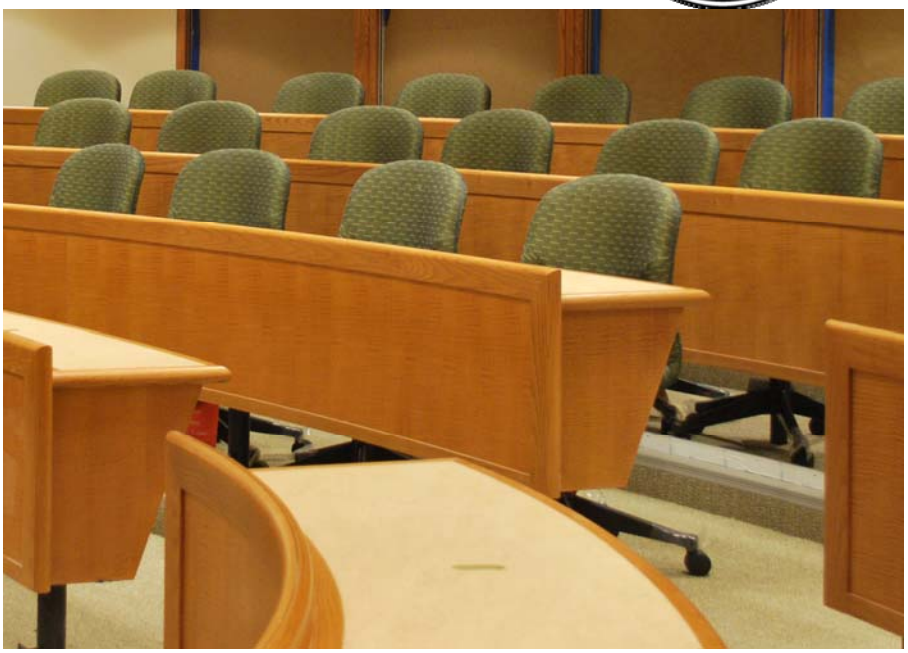
HARVARD
GRADUATE SCHOOL OF EDUCATION

LARSEN HALL CLASSROOM RENOVATION
OCTOBER 2009, LEED-CI v2.0 PLATINUM

Originally constructed in 1965, Larsen Hall is an eight-story classroom and office building located at 14 Appian Way on the Harvard Graduate School of Education (HGSE) campus.

This 7,006 square foot renovation included the creation of an 80-seat tiered classroom and adjacent seating areas on the first floor, and a 50-seat tiered classroom and flexible learning space on the second floor. The project required reworking the first and second floor completely; which included upgrading aspects of the mechanical, electrical, plumbing, fire alarm, fire protection, tel/ data and audio visual systems.

HGSE is committed to sustainability and reducing greenhouse gas emissions. The project achieved LEED for Commercial Interiors (LEED-CI) version 2.0 Platinum certification, the highest certification level possible.



Larsen Classrooms
Photo: Harvard Office for Sustainability. 2009

LEED® Facts

Graduate School of Education
Larsen Hall Classrooms
2009 Renovation

Location	Cambridge, Massachusetts
Rating System	Commercial Interiors v2.0
Certification	Platinum
Total Points Achieved	44 / 57
Sustainable Sites	7/7
Water Efficiency	2/2
Energy and Atmosphere	11/12
Materials and Resources	6/14
Indoor Environmental Quality	13/16
Innovation and Design	5/5

