eco-structure

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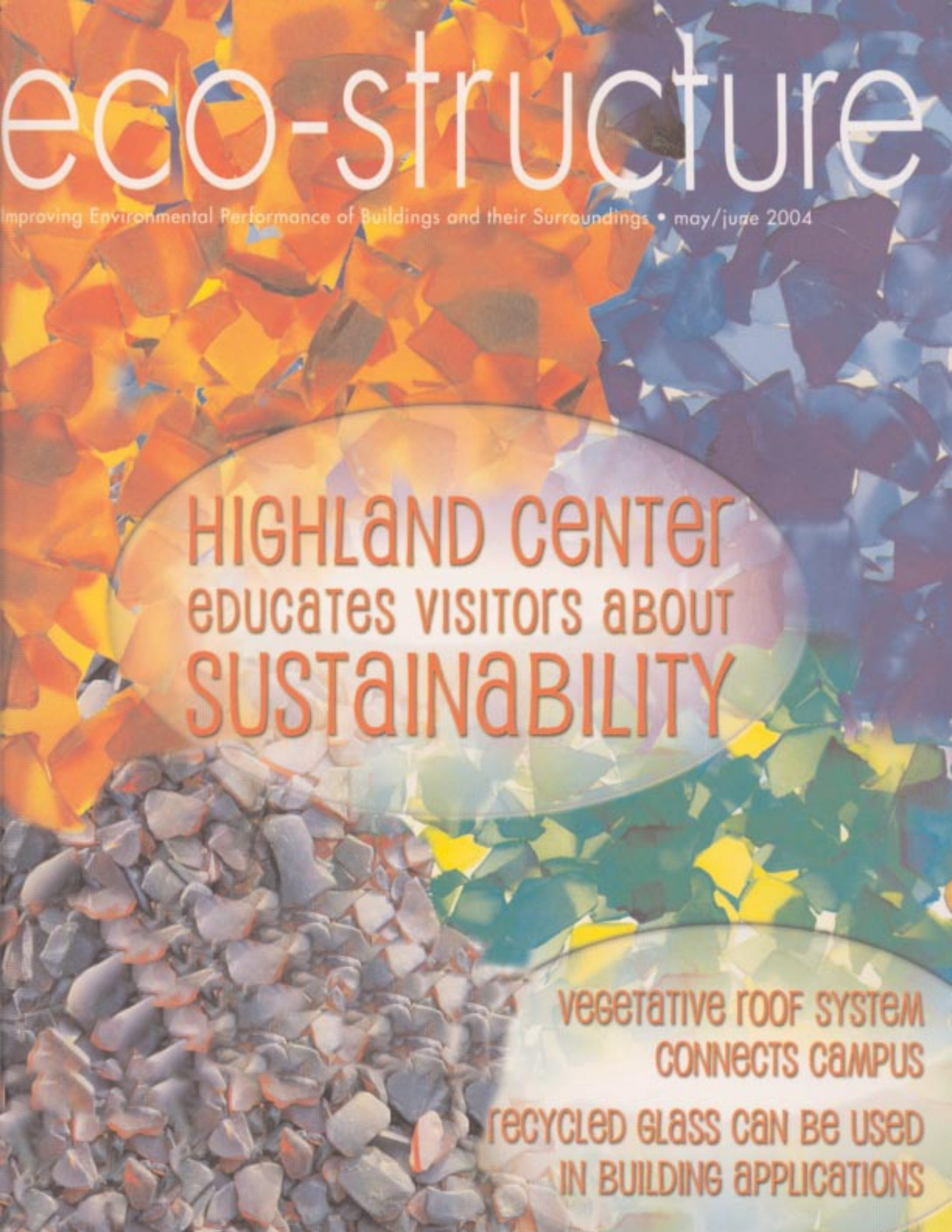

