U of M - Samuel T. Dana Building

Ann Arbor, Michigan

Case Study

THE GREENING OF DANA

University of Michigan (U of M) endured many changes, relocations, and expansions since its conception in Detroit in 1817, including a move to Ann Arbor, Michigan in 1837. The Samuel Trask Dana Building, constructed in 1901, recently underwent many renovations in order to resolve numerous maintenance issues while retaining its original structure. The Dana Building is not only a place where environmental principles are taught, but it is an example to the local community as well as the entire nation of U of M's commitment to new and innovative environmental designs.

The Dana Building renovations aimed to provide more space, create a more comfortable and productive working environment, and bring the building up to code. U of M administrators, faculty, and students who actively participated in the "Greening of Dana" project took these goals and modified them to promote green policies including the conservation of energy, water, and materials. These goals would improve the building's performance and reduce operational costs. This generated interest in applying for the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) award. The USGBC presents four different LEED distinctions beginning with certified and progressing up to silver, gold, and finally platinum which is the most prestigious label. The scoring is based on the building's performance level and environmental friendliness.

Site Management

Preserving the site's existing natural, historical, and cultural features during the renovation was important to U of M. Special locations were designated for trailers and equipment during construction while other existing open areas were protected. No vegetation was cleared beyond 40 feet of the building's perimeter. Methods for clearing and grading the site were as low impact as possible. Low impact development works to replicate the pre-development hydrologic regime of watersheds in the surrounding area.

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U of M used structural and nonstructural methods to control sediment and soil erosion while protecting existing trees and plants. Structural control included a fabric silt fence and inlet filters installed at the catch basins. Nonstructural management consisted of cleaning the trench drain and sweeping sediment that was tracked off the site.

Waste Minimization

All newly purchased products had minimal or no packaging if possible. Materials were obtained in the sizes needed to avoid additional waste from cutting and discarding extra material.

Although many modifications took place within the Dana Building, numerous materials were salvaged and reused. This included the reuse of salvaged brick and pavers in an adjoining plaza, the reuse of doors, and the removal and reuse of original roof timbers for tables. Pine beams in the old attic were salvaged and used for trim throughout the remodeled building. Furniture was refurbished and reused rather than purchasing new items.

Reusing and recycling as many materials as possible decreased the amount of debris taken to landfills. A notable recycling group in the area, Recycle Ann Arbor, assisted these efforts by gathering many reusable items and selling them through their re-use center. They also salvaged several windows and reused them.

U of M purchased new upholstery in the form of recycled polyethylene terephthalate (PET) or recycled polyester for office furniture and panels in the business office and academic programs office. Bathroom walls and floors were enhanced with tiles that are 58% recycled glass, mostly from airplane windshields that are replaced during routine maintenance. Plastic sheet material used as partitions in the bathrooms was manufactured from 100% post-consumer plastic. Ground floor corridors are paved with recycled tire rubber and post-industrial colored rubber provided by Dodge-Regupol.

Raw Resources

All purchased materials had the lowest environmental impact as possible, with preference given to recycled, renewable or recyclable materials. Ready to install wool carpeting was obtained for carpet in classrooms, offices, and corridors because it requires very little energy to manufacture. Natural cork flooring in the second floor conference rooms came from the outer bark of the cork oak tree which is harvested about every nine years to allow for new outer bark re-generation. Areas of the fourth floor were finished with bamboo flooring. Bamboo is a renewable resource that looks and behaves like a hardwood in the manufacturing process even though it is actually a fast growing grass. Some countertops and floors in the labs, closets, kitchen, and mailroom feature all-natural linoleum flooring composed of linseed oil mixed with natural resins, cork and wood flour, and organic pigments which is applied to a jute backing.

The composite material for casework and non-wet countertops was made from annually renewable resources such as wheat straw, sunflower seed hulls, soy flour, and waste newspaper. Pressed aspen fiber acoustical ceiling tiles were selected due to the fast growing nature and positive response to intensive management of the aspen tree. Low level volatile organic compound (VOC) paints, adhesives, and sealants were used for the health of the building occupants. Certified lumber for new construction was purchased from forests that are managed in a sustainable manner. Sustainable management meets the economical, social, and environmental needs of the present without compromising future generations' ability to meet their own needs.

Water Management

All plumbing equipment in the building was replaced with low-flow fixtures. The men's restrooms were upgraded with waterless urinals. Motion activated faucets replaced traditional sink faucets to eliminate the chance of water being left running while not in use. Three composting toilets were installed throughout the building. A composting toilet is a waterless toilet that produces a safe-to-handle compost "tea" through microbial decomposition in a self-contained system. The compost "tea" can be used as a plant fertilizer and soil amendment. All of the new fixtures were estimated to decrease water use by 31% and reduce wastewater generation by 50%.

