemental Electric Heat	VRF Air-Source Heat Pumps w/ Supplemental Electric Resistance heat	VRF Air-Source Heat Pumps
All Electric*	~~D~~ (All Electric)	~~Ground-Source Heat Pumps~~	~~Ground-Source Heat Pumps~~	~~Ground-Source Heat Pumps~~
All Electric*	E (All Electric)	Ground-Source Heat Pumps w/ Air-Source Heat Pumps	Ground-Source Heat Pumps w/ Air-Source Heat Pumps	Ground-Source Heat Pumps w/ Air-Source Heat Pumps

*Fuel use noted above relates to mechanical equipment only.

Building Systems Process

Mechanical Systems Zoning Diagram



The Green Engineer

Chris Schaffner, Founder & CEO

Bartlett High School – LEED for Schools

LEED v4 for BD+C: Schools
Project Checklist

Project Name: **Webster Bartlett High School**
Date: **7/1/21**

Y	?	N				
1	**0**	**0**	**Integrative Process**			**1**
1			Credit	Integrative Process		1
1	**2**	**12**	**Location and Transportation**			**15**
		x	Credit	LEED for Neighborhood Development Location		15
	1		Credit	Sensitive Land Protection		1
		2	Credit	High Priority Site		2
		5	Credit	Surrounding Density and Diverse Uses		5
		4	Credit	Access to Quality Transit		4
		1	Credit	Bicycle Facilities		1
	1		Credit	Reduced Parking Footprint		1
1			Credit	Green Vehicles		1
6	**2**	**4**	**Sustainable Sites**			**12**
Y			Prereq	Construction Activity Pollution Prevention		Required
Y			Prereq	Environmental Site Assessment		Required
1			Credit	Site Assessment		1
		2	Credit	Site Development - Protect or Restore Habitat		2
1			Credit	Open Space		1
	2	1	Credit	Rainwater Management		3
2			Credit	Heat Island Reduction		2
1			Credit	Light Pollution Reduction		1
		1	Credit	Site Master Plan		1
1			Credit	Joint Use of Facilities		1
5	**1**	**6**	**Water Efficiency**			**12**
Y			Prereq	Outdoor Water Use Reduction		Required
Y			Prereq	Indoor Water Use Reduction		Required
Y			Prereq	Building-Level Water Metering		Required
2			Credit	Outdoor Water Use Reduction		2
2	1	4	Credit	Indoor Water Use Reduction		7
		2	Credit	Cooling Tower Water Use		2
1			Credit	Water Metering		1
20	**3**	**8**	**Energy and Atmosphere**			**31**
Y			Prereq	Fundamental Commissioning and Verification		Required
Y			Prereq	Minimum Energy Performance		Required
Y			Prereq	Building-Level Energy Metering		Required
Y			Prereq	Fundamental Refrigerant Management		Required
4		2	Credit	Enhanced Commissioning		6
16			Credit	Optimize Energy Performance		16
	1		Credit	Advanced Energy Metering		1
	1	1	Credit	Demand Response		2
	1	2	Credit	Renewable Energy Production		3
		1	Credit	Enhanced Refrigerant Management		1
		2	Credit	Green Power and Carbon Offsets		2
7	**3**	**3**	**Materials and Resources**			**13**
Y			Prereq	Storage and Collection of Recyclables		Required
Y			Prereq	Construction and Demolition Waste Management Planning		Required
3	1	1	Credit	Building Life-Cycle Impact Reduction		5
1		1	Credit	BPDO - Environmental Product Declarations		2
	1	1	Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials		2
1	1		Credit	Building Product Disclosure and Optimization - Material Ingredients		2
2			Credit	Construction and Demolition Waste Management		2
9	**2**	**5**	**Indoor Environmental Quality**			**16**
Y			Prereq	Minimum Indoor Air Quality Performance		Required
Y			Prereq	Environmental Tobacco Smoke Control		Required
Y			Prereq	Minimum Acoustic Performance		Required
2			Credit	Enhanced Indoor Air Quality Strategies		2
2	1		Credit	Low-Emitting Materials		3
1			Credit	Construction Indoor Air Quality Management Plan		1
1		1	Credit	Indoor Air Quality Assessment		2
1	1		Credit	Thermal Comfort		1
1			Credit	Interior Lighting		2
		3	Credit	Daylight		3
1			Credit	Quality Views		1
		1	Credit	Acoustic Performance		1
4	**2**	**0**	**Innovation**			**6**
1			Credit	Innovation: Responsible Purchasing - Lamps		1
	1		Credit	Innovation: TBD		1
1			Credit	Innovation: Pilot - Integrative Analysis of Building Materials		1
1			Credit	Innovation: Exemplary Performance (EDPs)		1
	1		Credit	Innovation: TBD		1
1			Credit	LEED Accredited Professional		1
1	**3**	**0**	**Regional Priority (max of 4 points)**			**4**
	1		Credit	Building Lifecycle Impact Reduction (RP@2)		1
		X	Credit	Surrounding Density and Diverse Uses (RP@4)		1
		X	Credit	High Priority Site (RP@2)		
	1		Credit	Optimize Energy Performance (RP@8)		
	1		Credit	Renewable Energy Production (RP@2)		1
1			Credit	Building Lifecycle Impact Reduction (RP@2)		1
54	**18**	**38**	**TOTALS**		**Possible Points:**	**110**

Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110

The Green Engineer
Sustainable Design Consulting

Building and Site Improvements

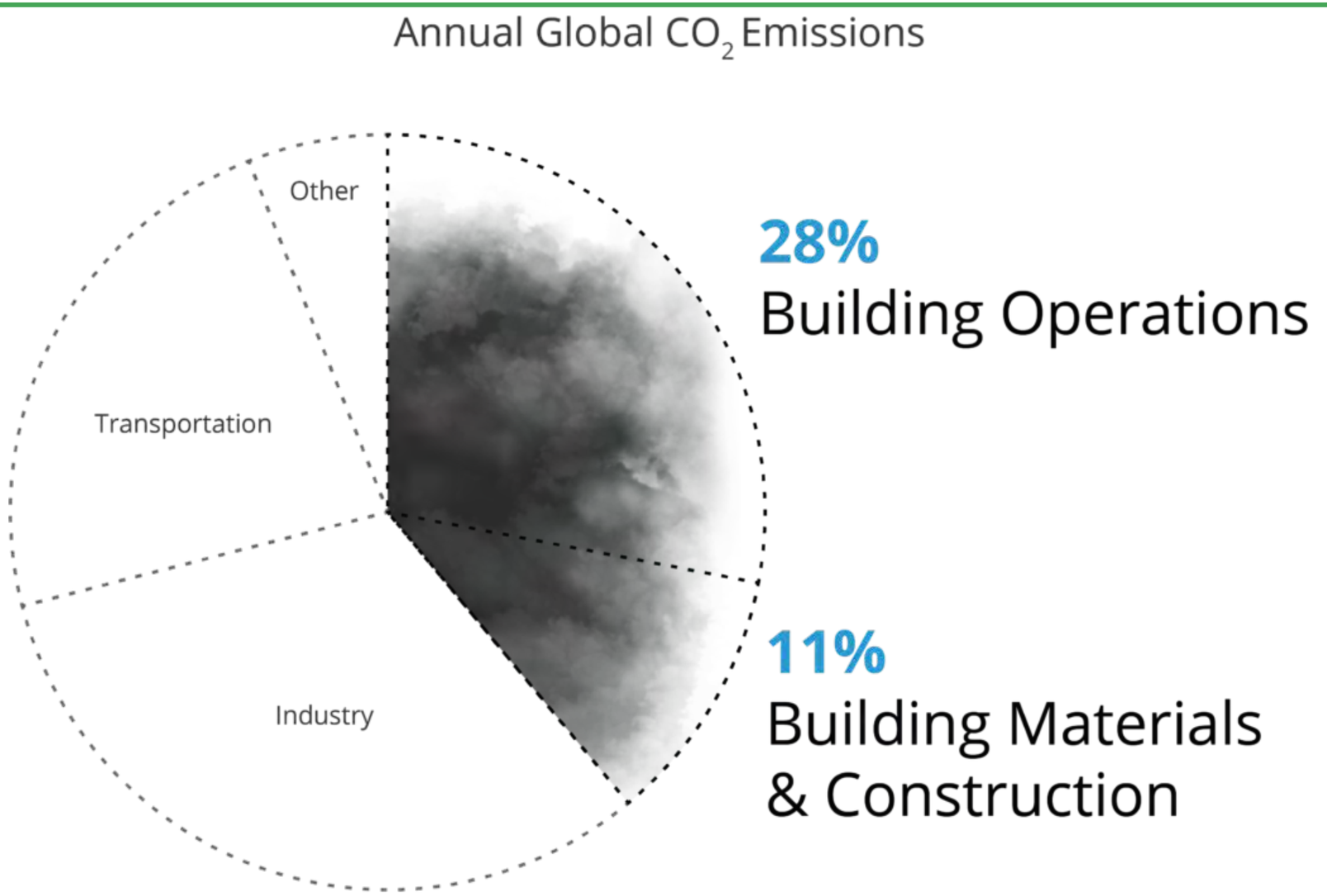
Sustainable Design measures:

- Partial demolition and interior renovations to improve building use
- Building reuse – mitigates environmental impact of building
- Building systems replacements to increase energy efficiency
  - High performance equipment
  - Lighting upgrades
- Ventilation system upgrades for improved indoor air quality
- Interior finish materials replacement for improved indoor air quality
- Site improvements to address rainwater management; native and adaptive landscaping and outdoor area uses

Elements of Building's GHG Impact



Sustainability



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Data Sources: Global ABC Global Status Report 2018, EIA

Sustainability

Nauset Regional High School Renovation/Addition



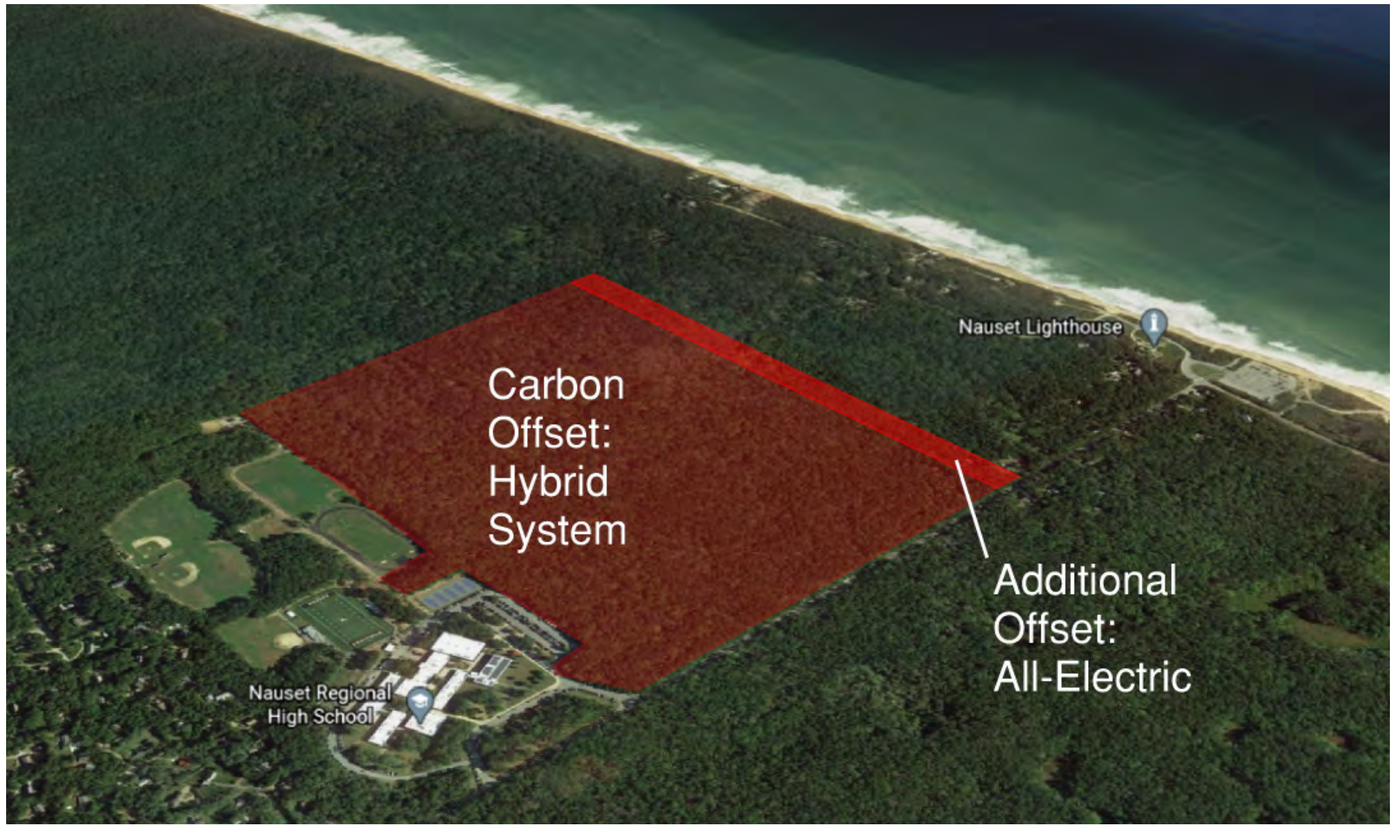






Nauset Regional High School Renovation/Addition

Estimated Lifetime GHG (MTCO2e) Savings vs. BOD (Option 1)



Virtually no difference in emissions between the hybrid option and the all-electric option.

Analysis courtesy of Vanderweil Engineers

Embodied Carbon

Embodied carbon - Greenhouse gases that are emitted to construct our buildings

Initial embodied carbon—the impacts associated with extracting, manufacturing, and transporting materials to the jobsite.