HIGHLAND CENTER EDUCATES VISITORS ABOUT SUSTAINABILITY

VEGETATIVE ROOF SYSTEM CONNECTS CAMPUS

RECYCLED GLASS CAN BE USED IN BUILDING APPLICATIONS

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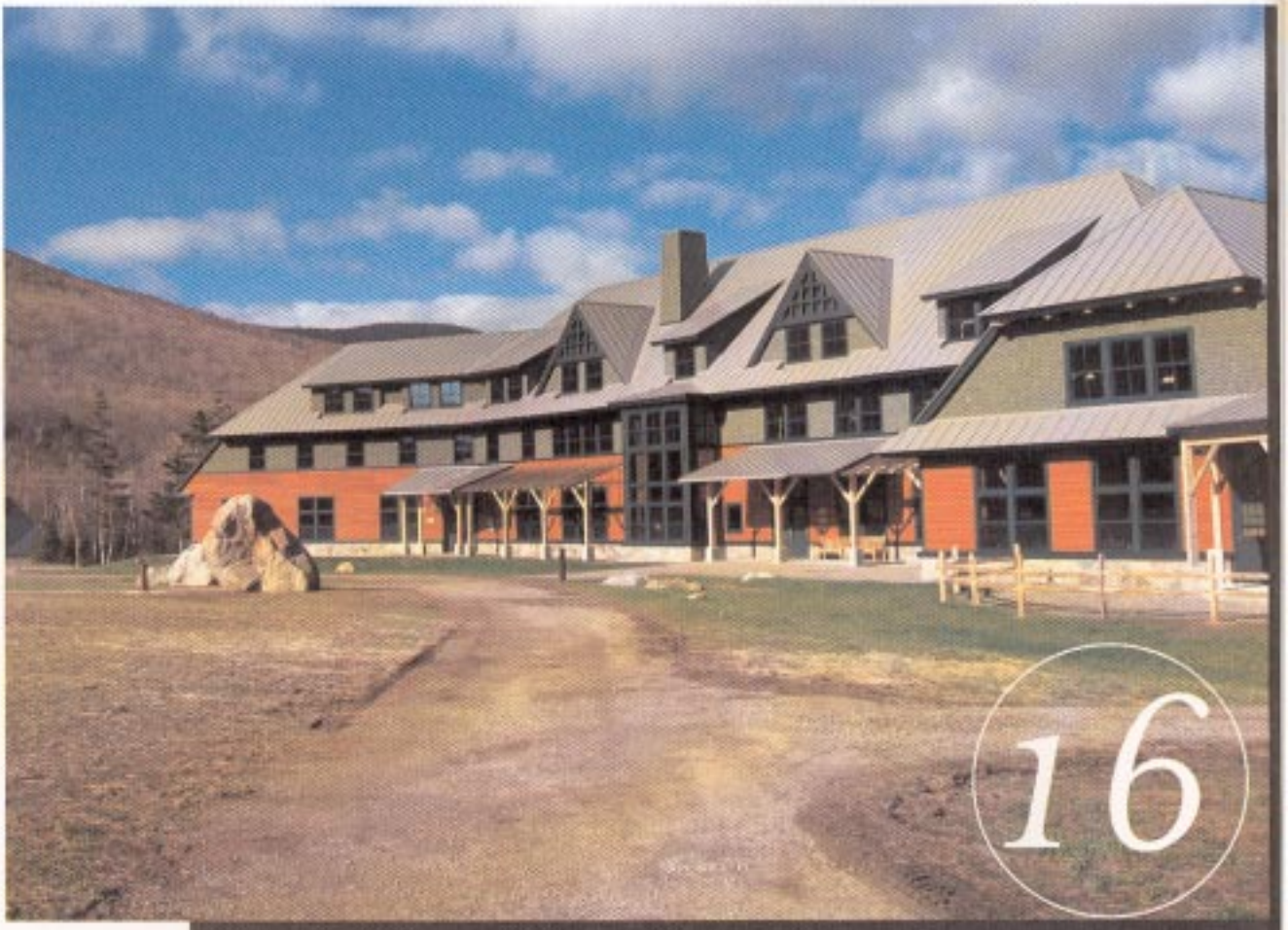
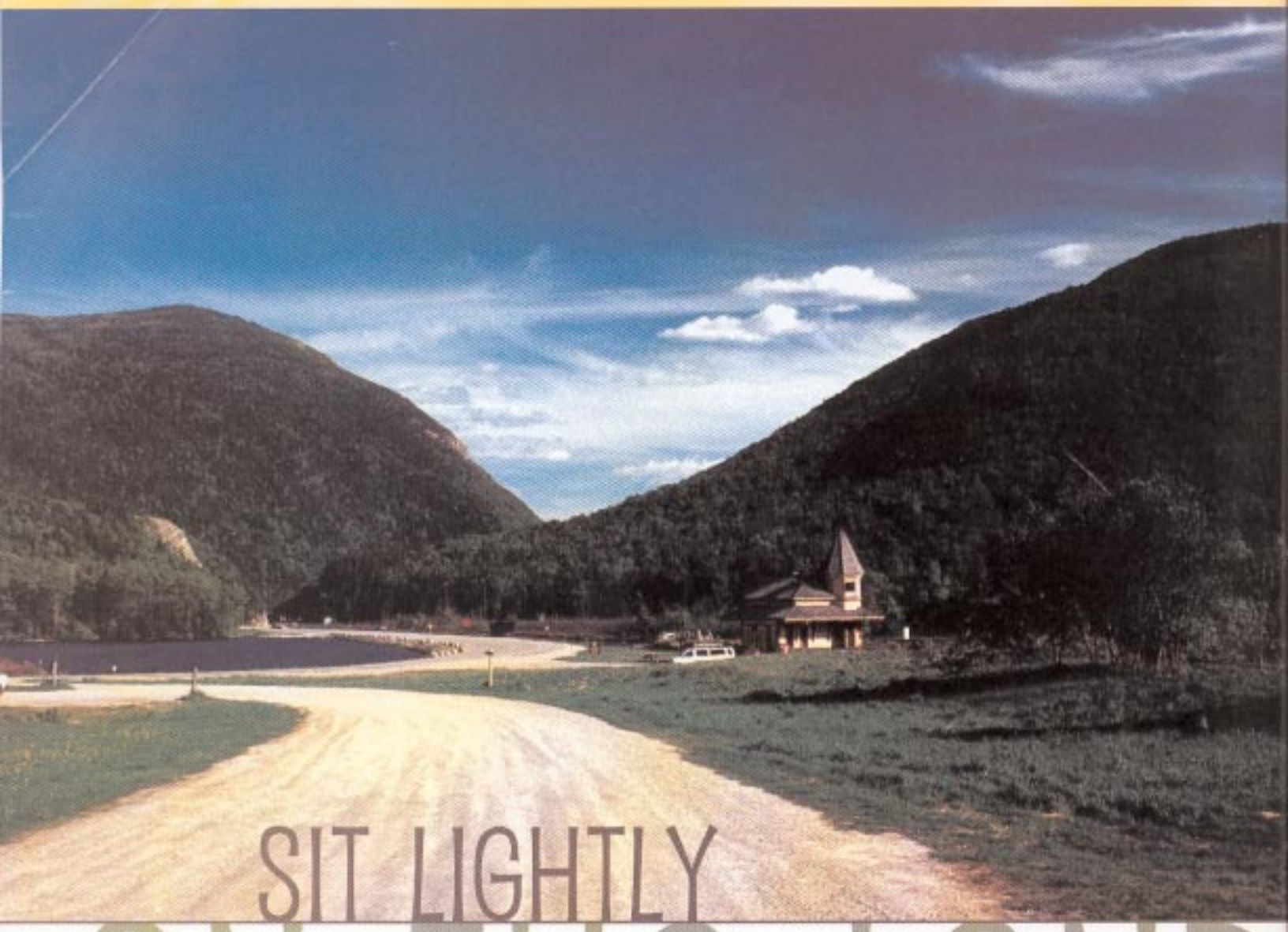




