Summary

The new Harvard University Library (HUL) building is home to the Office for Information Systems, Weissman Preservation Center and Open Collections Program, as well Cambridge-based personnel for the Harvard Depository and HUL Human Resources. The Harvard University Library is the central service provider and coordinating body for the 90-plus libraries that compose Harvard's library system and together form the largest academic library in the world. Sidney Verba, Carl H. Pforzheimer University Professor and Director of the University Library, wrote, “We believe that the synergies achieved by locating these programs in a shared space will lead to new and higher levels of thoughtful service to the Harvard libraries.” The Globe Corner Bookstore, a retail establishment, currently occupies a portion of the ground level. The 30,405 square foot building is meant to “...make an architectural statement, a statement of modernity and the vibrancy of our Cambridge urban setting.” The new facility was constructed and is operated by Harvard Real Estate Services. It was designed by Leers Weinzapfel Associates Architects of Boston and the interior fit-out, including a state of the art special collections conservation lab, was designed by Alspector Anderson Architects of New York City.

Building Highlights

- Designed to be 32% more energy efficient than an ASHRAE 90.1-1999 compliant building
- Ground source heat pumps used for heating and cooling
- 96% of construction waste diverted from landfills
- Glazed curtain wall and skylights provide natural daylighting throughout the building
- Water use reduced by 43% over EPAct 1992 requirements
- First project at Harvard to use the indoor air quality testing method for LEED compliance
Summary, continued:

Very early in the design process, it was decided that the Library Services building would be an example of green design at Harvard University. This project demonstrates that a sustainable building can be constructed despite challenges associated with a small urban site, an extensive public approvals process, strict temperature and humidity requirements, and two architectural teams. The geothermal heating and cooling system was a keystone for the project. Aside from the energy efficiency and life cycle costing advantages, this system addressed community concerns regarding noisy rooftop equipment, Cambridge Historical Commission concerns regarding the scale of the building, including rooftop penthouses, and local zoning requirements. Great care was taken to allow protection of the collections while providing natural daylighting throughout the building for the 86 full-time employees.

Location

90 Mount Auburn Street is centrally located in Harvard Square, a popular shopping, dining, cultural and historical destination. The university’s central administrative structure, Holyoke Center, is located across the street. The densely developed location and two levels below grade necessitated the use of slurry wall construction techniques. The site was previously occupied by the Harvard Provision Company and two other private businesses.

Google map location of 90 Mount Auburn Street

Program

The client required that the building achieve all of the following:

- Over 24,000 net square feet of highly specialized spaces (conservation labs, training rooms, etc.) while remaining flexible for alternative future tenants (custom workstations are flexible and portable)
- An open, engaging face that speaks of the building’s internal workings, despite the institutional function
- An integrated work environment and generous visual space
- Community involvement in the design process (community groups, planning board, zoning board and Cambridge Historical Commission were all engaged throughout design)
- Sustainable design leading to LEED certification

Schedule

Schematic Design: August 30, 2002
Design Development: January 30, 2003
Construction Documents: June 25, 2003
Issued for Construction: December 5, 2003
Completion: April 2006

Project Team

Owner: Harvard Real Estate Services
Occupant: Harvard University Library
General Contractor: Jackson Construction
Civil: Green International
Landscape: Steven Stimson Associates
Geotech: Haley & Aldrich
Shell/Core Architects: Leers Weinzapfel Associates
MEP/Fire Protection/Security: Cosentini Associates
Geothermal: Water Energy Dist., Inc.
Structural: Lim Consultants
Interior Architect: Alspector Anderson Architects LLP
Lighting Consultant: Branston Partnership
Commissioning: Facility Dynamics Engineering
Waste Management: Institution Recycling Network
Sustainability: Harvard Green Campus Initiative
Building Description

The building is constructed on a dense urban site, requiring a vented slurry wall foundation system. The building occupies 68% of the 7,200 square foot site. Given the small building footprint and lot, the program was accommodated by developing two levels below grade and four levels above grade. Utilizing a concrete structure minimized the overall scale of the building. Ceiling heights were maximized by strategically locating mechanical equipment around the core of the building and exposing the concrete slabs along the perimeter. Unsightly and noisy roof top equipment was eliminated by utilizing a geothermal heating and cooling system and by introducing an areaway along the east side of the building to provide outside air to the air handling units at the sub-basement level.