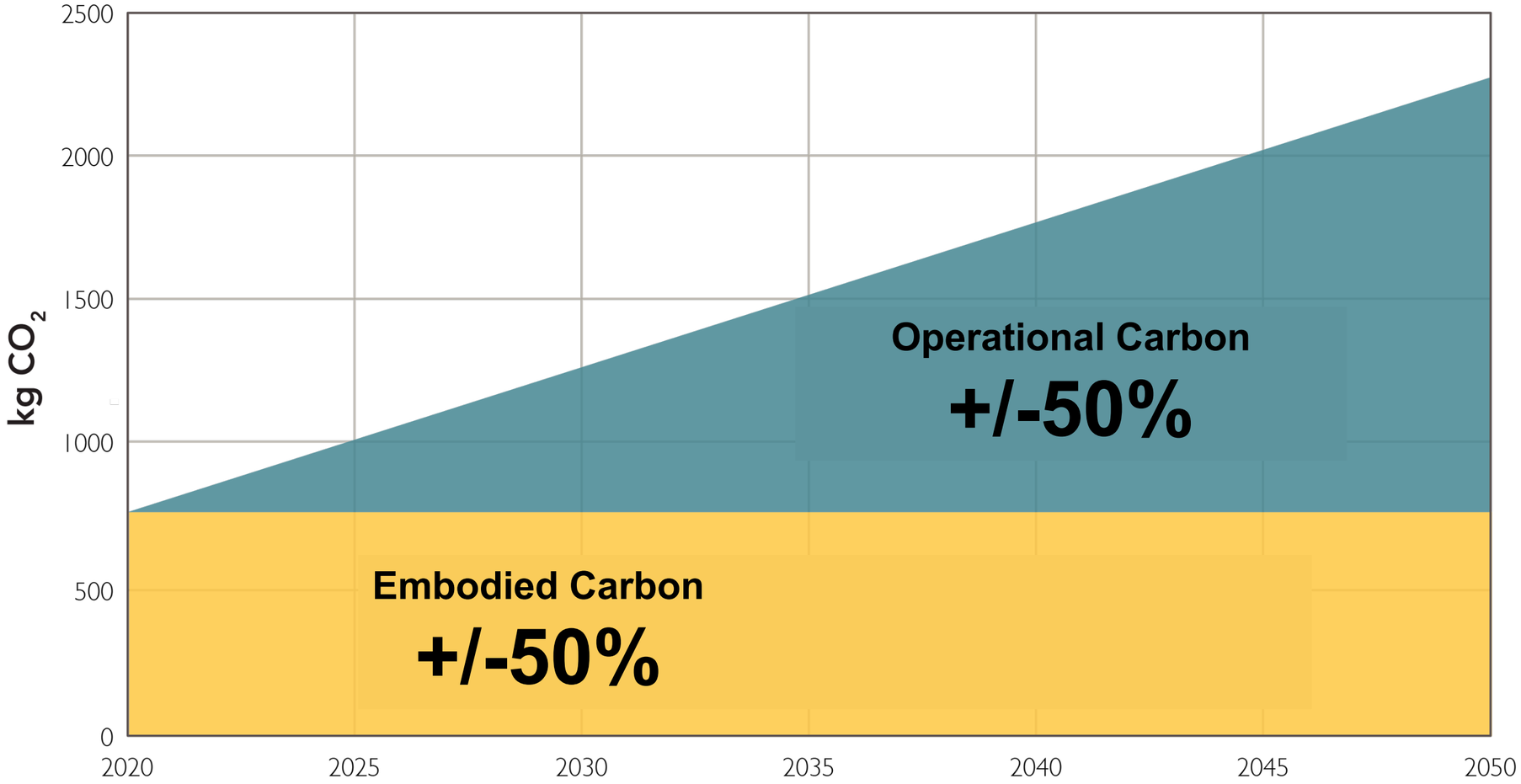
Operational carbon – Greenhouse gas emissions associated with the use phase of the building – primarily energy consumption, but can include transportation, maintenance and replacement cycles of finishes

“Carbon” is used to indicate all greenhouse gas emissions, not just carbon dioxide.