SIT LIGHTLY ON THE LAND

AN ENVIRONMENTAL EDUCATION AND LODGING CLUB INTEGRATES SUSTAINABLE DESIGN AND RESTORATION IN A NEW FACILITY

Photo by Craig Herbranson

By Christina Kaak

For centuries, travelers and outdoorsmen have enjoyed and struggled against the raw beauty of New Hampshire's White Mountains. The area is wild yet compelling and draws visitors to its trails and natural wonders, as well as inspires artists, including Frank Shapleigh, who built his studio at Crawford Notch in the late 1800s.

In 1852, a developer spied the majesty of the mountains and built Crawford House hotel as a respite from the unrestrained wilderness and harsh weather. When the hotel was destroyed by fire in 1859, a second Crawford House was constructed, this time on the highest point of the land. By 1875, the railroad brought more travelers to the region, which caused Crawford House to be expanded every decade until 1976, when it burned to the ground.

Now the area is the focus of a new type of development. The nonprofit Appalachian Mountain Club (AMC), America's oldest recreation and conservation organization, recently opened a retreat on a 26-acre (11-hectare) site surrounded by state and national parks. Known as the Highland Center, it

1880

APPALACHIAN MOUNTAIN CLUB

For more than 100 years, the Appalachian Mountain Club (AMC) has been helping people enjoy the Appalachian region through education, conservation, and recreation. More than 90,000 members currently reap the benefits of 12 regional chapters that offer year-round recreational activities.

Although 50 percent of visitors tend to be AMC members, retreats are open to the general public.

"What's most important to us is that visitors leave with a better understanding of the natural environment and how to care for it," says Paul Cunha, outdoor centers director for the Highland Center in Crawford Notch, N.H. "We also want them to gain specific new information that was fun to learn, including what green building is about and how to make it part of their lives."

For more information about AMC, visit www.outdoors.org.

1960

Photos courtesy of Appalachian Mountain Club

features the newly constructed Highland Lodge; renovated Thayer Hall, which formerly was a carriage house built in 1905; historic Shapleigh Studio (circa 1885); and Crawford Notch Railroad Depot (circa 1875).

The Highland Center captures the essence of the White Mountains in its lodging and meeting facilities, environmental education venues, and AMC staff offices. The project integrates cost-effective and proven sustainable building and landscaping techniques throughout. And, by constructing in a way that makes the new building compatible with the site and its historic structures, the retreat follows the AMC principle to "sit lightly on the land."

THE PLAN

AMC, established in 1876, promotes wise use of mountains, rivers, and trails in the Appalachian region. For this reason, the organization rarely builds. When it decided to develop the retreat at Crawford Notch, its board members and staff wanted the area to remain as undisturbed as possible and the design to be environmentally sensitive.

"We feel it's very important to educate people about the environment while providing services in concert with the natural surroundings," say Paul Cunha, outdoor centers director at the Highland Center. "Many of our outdoor activities are in special places, and these places need special treatment."

Cambridge, Mass.-based Carlone Dick LaFleche, a collaboration of Carlone & Associates and LDa Architects, was chosen to design Highland Center. They developed a master plan with support from AMC board members and staff that provided a rudimentary site plan integrating existing historical structures with environmentally sensitive new construction. The final design ensured construction and paving would disturb less than 2.5 percent of the proposed site.

Most important to the project were sensible green building practices. AMC promotes using proven, cost-effective sustainable techniques because it wants visitors to integrate similar practices in their homes and businesses after seeing how easily it can be done. For example, the Highland Center features a twice daily green tour that explains green building and shows how systems work. Cunha says a lot of people have heard about green building but don't understand what it entails. The green tour was designed to change that.

recycle, reuse!