The design and construction of the exterior envelope, including the rainscreen, glazed curtain wall and skylights, had to achieve special thermal and humidity performance, per Conservation Department requirements. The glazed curtain wall along the front of the building takes advantage of the building's north orientation and provides abundant diffused light to the open work spaces at each level. A series of nine skylights with louvers provide additional controlled diffused light to the Conservation Center.

The building is a concrete structure with predominantly open floor plans and exposed concrete ceilings. The open workspaces grouped at the north side of each floor take advantage of the abundant natural illumination while dropped ceilings surrounding the core contain mechanical equipment, leaving slabs exposed through the façade. Up-lights in custom workstations illuminate uncluttered slabs, enhancing the building's transparency.

Each floor's core circulation is organized by a gently folded wall of bookcases punctuated by portals into private offices. Custom furniture throughout is moveable, including the specialized equipment of the Special Collections Conservation Laboratory, a state of the art facility for treatment of rare books, manuscripts, and maps – allowing flexible rearrangement and future relocation.

Design Process

The design was carefully evaluated by zoning and historical boards. Leers Weinzapfel was brought onto the project in 2002 after Hans Hollein's design didn't pass Cambridge Historical Society approval. Construction commenced in December 2003 and was completed in May 2006. LEED documentation was submitted to the USGBC in September 2006, and a Gold rating was achieved in the summer of 2007.

During schematic design, HRES and HGCI held a design optimization charrette, using LEED as a platform. The architects, engineer, commissioning agent, contractor, University Operations, the landscape architect, and other consultants were present. The team was able to jointly decide on which LEED points the project team would pursue and to assign primary responsibility for each strategy.

A communications plan was mapped out so that all the persons involved could contribute to the integrated design process. In addition, the team was able to include green language in the RFP for the construction team, so that bidders were well informed of HRES's goal of creating a sustainable project. This process was instrumental to supporting an integrated design process.
**Sustainable Strategies**

**Site**

**Brownfield Remediation**
Given the urban nature and historic use of the site (records indicate the property had been developed as early as 1873), HRES suspected that the site soils might be contaminated. Therefore, in February and March of 2003, Haley & Aldrich, Inc. conducted a soil pre-characterization program to identify the nature and extent of potential contamination at the site, which consisted of ten test borings and the collection and chemical analysis of 34 soil samples. The tests uncovered an approximate 8 foot thick layer of miscellaneous fill material at the site. With the presence of contamination, HRES was required by the MCP to prepare a number of regulatory compliance documents, and to retain a Licensed Site Professional (LSP) to oversee the remediation work, which included onsite stabilization of soils exhibiting the TCLP-lead characteristic for RCRA Hazardous Waste, off-site soil recycling by asphalt-batching, and off-site soil reuse of soil as landfill daily cover. Approximately 2,945 tons of excavated soil consisted of remediation waste.

**Light Pollution Reduction**
The site is located in IESNA Lighting Zone 4 (Major City Center/Entertainment District). Site lighting with cut-off angles prevent light trespass.

**Alternative Transportation**
Driving alternatives are provided for employees, including discounts for ZipCar and bicycle storage. Showers are available at nearby Malkin Athletic Center. The site is easily accessible to public transportation in Harvard Square.

**Water Efficiency**

**No Permanent Irrigation System**
The use of xeriscaping and grading eliminated the need for a permanent irrigation system. Through site grading and plant selection, proper conditions are created to allow the vegetation to thrive. The planting bed is limited to a narrow strip along the eastern property line. The two main components of the planting scheme are honey locust trees (Gleditsia triacanthos inermis) and Japanese pachysandra (Pachysandra terminalis 'greensheen'), both of which are hardy and drought resistant. The accent planting includes clematis, ladyfern, and Spanish bluebells. The adjacent walkway is sloped to provide water to the planting bed.