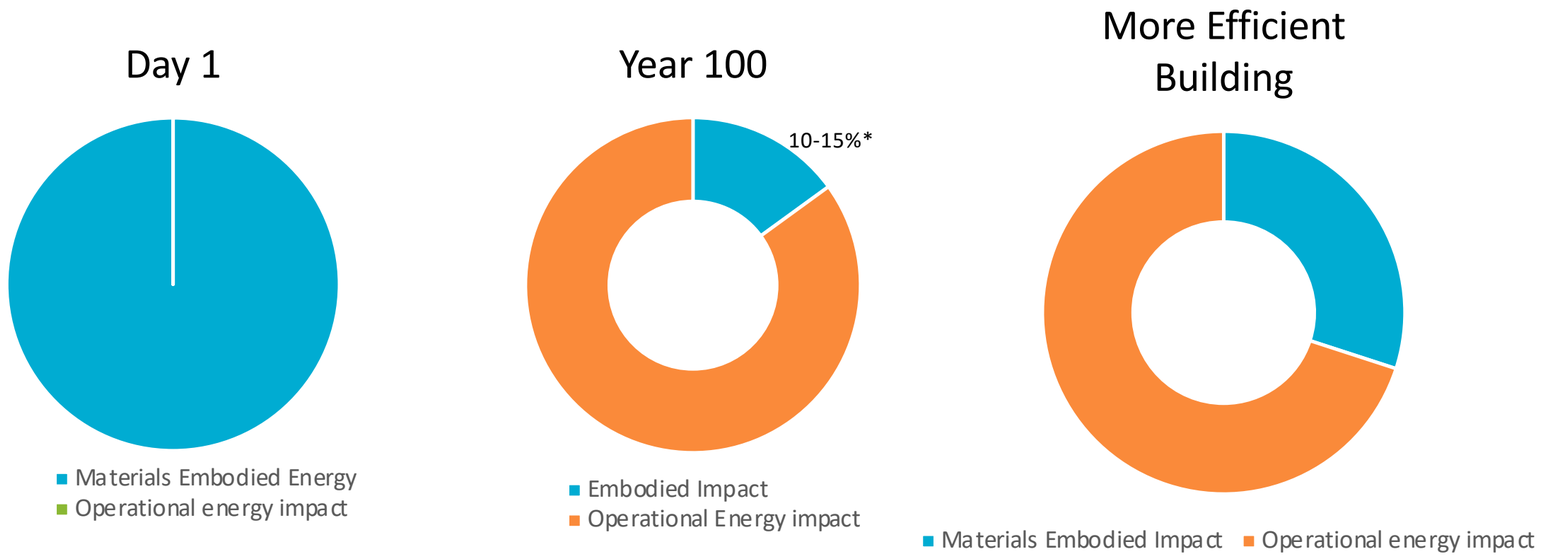
Total Carbon Emissions of **Single Building**

Global Average Building Carbon Footprint: Business as Usual



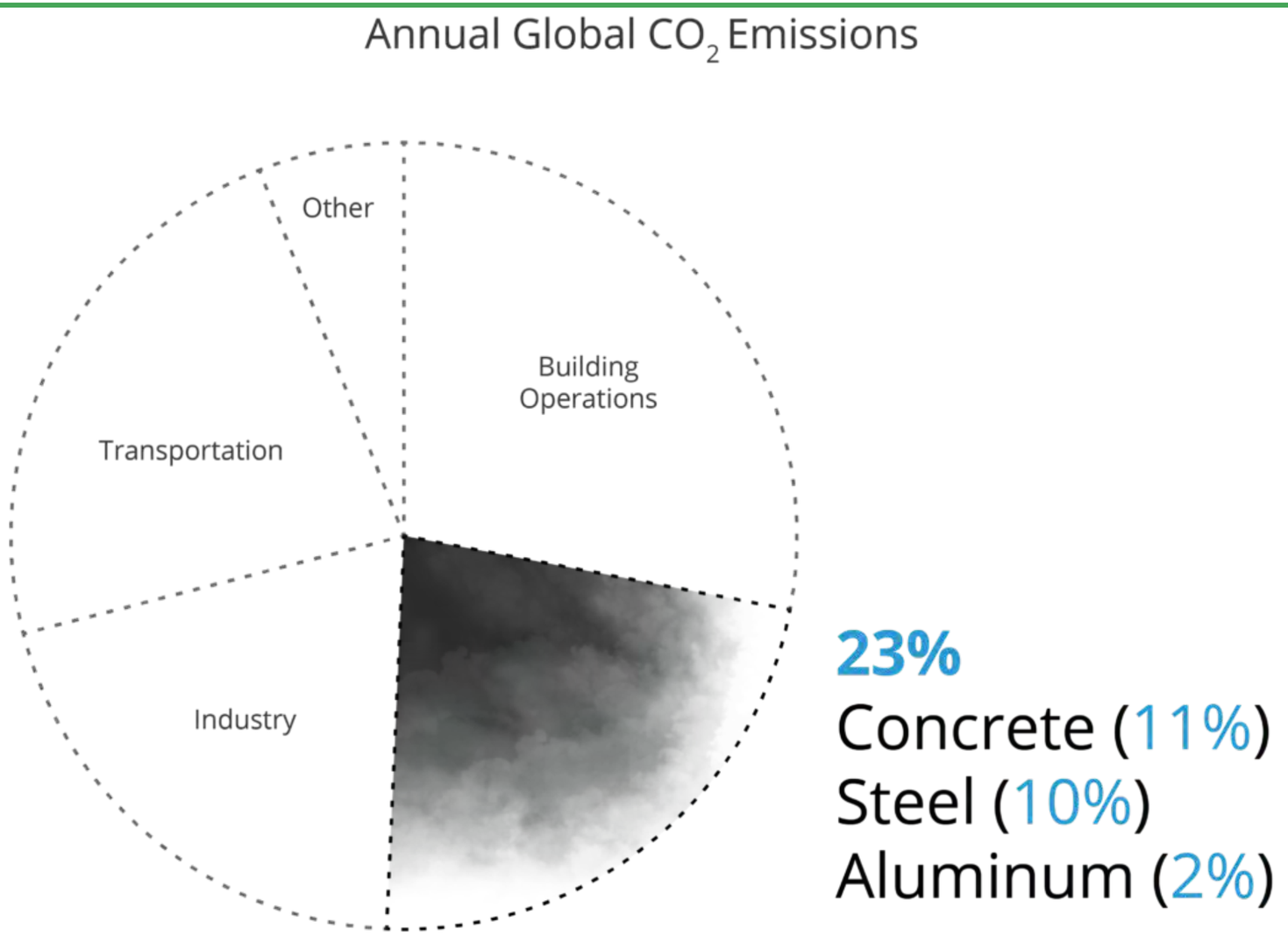
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Sustainability



