Harvard Green Campus Initiative
High Performance Building Resource

One Western Avenue Case Study
LEED-NC Silver
August 2003

Summary

One Western Avenue, graduate student housing located in Allston, opened in August 2003. The project achieved a LEED Silver Rating. The building has 235 apartments for approximately 365 occupants and an underground parking garage for approximately 625 cars. The combined total budget was $105 million (Y2003). The project provides about 229,000 gross square feet of new housing on a 95,077 square foot (2.18 acre) site.

The riverfront site at the corner of Memorial Drive and Western Avenue heralds the entrance to the Harvard University campus from the south and west. A civic front with a brick U-shaped courtyard facing the river is similar to the traditional yards of Harvard Business School and Harvard's River Houses. A 15-story tower continues a tradition of tall buildings along the Charles River. An elevated bar is unique to the building. It opens views to the river from the courtyard. The front lawn flanks a similar green open space on the existing Genzyme property and creates a pleasant terminus to the Western Avenue boulevard.

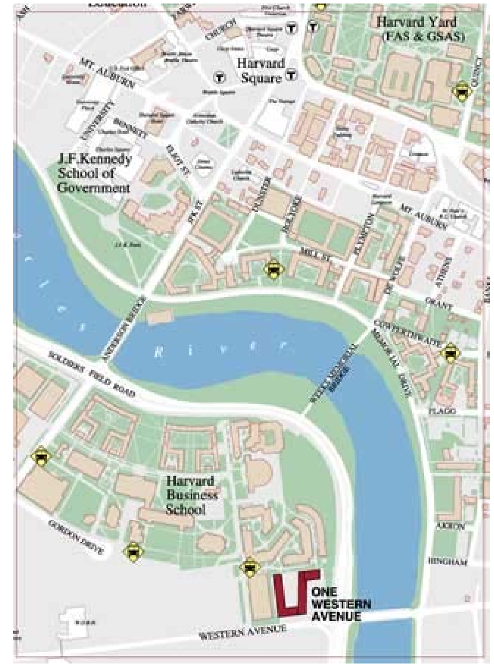
Building Highlights

- Open space along, and views to, the Charles River preserved by creating a cantilevered section of the building. 1.5 acres of open space created
- Harvard's first LEED Silver building.
- 19 electric car recharging stations in the garage, enough for more than 3% of the parking capacity
- Designed to be 50% more efficient than code.

Location

One Western Avenue is located on the corner of Western Avenue and Soldiers Field Road. The building was sited with deference to Chapter 91 of the Massachusetts General Law that protects tidal lands within 250 feet of the river. To maintain public access to the filled tidelands, One Western Avenue maintained this open space. With its prominent location, the building acts as a gateway building to the new campus in Allston.

[One Western Avenue location on Google maps]



Program

The building has approximately 230 apartments and an underground parking garage for approximately 625 cars. The project provides about 229,000 gross square feet of new housing. Harvard Residential Real Estate Services rents the apartments to graduate students. As with commercial real estate development, the rents must pay off a loan. If the 2 bedroom apartments with river views where on the public market, they would rent for more money that what graduate students could afford. To maintain this affordability, the project had to adhere to strict scheduling and budget limits.

Project Team

The university had a clear mandate from President Rudenstine to create notable architecture on significant sites. To meet this, HRES held an extensive search for a design team that began with over 50 architectural firms.

Many key professionals were involved early in the project, including a commissioning agent brought on during Schematic Design. Building operations representatives also participated in the design process. Both groups offered important insight into how the building would operate and be maintained. Also, the construction manager helped the team think through logistical and cost issues.

Client: Harvard Real Estate Services (HRES)

Project Management: Harvard Real Estate Services

General Contractor: Bond Brothers, Inc.

Architects: Machado and Silvetti Associates, Inc.

MEP: Cosentini Associates

Structural: Weidlinger Associates

Landscape Architect: Richard Burck Associates

Design Process

The building was actually designed twice; Boston Mayor Thomas Menino requested that Harvard University redesign the project for several reasons, notably the height of the tower, which originally had been 21 stories. Schematic and detailed designs were approved by the Boston Redevelopment Authority during the Article 80 Large Project Review. The impact reports submitted by HPRE included environmental considerations, construction management plans, urban design, wind and shadow effects, and the relationship to the Charles River.

The project manager introduced a commitment to use LEED standards during Schematic Design, in response to a request by his immediate Director for project managers to volunteer to participate in trialing the LEED standard. This request had emerged from a number of meetings and presentations given to members of HRES by the Harvard Green Campus Initiative targeting environmental building design.
The Harvard Green Campus Initiative provided funding for an environmental engineer and environmental architect to attend numerous planning meetings in the period from July – December 2000. Since they were not formal members of the design team, the core contribution of these professionals was the provision of primary information covering strategies for gaining LEED points, environmental product selection, contact details and recommendations for various environmental service providers. On June 27, 2001 a final presentation showing possibilities for materials that reduce waste, contain increased recycled content, are manufactured locally and/or have low-embodied energy. This presentation was extremely helpful to the architect and minimized the time they would have spent doing research into environmentally preferred building materials.

During the first design process, as part of Schematic Design, Senior Project Manager Jonathan Lavash required the architect and their MEP engineer to do a 40-year life cycle costing analysis (LCA). The study looked at sustainable alternatives in terms of initial capital cost, on-going maintenance, on-going utilities, and cost of replacement. According to the MEP engineer Bob Leber, PE, Vice President of Cosentini, hard data from operations at Harvard University, construction costs from the contractor, and cost of capital from the comptroller's office made this set of life cycle costing more accurate than the process often is. Clean Air Act Title 5 issues were considered in life cycle costing. This was the first detailed LCA undertaken in recent years in a Harvard University building design process. The process was useful in two ways. Firstly, LCA was proven to be an effective decision-making tool. However, this process also served to reveal the need for researching and developing an agreed approach to LCA for Harvard University projects. One perception of life cycle costing on the project is that results are projected costs that are unlikely to be very accurate. There are many assumptions that must be made in the LCA process that require advance research. One example of this is in relation to estimated future costs of electricity, gas and oil.

