

**MEMORIAL CHURCH LOWER-LEVEL RENOVATION
1 HARVARD YARD, CAMBRIDGE, MA
PROJECT PROFILE**

**LEED ID+C v3.0
CERTIFIED GOLD
AUGUST 2017**

The Memorial Church Lower-Level renovation is located in Harvard’s Memorial Church at 1 Harvard Yard, Cambridge, MA. The original building was designed by architects Coolidge, Shipley, Bulfinch & Abbott. Built in 1932, Memorial Church was dedicated in memory of those who died in World War I, as a gift of the alumni to the University. Memorial Church is part of a vibrant interfaith network of Harvard University and serves as a place of spiritual refuge to the entire Harvard community. The entire building encompasses a total of 33,171 gross square feet and the LEED project boundary consists of 11,291 gross square feet.

The renovation sought to reorganize and update the lower level of the church, creating new programming spaces focused on well-being and efficiency, including a new Student Oasis, choir and meeting rooms, kitchen space, and offices.

The project team was committed to sustainability from the onset and followed the Harvard Green Building Standards to make more informed decisions. These standards led to the inclusion of a number of progressive design strategies to meet aggressive energy targets and reduce water use without significant additional cost. The project achieved LEED-CI v3 Gold certification in August 2017.



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LEED® Facts

**Harvard University
Memorial Church Lower-Level**



Location.....Cambridge, MA
Rating System.....LEED-CI v3
Certification Awarded.....Gold
Total Points Awarded.....61/110

Sustainable Sites.....15/21
Water Efficiency.....6/11
Energy and Atmosphere.....22/37
Materials and Resources.....4/14
Indoor Environmental Quality.....7/17
Innovation.....6/6
Regional Priority.....1/4

PROJECT METRICS

- 31%** reduction in water use below EPA 1992 threshold
- 23%** of the total building materials, by value, have been manufactured using recycled materials
- 85%** of individual spaces have thermal comfort controls
- 21%** reduction in lighting power density
- 67%** of the total wood-based building materials are Forest Stewardship Council (FSC) certified
- 91%** of the connected lighting load is controlled by occupancy sensors



ENERGY EFFICIENCY AND INDOOR ENVIRONMENTAL QUALITY

MECHANICAL SYSTEMS

ECM 1: High Efficiency Fans and Motors

ECM 2: Exhaust Air Energy Recovery

ECM 3: Demand Controlled Ventilation

ECM 4: Air Economizer Mode

ECM 5: Variable Air Volume Boxes (VAV)

The Memorial Church Lower-Level renovation included upgrades to the heating, cooling, supply, and exhaust systems. New air handling units (AHUs) were provided to serve the sanctuary and basement in the most efficient ways possible. The primary AHU is controlled by demand controlled ventilation based on CO₂ levels, VAVs, and has an efficient electronic commutated motor (ECM). VAVs help to save energy by increasing/decreasing ventilation as needed, a feature constant volume systems are unable to utilize. The demand controlled ventilation helps to limit the amount of outside air that needs to be conditioned while providing a high quality indoor environment. This AHU is also equipped with an economizer mode which enables free cooling when outdoor conditions are suitable, saving energy by reducing the need for mechanical cooling. The second AHU provides 100% fresh air which is first treated through high efficiency filters and, in turn, dilutes pollutants in the indoor environment in order to create a high quality indoor environment. This system also recovers energy from the exhaust air via an energy wheel, which has a very high energy transfer effectiveness in comparison to other energy recovery techniques. Last, the third and fourth AHUs also control new fan coil units and also have ECMs.

All rooms have new temperature sensors that are tied in to the building automation system to determine the appropriate occupancy and seasonal temperature setbacks. These sensors ensure the HVAC system is not wasting energy during unoccupied hours and protect the system from overheating and/or overcooling during the heating and cooling seasons.



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INDOOR ENVIRONMENTAL QUALITY

The high indoor environmental quality of the Memorial Church Lower-Level renovation was a significant focus of the project. The following strategies were enabled to promote the comfort and well-being of construction workers and building occupants:

- Increasing ventilation by at least 30% above the minimum rates required by ASHRAE 62.1-2007.
- Enacting an indoor Quality Management Plan used to reduce air quality problems resulting from construction.
- Selecting 100% low-emitting adhesives, sealants, paints, coatings, and wood products.
- Designing entrances to minimize exposure to hazardous particulates by providing sufficient walk-off mats.
- Providing MERV 13 filtration to ensure all ventilation air is properly filtered.