Carlone Dick LaFleche believed it was important the Highland Center design include traditional materials, such as wood and stone, to replicate the area and the historical structures that would remain on-site. In fact, the spirit of historic structures was relied upon to design Highland Lodge with the atmosphere of a small village. In this endeavor, the architects decided to recycle and reuse buildings and construction materials still standing from the time of the Crawford House.

Douglas Dick, a partner with Carlone Dick LaFleche, believes it was functionally and sustainably important to rely on the historic buildings for design purposes.

He explains: "Common sense design strategies used in the North Country for centuries topped our list for functional reasons. For example, steeply sloping standing seam roof forms were imperative to deal with 100 pound/square foot [45 kg/m²] snow loading. By having roof pitches that exceed 9:12, the required snow loading could be reduced. Broad, deep overhangs provide shading in the summer months and help keep wind-blown rain from running down the face of the building. Placing gable dormers at building entry points also diverts sliding snow and ice from the places people will be. In addition, traditional punched double-hung windows provide a simple, easily maintained method for ventilation. The lodge also features locally produced cedar siding, which should last for decades."

Dick also saw the aesthetic and emotional importance of designing with the historic structures in mind: "We wanted to impart a sense of continuity to the built environment of the Crawford Notch site. We desired to create a building that complimented the history

Photo on left: The spirit of historic structures was relied upon to design Highland Lodge with the atmosphere of a small village

Photo on right: Guests are encouraged to interact in the lodge tradition. The Highland Lodge's Great Room offers this opportunity.

Photo below: The Highland Lodge's front desk is the center-point for all business and information.

Photos by Peter Vanderwarker.

of the existing Victorian structures yet was responsive to function and the environment. The design was an effort to show that sustainably designed buildings can respond in a compatible manner to their context—built and natural—as well as literally express the technologies involved in their construction and operations."

The center's main building is Highland Lodge, a $5.19 million new construction project that averages $137 per square foot. The structure is reminiscent of Crawford House; it features characteristics from the hotel's porch and roof line, which resembled the White Mountains' peaks.

Recycled and recyclable products were used throughout the building. Notably, the lodge's dining room features Douglas fir columns and beams that once were part of a Portland, Ore., pier. The lodge's steel frame is composed of 95 percent recycled steel and was fabricated 45 miles (72 km) from the site. The gypsum board also is locally produced and made of 100 percent recycled material.

Dick points out the unique reuse of asphalt paving installed sometime during the Crawford House era. "We crushed the asphalt on-site and used it for the new parking lot and roadway. The roadway base and top courses of gravel are made completely from crushed asphalt, boulders, and rock removed from the site during construction."

Thayer Hall, which formerly was a 10,000-square-foot (929-m²) carriage house, had a basic timber frame, which Dick describes as "serviceable and visually attractive." Because the structure was sound, it made sense to reuse the building. However, it had no foundation, and its location didn't fit the Highland Center's new schematics. Therefore, it was moved intact to a new foundation.

"Once the building was placed on its foundation, the challenge was providing for the programmed functions, including offices, meeting rooms, assembly space, and dorm rooms, within the 8-foot [2 2/5-m] timber-frame grid without losing the wonderful aesthetic of the barn," Dick remembers. "Because of the natural fire-resistance of large wood timbers, we were able to leave the timbers and some roof rafters exposed to celebrate the aesthetic of the original barn."

Sprinklers and reinforcing steel channels under the roof and timbers brought the building to current building code requirements.

Thayer Hall now features offices to accommodate 40 AMC staff members and an art gallery that doubles as a meeting area for 200 people. Conference rooms also are available, and the second floor includes 20 dormitory rooms for staff.

During construction, Shapleigh Studio also was relocated intact to the site's perimeter and placed on a new foundation. The former painting studio had served as an AMC hostel. It now includes a library, small kitchen, and apartment for visiting scientists, artists, and writers. The studio remains virtually unchanged from its original design.