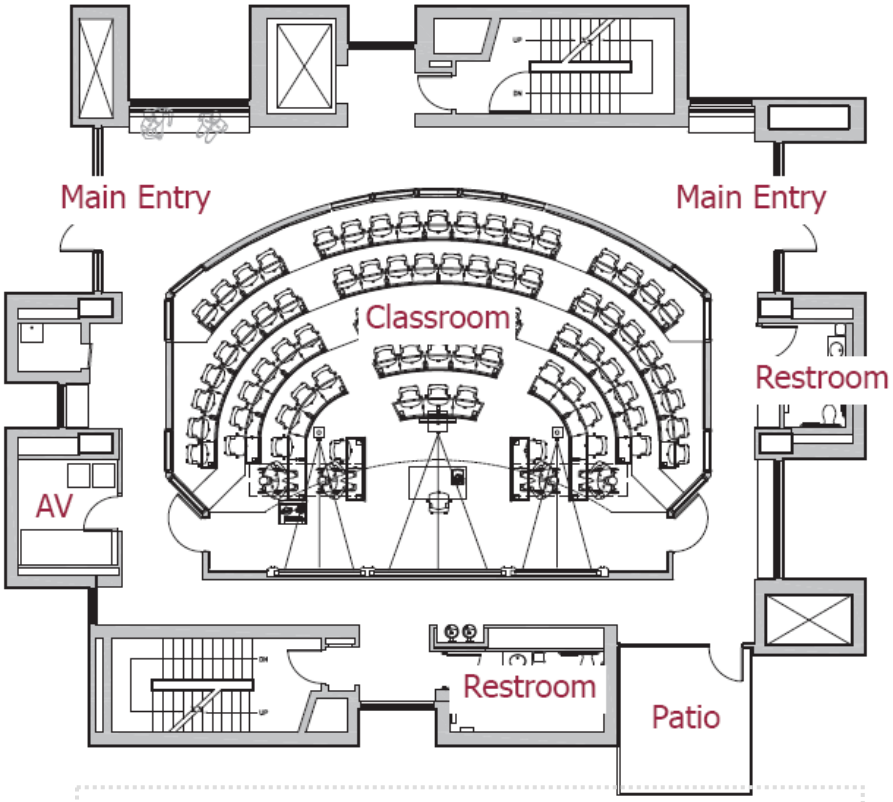
PROJECT HIGHLIGHTS

- **27%** reduction in lighting power (installed watts per square foot) by using efficient lamps and fixtures
- **22%** of the total value of materials has recycled content
- **80,730** gallons of water are estimated to be saved annually over code-maximum fixtures
- **80%** of the construction waste has been diverted from landfills.
- Heating and cooling is controlled using occupancy sensors
- Daylight dimming integrated into light fixtures near windows dim lights when there is sufficient daylight
- Fully commissioned by a third-party Commissioning Authority to verify and document the performance of the energy-related systems

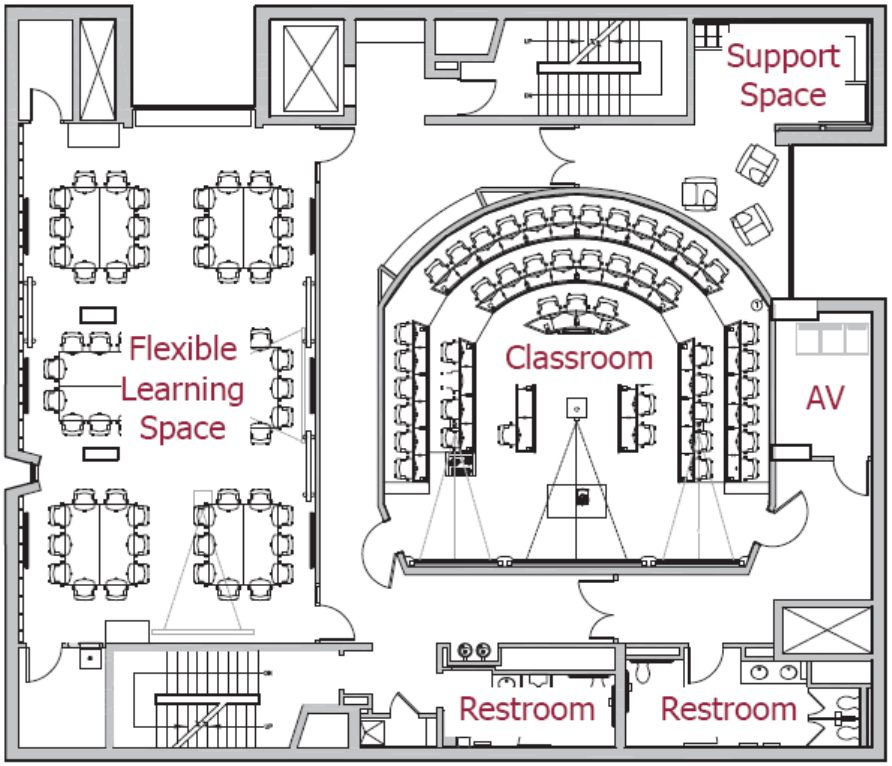
LARSEN HALL CLASSROOM RENOVATION 2009

Project Overview

Photo: Harvard Office for Sustainability. 2009



Larsen Hall First Floor



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Larsen Hall Second Floor

Project Team

Project Manager
Jason Carlson, HGSE Director of Operations
Architect
Baker Design Group
Engineer
BLW Engineers, Inc.
Contractor
Shawmut Design and Construction
Commissioning Authority
Energy Management Associates, Inc.
Sustainability Consultant
Harvard University Office for Sustainability— Green Building Services

SITE

14 Appian Way—Cambridge, Massachusetts

> To encourage alternatives to driving, all occupants of Larsen Hall have access to Harvard's comprehensive Commuter Choice program, which provides discounts on public transportation and carpooling incentives.