* B. Lippke et al “Life-Cycle Environmental Performance of Renewable Building Materials” June 2004 Journal of Forest Products

Sustainability



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Data Sources: Global ABC Global Status Report 2018, EIA

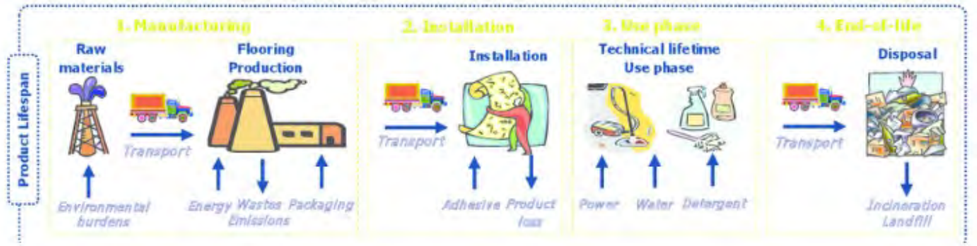


Where is the Embodied Carbon ?

"Structural systems almost always comprise the largest source of embodied carbon in the building—up to 80%, depending on the building type" – Environmental Building News

Benefits of Existing Buildings Reuse

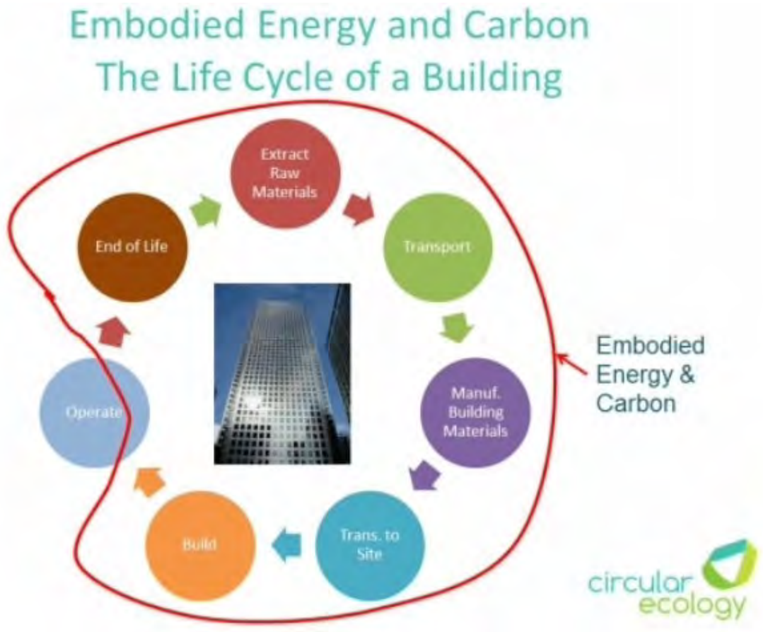
- Limits use of new materials, and associated environmental impacts
- Reduced site disturbance
- Reduces amount of waste sent to landfills (approximately 90% of Construction waste sent to landfills is from demolition of existing buildings)
- Preserves existing embodied carbon, reduces new carbon emissions
- Preserves cultural heritage
- Reduces project cost