The Crawford Notch Railroad Depot, which served railroad passengers in the late 1800s, now is a visitor center for guests arriving by car or train. The historic building already had been renovated before the Highland Center project began and served as inspiration for the Highland Lodge's design.

In addition, two cabins on the site were too small to be used by AMC. They were donated to a nearby village and combined and renovated into a new town hall.

energy efficiency

An integral design characteristic of Highland Center's buildings is energy efficiency. Simple and complex strategies were integrated to ensure the buildings exceed the New Hampshire Energy Code.

For example, all buildings are situated east to west to maximize daylighting, summer breezes, and views of the area, as well as minimize noise from nearby Route 302 and

Photos by Carlone Dick LeFleche, Cambridge.

Thayer Hall after

Thayer Hall and Shapleigh Studio (bottom right) were relocated to new foundations during the Highland Center project.

Photo by Peter Vanderwarker.

The lodge's dining room features Douglas fir columns and beams that once were part of a Portland, Ore., pier.

PROJECT TEAM

ARCHITECT AND PLANNER
Carlone Dick LaFleche, a collaboration of Carlone & Associates and LDa Architects, Cambridge, Mass., www.cdl-arch.com

LANDSCAPE ARCHITECT
Halvorson Design Partnership, Boston, www.halvorsondesign.com

STRUCTURAL ENGINEER
LeMessurier Consultants, Cambridge, www.lemessurier.com

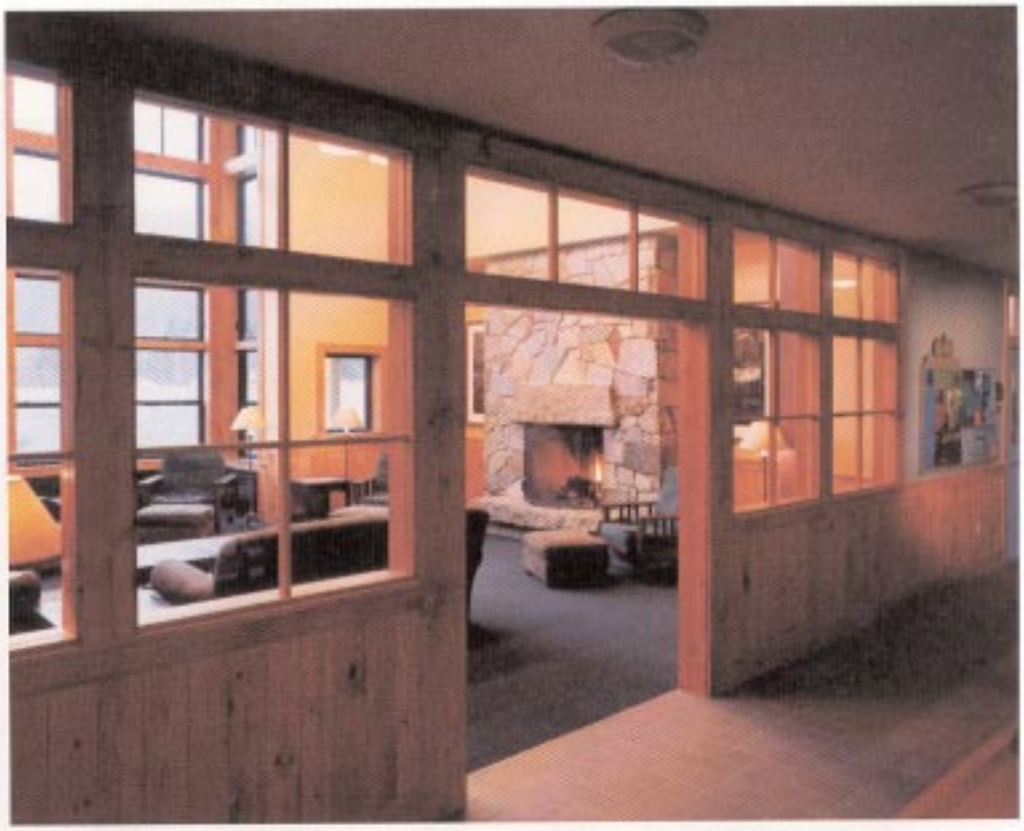
MECHANICAL/PLUMBING ENGINEER
Kohler and Lewis, Keene, N.H., www.kohlerandlewis.com