> The building is located within walking distance to the Harvard Square MBTA stop, several bus lines, and the Harvard University Shuttle.

> Larsen Hall also provides several bicycle racks adjacent to the building and is located within walking distance to Hemenway Gymnasium, with locker rooms and showers.

> The building is located in a dense urban area with several services, which allows occupants to walk and easily access amenities such as restaurants, banks, churches, and retail stores.

WATER EFFICIENCY

Larsen's low-flow restroom and kitchen fixtures are estimated to reduce domestic water consumption below standard Energy Policy Act of 1992-compliant (EPAct 1992) fixtures by approximately 47%. This is the equivalent of saving over 80,000 gallons of potable water per year.

Water Consumption of Larsen Fixtures versus EPAct 1992 Fixtures

Fixture Type	Larsen	EPAct 1992
Water Closet [GPF]	Dual-Flush 1.6 & 1.1	1.6
Urinal [GPF]	0.125	1.0
Lavatory Sinks [GPM]	0.5	2.5
Kitchen Sinks [GPM]	0.5	2.5
[GPF - Gallons Per Flush]	[GPM - Gallons Per Minute]	

FIXTURES IN LARSEN HALL

Please print this project profile only if necessary.
If printing is required, please print double sided and recycle when finished. Thank you!

ENERGY EFFICIENCY

MECHANICAL SYSTEMS

HGSE has committed, along with the larger Harvard University, to reduce greenhouse gas emissions **30%** below 2006 levels by 2016, inclusive of growth. To this end, energy efficiency was the primary sustainability-related goal in this renovation project.

> **Building Automation System:** All automatic temperature controls are direct digital control (DDC). Automatic controls provide energy savings based on system zoning, scheduling, occupied/unoccupied setbacks and demand control ventilation. This system monitors all the carbon dioxide ($C0_2$) sensors throughout the building and modulates the air handling unit return, exhaust and outdoor air dampers as required to maintain the $C0_2$ setpoint for demand control ventilation.

> **Demand-Control Ventilation** $C0_2$ sensors in each space provide demand control ventilation, which means the space is ventilated based on actual occupancy.

> **Occupancy-Based Temperature Control:** Occupancy sensors are used to reset the space temperature setpoint in increments of 2 degrees Fahrenheit per hour up to a total of 4 degrees Fahrenheit above setpoint in the cooling mode or below setpoint in the heating mode.

> **Heat Recovery:** A heat recovery unit was added to the air handling unit to increase outdoor air for ventilation from 25% of total air volume to 50% of total air volume.

> **Plug Loads:** Energy Star equipment was selected for all Energy Star-eligible equipment in the space. This includes three computers and a commercial refrigerator.

> **Commissioning:** The mechanical and electrical systems were fully commissioned by a third-party Commissioning Authority, which ensured that all energy-related systems were installed as designed and operating efficiently prior to occupancy.

> **Renewable Energy:** Renewable Energy Certificates (RECs) were purchased from Sterling Planet (wind power) equivalent to 100% of the anticipated electricity use of a typical 7,006 square foot classroom and office space over a two year period. The project purchased 228 MWh of RECs.

Occupancy Sensor
Photo: Harvard Office for Sustainability. 2009

ELECTRICAL SYSTEMS

> **Light Fixtures:** Energy-efficient fluorescent lighting fixtures and lamps were carefully chosen and placed to reduce electricity consumption. Through these measures, the lighting power density (wattage) is reduced by over **27%** below code-compliant fixtures. The total interior connected lighting load is 6,093 watts, which refers to demand. The estimated kWh reduction (consumption) with the installed lighting controls is **45%**.

> **Lutron Dimming System:** Classrooms 106 and 203, as well as break-out room 214 are each being provided with a complete Lutron Dimming System. Fixtures are controlled by ceiling mounted occupancy sensors that are also tied into a dimming control system. The fixtures are controlled via a system of touchscreen buttons provide flexibility in controlling various scenes in the rooms. The dimming system enables users to dim the fixtures down to 1% of their light output.