ENERGY EFFICIENCY AND INDOOR ENVIRONMENTAL QUALITY

LIGHTING AND ELECTRICAL SYSTEMS

The Memorial Church space is expected to be occupied for extended periods through-out the year, therefore, it was important to design the lighting system in a way that is effective yet energy efficient. The lighting system differs per space type within the LEED boundary, including specialized lighting for the conference rooms, offices, multi-purpose rooms, kitchen, and hallways. Some of the strategies employed include:

- Reduce lighting power density by 21% below the ASHRAE 90.1 baseline standard
- High performance LEDs installed throughout the project
- Ceiling mounted occupancy & daylight sensors capable of managing lighting setbacks throughout the project space
- Lighting controls with multiple lighting levels to provide adequate illumination for a higher indoor environmental quality



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Photo: copyright: Harvard Green Building Services, 2017

PLUMBING SYSTEMS AND WATER USE REDUCTION



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There are several areas throughout the interior of project space that showcase low-flow plumbing fixtures. The bathrooms are equipped with 1.28 GPF water closets 0.125 GPF urinals, and 0.35 GPM public lavatories. The kitchen boasts a low-flow 1.5 GPM kitchen sink and a water-efficient 1.3 GPM water bottle filling station. The water bottle filling station even displays the number of water bottles saved by refilling reusable water bottles. These strategies led to a water use reduction the space by over 31% when compared to the baseline plumbing fixtures required by EPAct 1992.

Further, the new exterior irrigation system includes a unique quick response feature which immediately turns off the irrigation system at the first sign of precipitation. Thus, the Memorial Church irrigation system is increasing water savings even further.



PRODUCTS AND MATERIALS

LIGHTING AND CONTROLS

- 21% reduction in lighting power density (watts/square foot)
- 100% LED fixtures



**Wet Location Luminaire
Vanessa LED**
Birchwood Lighting

✓ High efficiency: 89.4 lumens/watt



**Ceiling-Wall Arm LED
WingRail**
Vode Lighting

✓ High efficiency: 102 lumens/watt



**Pendant LED
Toldbod**
Louis Poulsen

✓ High efficiency: 34 lumens/watt

ENERGY EFFICIENT APPLIANCES & WATER EFFICIENCY

- 100% of the equipment purchased for the project is **ENERGY STAR RATED** (by rated power).
- 31% reduction in annual water use when compared to Epcat 1992 baseline standard.



**Undercounter Dishwasher
GLDT696J**
GE

✓ ENERGY STAR certified



**Flushometer Toilet System
AFWALL® FloWise®**
American Standard

✓ 1.28 GPF Selectronic® flush valve



**Electronic Lavatory Faucet
EAF-275**
Sloan

✓ 0.35 GPM spray head

LOW-EMITTING MATERIALS

- 100% of the project's adhesives, sealants, paints, coatings, and wood products are **low-emitting**.



**Waterproofing Membrane
Hydro Ban™**
Laticrete

✓ VOC content: 2.39 g/L, which is significantly lower than industry baseline of 350 g/L



**Engineered Hardwood Flooring
TreeSmart**
Saroyan Lumber

✓ Reduced formaldehyde (CARB Phase 2 compliant)



**Interior Eggshell Finish
Ultra Spec 500**
Benjamin Moore

✓ VOC content: 0 g/L

Please note that while many products are described in this project profile, these are provided for informational purposes only, to show a representative sample of what was included in this project. Harvard University and its affiliates do not specifically endorse nor recommend any of the products listed in this project profile and this profile may not be used in commercial or political materials, advertisements, emails, products, promotions that in any way suggests approval or endorsement of Harvard University.



PROJECT SCORECARD

HRE Memorial Church Basement Renovation

Project ID 1000071446
 Rating system & version LEED-CI v2009
 Project registration date 04/08/2016



D and C Application Decision

CERTIFIED: 40-49, SILVER: 50-59, GOLD: 60-79, PLATINUM: 80+

LEED 2009 COMMERCIAL INTERIORS

ATTEMPTED: 63, DENIED: 6, PENDING: 0, AWARDED: 61 OF 107 POINTS

SUSTAINABLE SITES 15 OF 21	
SSc1 Site Selection	1 / 5
SSc2 Development Density and Community Connectivity	6 / 6
SSc3.1 Alternative Transportation-Public Transportation Access	6 / 6
SSc3.2 Alternative Transportation-Bicycle Storage and Changing Room	0 / 2
SSc3.3 Alternative Transportation-Parking Availability	2 / 2