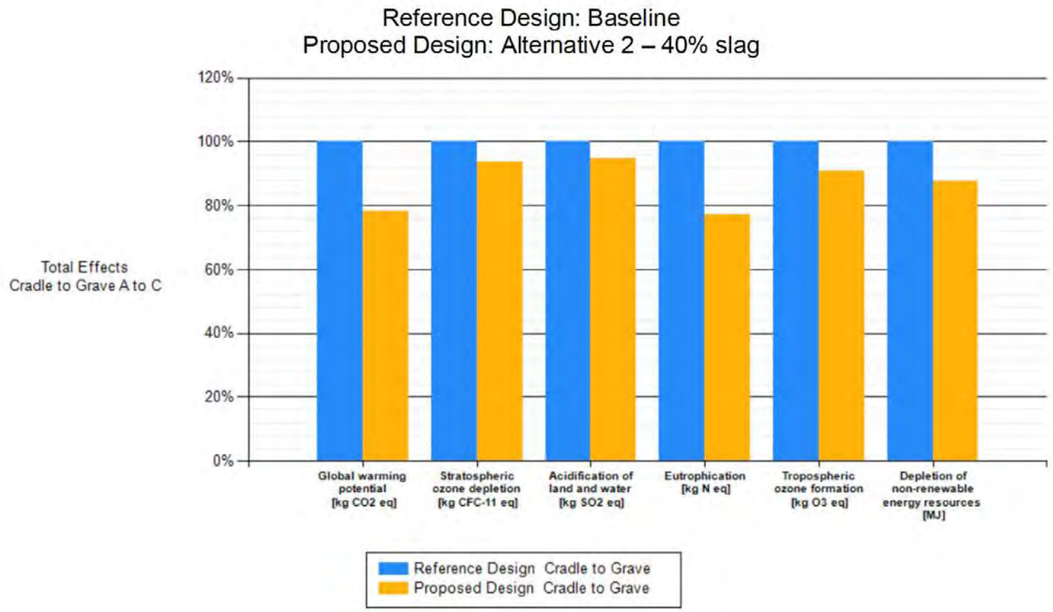


Life cycle of floor coverings – main phases

Embodied Carbon + Life Cycle Assessment

- Consumption of embodied energy consumed from ‘cradle to gate’
- Overall reduced environmental impact can be estimated through a comparison to a similar new build project, a **Life Cycle Assessment**





MSBA Incentive

John Jumpe, Director of Project Management

Massachusetts School Building Authority

Deborah B. Goldberg, State Treasurer and Receiver-General *Chairperson*

James MacDonald
Chief Executive Officer

John K. McCarthy
Executive Director



Incentive Points Offered for School Renovation Projects

Major Reconstruction or Reno / Reuse

(up to 5 points)

MSBA Incentives

Incentive Points (0-5)