> **Occupancy Sensors:** All corridor fixtures are controlled via ceiling-mounted occupancy control sensors. These occupancy controls sensors also include a photocell in the sensor that will shut off fixtures if they sense enough daylight.

> All classrooms, restrooms, janitor closets, and storage rooms include ceiling-mounted occupancy sensors to turn off lights when not in use.

INDOOR ENVIRONMENTAL QUALITY

The Graduate School of Education is committed to providing a healthy indoor environment for all occupants. The project team was careful to maintain healthy indoor air quality during construction and to also ensure the space is designed to promote healthy indoor air quality during occupancy.

> **Indoor Air Quality During Construction:** The building maintained occupancy throughout construction. Thus, a comprehensive indoor air quality management plan was implemented during construction to maintain healthy indoor air quality. For example, all grills and vents were sealed and a HEPA Filtration unit maintained negative pressure to keep any construction debris from migrating into occupied spaces.

> **Indoor Air Quality Testing:** Prior to occupancy, indoor air quality testing compliant with LEED criteria was performed to test the levels of formaldehyde, particulates, and the total levels of Voss and ensure they were within acceptable ranges

> .

> **Materials:** Volatile Organic Compounds (VOCs) are chemical compounds and known carcinogens found in many construction materials that can have detrimental health effects on occupants. Reducing the use of Voss whenever possible improves indoor air quality and consequently occupant health and productivity. VOC limits are set by Green Seal standards and the South Coast Air Quality Management District Rules #1168 and #1113.

> Only low-VOC paints, adhesives, and sealants were used in the classrooms. The joint compound, the cove base adhesive, and the carpet adhesive all contain zero VOCs. Per LEED, carpet systems must meet or exceed the Carpet and Rug Institute's Green Label Plus testing and product requirements. Larsen's carpet meets these requirements. Additionally, none of the composite wood used contains any added urea-formaldehyde.

Thermal Comfort Survey: To ensure comfort, occupants will be surveyed about their thermal comfort at least once per season. HGSE Operations will adjust the heating or cooling and needed.

Lighting and Controls
Photos: Harvard Office for Sustainability. 2009

Material Selection

Selecting environmentally preferable materials was important to the project. Preference was given to locally manufactured, low-emitting materials with recycled content. Additionally, waste leaving the site during construction was either salvaged or recycled as much as possible.

- **80%** of the construction waste was diverted from landfills.
- **22.6%** of the total material value consists of post-consumer and/or pre-consumer recycled content materials.
- **24.9%** of the total material value consists of materials manufactured within 500 miles of the project site
- **83.1%** of the wood value consists of wood certified by the Forest Stewardship Council

Materials and Furnishings
Photos: Harvard Office for Sustainability. 2009

Environmentally Preferable Materials in Larsen

- Gypsum Wallboard (USG): 94% pre-consumer, 5%, post-consumer, 392 miles
- Ceiling Grid (Armstrong Silhouette XL): 23% post-consumer, 7%, pre-consumer, 390 miles
- Ceiling Tile (Armstrong Cirrus): 29% post-consumer, 54% pre-consumer, 390 miles
- Ceiling Tile (Astro ClimaPlus): 65% pre-consumer, 3 miles
- Countertops (Paperstone): 100% post-consumer
- Ceramic Wall Tile (Datile): 45% pre-consumer, 470 miles
- Particleboard (Vesta): 100% pre-consumer, 166 miles
- Particleboard (Uniboard Nugreen): 100% pre-consumer
- Wood Doors (Marshfield): 54% pre-consumer
- Carpet (Bentley Prince Street) 9% post-consumer, 39% pre-consumer
- Carpet (Fortune) 30 % post-consumer
- Flooring (Forbo Marmoleum): 45% pre-consumer
- Chairs (Aeron): 40% post-consumer, 20% pre-consumer
- Chairs (Equa 2): 19% post-consumer, 17% pre-consumer

Additional Resources

For more information:

> Harvard Graduate School of Education, Operations : 617.496.5766
> Harvard Graduate School of Education: http://www.gse.harvard.edu/
> Sustainability at the Graduate School of Education : http://www.green.harvard.edu/gse
> Harvard Green Building Services : http://www.green.harvard.edu/green-building-services
> Harvard Green Building Resource : http://www.green.harvard.edu/theresource