WATER EFFICIENCY 6 OF 11	
WEp1 Water Use Reduction-20% Reduction	Y
WEc1 Water Use Reduction	6 / 11

ENERGY AND ATMOSPHERE 22 OF 37	
EAp1 Fundamental Commissioning of the Building Energy Systems	Y
EAp2 Minimum Energy Performance	Y
EAp3 Fundamental Refrigerant Mgmt	Y
EAc1.1 Optimize Energy Performance-Lighting Power	2 / 5
EAc1.2 Optimize Energy Performance-Lighting Controls	1 / 3
EAc1.3 Optimize Energy Performance-HVAC	5 / 10
EAc1.4 Optimize Energy Performance-Equipment and Appliances	4 / 4
EAc2 Enhanced Commissioning	5 / 5
EAc3 Measurement and Verification	0 / 5
EAc4 Green Power	5 / 5

MATERIALS AND RESOURCES 4 OF 14	
MRp1 Storage and Collection of Recyclables	Y
MRC1.1 Tenant Space-Long-Term Commitment	1 / 1
MRC1.2 Building Reuse	0 / 2
MRC2 Construction Waste Mgmt	0 / 2
MRC3.1 Materials Reuse	0 / 2
MRC3.2 Materials Reuse-Furniture and Furnishings	0 / 1
MRC4 Recycled Content	2 / 2
MRC5 Regional Materials	0 / 2
MRC6 Rapidly Renewable Materials	0 / 1
MRC7 Certified Wood	1 / 1

INDOOR ENVIRONMENTAL QUALITY 7 OF 17	
IEQp1 Minimum IAQ Performance	Y
IEQp2 Environmental Tobacco Smoke (ETS) Control	Y
IEQc1 Outdoor Air Delivery Monitoring	0 / 1
IEQc2 Increased Ventilation	1 / 1
IEQc3.1 Construction IAQ Mgmt Plan-During Construction	1 / 1
IEQc3.2 Construction IAQ Mgmt Plan-Before Occupancy	0 / 1
IEQc4.1 Low-Emitting Materials-Adhesives and Sealants	1 / 1
IEQc4.2 Low-Emitting Materials-Paints and Coatings	1 / 1
IEQc4.3 Low-Emitting Materials-Flooring Systems	0 / 1
IEQc4.4 Low-Emitting Materials-Composite Wood and Agrifiber Products	1 / 1
IEQc4.5 Low-Emitting Materials-Systems Furniture and Seating	0 / 1
IEQc5 Indoor Chemical and Pollutant Source Control	1 / 1
IEQc6.1 Controllability of Systems-Lighting	0 / 1
IEQc6.2 Controllability of Systems-Thermal Comfort	1 / 1
IEQc7.1 Thermal Comfort-Design	0 / 1
IEQc7.2 Thermal Comfort-Verification	0 / 1
IEQc8.1 Daylight and Views-Daylight	0 / 2
IEQc8.2 Daylight and Views-Views for Seated Spaces	0 / 1

INNOVATION IN DESIGN 6 OF 6	
IDc1.1 Occupant Education with Case Study	1 / 1
IDc1.1 Innovation in Design	0 / 1
IDc1.2 Low-Mercury Lighting	1 / 1
IDc1.2 Innovation in Design	0 / 1
IDc1.3 Innovation in Design	1 / 1
IDc1.3 Innovation in Design	0 / 1
IDc1.4 Innovation in Design	1 / 1
IDc1.4 Innovation in Design	0 / 1
IDc1.5 Green Power	1 / 1
IDc1.5 Innovation in Design	0 / 1
IDc2 LEED® Accredited Professional	1 / 1

REGIONAL PRIORITY CREDITS 1 OF 1	
EAc1.3 Optimize Energy Performance-HVAC	1 / 1

TOTAL 61 OF 107

MORE INFORMATION

- >Harvard Real Estate: <https://www.campuservices.harvard.edu/real-estate>
- >The Memorial Church: <https://memorialchurch.harvard.edu/>
- >Sustainability at Harvard: <http://green.harvard.edu/>
- >Harvard—Green Building Resource: <http://www.energyandfacilities.harvard.edu/green-building-resource>
- >Harvard—Green Building Services: <http://www.energyandfacilities.harvard.edu/project-technical-support/capital-projects/sustainable-design-support-services>