Exhibit C

Calendar Year 2020

Webster

Bartlett High School - 201803160505

MSBA Reimbursement Rate Calculation

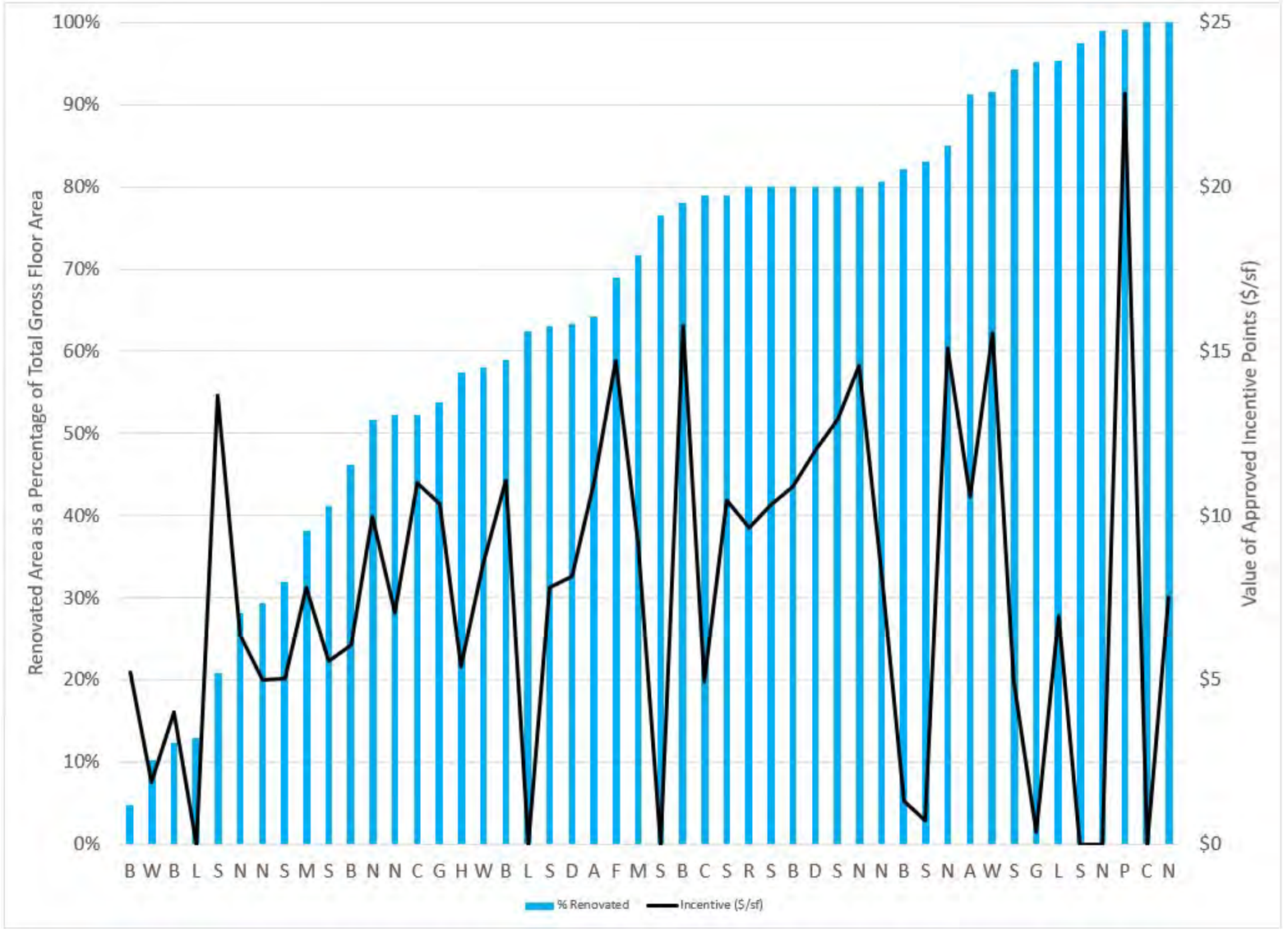
Base Points	31.00
Income Factor	8.21
Property Wealth Factor	20.63
Poverty Factor	17.00
Subtotal: Reimbursement Rate Before Incentives	76.84
Incentive Points	
Maintenance (0-2)	-
CM @ Risk (0-1) Only projects invited to Capital Pipeline prior to 1/2/17	-
Newly Formed Regional District (0-6)	-
Major Reconstruction or Reno/Reuse (0-5)	-
Overlay Zoning 40R & 40S (0-1)	-
Overlay Zoning 100 units or 50% of units for 1, 2 or 3 family structures (0-0.5)	-
Energy Efficiency - "Green Schools" (0 or 2)	-
Model Schools (5) Only projects invited to Capital Pipeline prior to 1/2/16	-
Total Incentive Points	-
MSBA Reimbursement Rate	76.84

From Module 4 – Schematic Design

Up to five (5) incentive percentage points may be allocated for a renovation project that requires no new construction. Less than five (5) incentive percentage points may be allocated on a sliding scale that relates the percentage of gross square feet of renovated space to the total gross square feet of the total project. For example, if 50% of the total gross square feet of the complete project is renovated area, 2.5 incentive percentage points would be awarded.

MSBA Incentives

MSBA Experience



Energy Efficiency (0 or 2)

- NE-CHPS:
  - Renovation projects require roughly 15-20% fewer total points to achieve "Verified" and "Leader" compared to new;
  - Pre-requisite points typically apply to "scope of work" areas only;
  - Materials re-use category is targeted to renovation projects;
  - Several categories make exceptions / lower point requirements for renovation projects (controllability of systems, views, interlock systems, site selection).

Energy Efficiency (0 or 2)

- LEED-S:
  - Energy performance requirements are lower for renovation projects;
  - "Building Life-Cycle Impact Reduction" allows for existing building and material reuse;
  - Projects that incorporate part of an existing building for reuse may apply the reused portion toward the achievement of MR Credit Construction and Demolition Waste Management;
  - Several categories make exceptions / lower point requirements for renovation projects (Minimum Indoor Air Quality Performance, Naturally Ventilated Spaces of projects registered as historic buildings).



Questions?

MSBA assigned Project Manager

John F Jumpe Jr.
Director of Project Management