**Water Use Reduced by 43%**
Water use is designed to exceed EPAct of 1992 baseline fixture performance requirements by 43%. The project uses Caroma Caravelle dual-flush toilets and Toto Eco-Power hand wash sinks in all restrooms. The toilets offer a 1.6 gallon “solid” flush and a 0.8 gallon “liquid” flush to reduce water consumption. The sinks distribute water at 0.5 gallons per minute, compared to the 2.5 gallon per minute standard. They also employ a hydro-turbine to automatically recharge the sensor battery every time the water is used. The sensor ensures that water shuts off when no one is present.
Energy

32% More Efficient than Code
By design, the use of ground source heat pumps, variable speed drives, energy efficient lighting, and low-e glazing in the windows and curtain wall will result in a 32% more efficient building than a ASHRAE 90.1-1999 compliant building. The building has also been designed so that the majority of fenestration is located on the northern exposure, which helps reduce solar heat gain and lessen the cooling load. The presence of natural lighting through the curtain wall and skylights helps eliminate the need for artificial lighting during the day.

Energy Simulation
An energy simulation was performed using Trane TRACE 700 v.4.1.

Ground Source Heat Pumps
Heating and cooling is provided by a ground source water to water heat pump system. The system is located in the basement and includes five heat pumps that can operate in cooling or heating mode. Direct digital controls turn the heat pumps on and off in the appropriate mode (cooling or heating) to maintain design temperatures in the heating and chilled water accumulation tanks. The chilled water and hot water from these tanks is distributed to hot water coils and chilled water coils throughout the building. Three standing column wells have been installed around the perimeter of the building as the heat source/sink for the ground source heat pumps. Ground water is pumped from the wells to the heat pumps and returned to the standing column wells. The speed of the well pumps are modulated by variable frequency drives to match the cooling and heating loads of the buildings. The hot water and chilled water distribution pumps are provided with variable frequency drives to reduce pump energy. Cooling towers on top of the structure would have increased the building height beyond zoning requirements, and also would have been quite noisy. The geothermal wells are an effective alternative to cooling towers.

Controls
A direct digital control system was installed in the building, which allows for improved control and energy savings. Occupancy sensors throughout building further reduce energy consumption.

Envelope
The envelope has been designed to be a high performance envelope. The north wall is predominantly a glass curtain wall of high performance glass. The roof is concrete with rigid insulation. The walls are block with insulation with an exterior panel system. A white Energy Star roof reduces the cooling load while also reducing the heat island effect.
Low-emitting materials

### Materials and Waste

#### 96.26% of Construction Waste Diverted from Landfills

The Institution Recycling Network was hired as the project's Waste Management Consultant. They worked with Jackson Construction to achieve an amazing waste diversion rate, especially given the site restrictions. Of the 1,370 tons of C&D waste generated, less than 6 tons was directly disposed of as solid waste and only 346 tons was taken to a fully mechanized mixed debris processing plant. The remaining 1,018 tons was source separated and recycled. C&D waste management resulted in the reduction of 642 tons of greenhouse gas emissions according to the Northeast Recycling Council’s figures.

- 5.5% recycled-content materials
- 50% of materials manufactured locally
- 13.47% of materials extracted locally (by total materials cost)

Carpet tiles with recycled content allow individual tiles to be recycled and replaced, as necessary.

Untreated concrete floors and walls are durable and require minimal maintenance and no waxes or special cleaning.

90% of wood certified by Forest Stewardship Council as coming from sustainably harvested forests.

### Indoor Environmental Quality

#### Indoor Air Quality

This was the first project at Harvard to use the Indoor Air Quality testing method for LEED Compliance (equipment pictured at the left). An IAQ Management plan also ensured healthy indoor air quality during construction.

**Daylighting:** Skylights in the roof, and a curtain wall on the north side provide extensive daylight and views throughout the building.

**Non-toxic Materials:** Low or no VOC-emitting adhesives, sealants, paints, and carpets were used. A green cleaning contract was signed to ensure that non-toxic chemicals are used for housekeeping and that resources are conserved.