The Dana Building was included in U of M's storm water management system since it is located on the central campus. The two most important parts of this system are catch basins and storm water management basins. Catch basins collect runoff and allow sediment to settle before the water is sent through the storm water lines. Storm water management basins store or impede storm water runoff, allowing sediment to settle. Both of these are maintained regularly to ensure effective flood control and pollutant removal.

U of M created the Salt Use Improvement Team (Salt Team) to reduce the amount of salt and sand used during the winter months to combat snow and ice. Normally salt melts the snow and ice while sand provides traction for pedestrians and vehicles. When snow and ice melt, the runoff containing salt and sand is deposited into surface waters causing detrimental effects to the environment. The Salt Team implemented alternative methods that include closing infrequently used areas, having snow removal crews work at night, and training snow removal crews in effective salt and sand application. Alternative de-icing and anti-icing products such as calcium magnesium acetate in granular form and carbohydrate based solutions blended with magnesium chloride are used. Innovative application equipment like the Bobcat Toolcat simultaneously sweeps snow and applies liquid de-icers.

Native plants that require no irrigation were planted outside the building. This includes short-grass prairie/oak savanna ecosystems which thrive in a hot, sunny, and dry habitat as well as a woodland ecosystem which flourishes in a shady and dry environment. Each ecosystem was planted on the proper side of the building in order to meet the required conditions.

Energy Efficiency

Fluorescent light fixtures were installed throughout the building as opposed to incandescent or halogen lights. Fluorescent lights give off less heat during the conversion of electricity into light, resulting in a more efficient use of energy. Most office and classroom lighting was improved to include sensor-activation so lights are turned off when a room is not in use.

A radiant cooling system was installed in the building rather than a forced-air system or a wall-unit air conditioner. In a radiant cooling system, cold water runs through copper pipes at the ceiling level. The cold water acts as a heat sink for the warm air in the room. Water is about three times more efficient than air as a heat transfer medium. It is estimated that this method is approximately 10% more efficient than a forced air system.

The new mechanical and electrical systems can be monitored and controlled with ease. All systems were installed with Direct Digital Controls (DDC) that display the current status of the system so any problems can be addressed quickly. Individual thermostats and light controls were placed in each room to deter occupants from using personal devices such as wall air conditioning units, space heaters, halogen lamps, etc.

A large skylight that covers the old courtyard was installed. This lets daylight travel into many interior workspaces allowing students and staff to work without artificial lights.

A complete re-insulation process was one of the most energy saving features of the entire renovation. Originally, the building had no insulation, only 16 inches of brick that separated the inside of the building from the outdoor elements. Each exterior wall was built out with steel studs and insulated with state-of-the-art soft foam on the interior face. This modification made the heating and cooling of the building much more efficient.

A 33-kilowatt photovoltaic system was added to the roof of the building after the LEED rating process was completed. The electricity generated from this system is used in the building in real time to off-set electricity generated at the U of M Central Power Plant and/or the local grid. Two types of photovoltaic panels on the roof allow students and researchers to collect data and compare the performance of thin-film and multicrystalline solar panels. Solar power provides approximately three percent of the building's electrical needs. The building would have received more points on the LEED scale if this system was installed before the scoring process took place.

The entire building is estimated to require approximately 12% less energy than it would have without all the upgrades. U of M also purchased wind energy to offset the energy load of for the Dana Building for a period of 2 years.

Economics and Society

The renovations to the Dana Building resulted in substantial monetary savings. The total energy costs for the building, including electricity, chilled water, and steam, were roughly $165,919 per year before the renovations. The total energy costs for the building are now $133,323 annually, which saves the University about $32,596 in energy costs each year.

The renovations to the Dana Building provided students and faculty with an example of how U of M is prepared to put its methods of teaching into practice. This site promotes sustainable design through higher education to its students, faculty, and all visitors in a facility that is now much more comfortable. After seeing various benefits from all features of this building, it is now much more realistic to try to incorporate these designs in many other projects.

Sustainability

Green buildings use resources like energy, water, materials, and land much more efficiently and effectively than buildings that are simply built to code. The rating system used to certify green buildings includes point allocations among five environmental impact areas. These include sustainable sites, energy and atmosphere, materials and resources, indoor environmental quality, and water efficiency. The Greening of Dana Project was scored using version 2.0 of the new commercial construction and major renovation projects scale. The building received Gold certification through the USGBC's LEED program by obtaining 40 points.

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