Energy

The building was designed to be 50% more efficient than code. Cosentini used Trane Trace 600 to create One Western Avenue's energy model.

An Energy Star white/high-albedo roof creates more thermally efficient design showing a small energy savings and no capital cost premium. A cool roof also reduces solar heat gain and heat island effect.

Exterior Glazing Shading Coefficient: The exterior glazing, Viracon VE1-2M, is a special glass with a lower shading coefficient. The life cycle cost analysis showed that this had good energy savings at small capital premium with a payback period of 13 years. This glazing was specified at all clear glass locations.

Heat Recovery for Exhaust Systems: Heat is recovered from the toilet and kitchen exhaust. Fresh air comes in from the outside and the heated exhaust air gives off its heat to the incoming cool air, reducing the burden on the heating system. There is some added expense because of increased ducting, but this standard and low technology system gives great energy savings and has a life-cycle payback period of about 11 years.

Green Power: HRES and HGCI negotiated a contract for Green-e certified renewable energy credits with EAD Environmental. 3,999,000 kWh worth of Renewable Energy Certificates (RECs) were purchased for a two-year period. This qualified One Western Avenue for Energy and Atmosphere credit 6, for purchasing carbon offsets for over 50% of the building's predicted energy requirements for two years.

Sustainable Strategies

Site

1.5 acres of open space was created.

Native/adapted plantings are used at One Western Avenue, including Swamp White Oak, Northern Red Oak, Native Crabapple, Fothergilia, Mountain Laurel, and Rhododendron. The use of these plants reduce demand for irrigation.

19 Electric recharging stations are provided in the garage for residents. This is enough for 3% of the parking capacity.

Materials and Waste

Construction and demolition waste was sorted on site and over 75% was diverted from disposal.

Water

No sustainable water strategies were used. The project complied with Massachusetts Building Code.

Indoor Environmental Quality

Low emitting adhesives and sealants were used.

Lessons Learned

One lesson is that negotiation for the purchase of the contract for green-e certified renewable energy credits for One Western Avenue required significant work. Finally, in spring 2005, HGCI and UOS negotiated a contract for Harvard University for renewable energy credits. Now, Harvard project managers can simply download a purchase order agreement form and purchase RECs based on the building's projected energy use, which can be found in the energy model.

One Western Avenue was denied EQc4.3 for not providing carpet cut sheets. From the specifications, it was not clear which product was used. Be sure to include cut sheets for all EQc4 projects.

Initiatives considered but not used

Some of the schematic MEP systems alternatives that were considered but not included were:

Screw Compressor Electric Chilled Water Plant and Gas Fired Hot Water Boiler Plant
It was less expensive to use gas from the city, but the project chose to use high-pressure steam for heating instead of gas because of the building's close proximity to the Harvard steam plant. Due to instability in the gas market, a longer term contract with the university was recommended from life cycle costing.

Geothermal Chiller/Boilers with Wet Wells
This was not possible due to the amount of land required. However, had the land been available, the energy savings would have been large enough for the client to strongly consider this alternative to fossil fuels dependence.

Rainwater Recycling
Rainwater recycling for site irrigation was considered, but there was considerable cost for the tank. It was prohibitive compared to the yearly water bill of $500. The building is not on a very large site, so the land around it does not require much irrigation. According to the architect, rainwater recycling is not best suited for this building because it does not have a large roof. A building with a large footprint, like a shopping mall, might be a good candidate. To have a tank above grade, on real estate that costs about $200/sf would have an adverse revenue impact. It would have the same result if the tank were to go into the parking garage, and take up two spaces, where each space is about $50,000 (Y2003 dollars).

(Rainwater recycling is now quite feasible.)

Initiatives considered but not used:

Greywater Use for Water Closets
Greywater use for water closets had a good payback of about $8,800 per year; however it was eliminated due to the upfront cost of the additional piping, holding tank, and treatment system.

Solar Energy for Domestic Hot Water
Because sustainability came in at schematic design, the project was limited to implementing strategies that would not change the building appearance. For example, the building was going through the public approval process when life cycle costing was being performed. The design team considered solar energy for domestic hot water, but they determined that the visual impact was inappropriate for such a significant site.

Exterior Insulation Requirements
Additional insulation was considered, but the reduction in building floor space due to the 2" increase in wall thickness outweighed this option. Associated costs were high, while energy savings were low.

(As demonstrated by the Blackstone renovation project, increasing insulation can result in smaller mechanical systems, saving overall cost. The envelope should be considered as a system and should undergo life cycle cost analysis with all other mechanical elements.)

Fuel Cell Technology
The benefits of fuel cells are similar to those of co-generation, but with the advantage that there are no emissions. One by-product is domestic hot water, which can run the refrigerators via an absorption cycle. Fuel cells use less expensive natural gas instead of purchased electricity from the grid. However, they required a lot of space, were too expensive, and did not have a long enough lifespan at the time of this project. According to the manufacturer, the fuel cell must be replaced every seven years at a cost of $200,000 – $250,000.

Green Roof
If the green roof had been applied, it would have reduced the air conditioning demand due to solar heat gain on the roof. However, the associated capital costs made the Energy Star roof a more favorable option.