ELECTRICAL ENGINEER
Downing Engineering, Harrisville, N.H., 603-827-3672

ENERGY CONSULTANT
Energysmiths/Marc Rosenbaum, Meriden, N.H., mjr@valley.net

CIVIL ENGINEER
H.E. Bergeron Engineers, North Conway, N.H., www.hebcivil.com

CONSTRUCTION MANAGER
MacMillin Co., Keene, www.macmillin.com



The Highland Lodge's interior windows allow hallways to bask in natural light.

Thayer Hall features the Brad Washburn Conference Center, as well as offices, meeting rooms, and dorm rooms within the timber-frame grid of a barn.

the AMC parking lot. More than 60 percent of the lodge's triple-glazed fiber-glass single-hung windows face south; service area windows typically face north. The windows have an R-value of 8. Interior windows also allow hallways to bask in natural lighting.

In addition to daylighting, the architects specified compact fluorescent lighting within the lodge and outlying buildings. The site has minimal outside lighting so visitors can admire the millions of stars in the night sky.

Dick emphasizes the design team and construction manager constantly were reminded of the importance of the building envelope for the Highland Center: "In the White Mountains and this microclimate at Crawford Notch, the hours of direct sunlight are limited—even in the summer—because of the proximity of the mountains to the east and south. There are a high percentage of overcast days, weeks of subzero temperatures and near constant winds, which sometimes exceed 75 mph [121 km/h]. Therefore, our most important 'green building' technology involved the building envelope."

Topping the list of building envelope necessities was insulation. Because the lodge has a braced steel frame, it required an uninterrupted insulating wrap outside of the frame and metal stud infill. The construction team integrated 6 1/2 inches (165 mm) of expanded polystyrene insulation panels in Highland Lodge's walls; 8 1/2 inches (216 mm) of insulation panels were installed in its roof. The insulation type was chosen because its manufacturer recycles scrap insulation during processing, and the insulation is not blown with ozone-depleting gases. As a result o these strategies, the walls and roof featur thermal ratings of R-27 and R-34, respectively

Thayer Hall's unoccupied attic holds 1 inches (457 mm) of blown cellulose; the wall include 6 inches (152 mm) of blown cellulose Because of thermal breaks in the wall insula tion, the entire building was wrapped in

Photo by Peter Vanderwarker.

1 1/2-inch (38-mm) foil-faced rigid insulation before the building wrap and shingles were installed.

To help buildings remain warm during extensive heating months, a centralized boiler system was specified for building heat and water. The system burns biomass, namely locally harvested cord wood, scraps, pallets, etc., and is expected to use 70 cords of wood during the heating season.

"Crawford Notch is not an ideal location for photovoltaics, and because the building is not air conditioned and the temperature extremes are so great, geothermal did not make economic sense. Biomass was most logical. The abundance of sustainably maintained forests within 50 miles (81 km) of the Highland Center suggested wood was the ideal fuel," Dick explains.

In each building, the biomass system is supplemented by fuel-oil fired boilers that heat water during the summer months. A separate building houses the biomass system and an electric generator. The systems are wired so AMC has the ability in the future to convert to a biomass co-gen boiler and produce heat and electricity on-site.

Other Sustainable Characteristics

The Highland Center also features water conservation and indoor air quality techniques that meet AMC's requirements and increase the comfort of the facility's guests.

Although ample water is supplied by two on-site wells, low-volume faucets and toilets, and showers instead of bathtubs have been installed in the lodge and Shapleigh Studio. Thayer Hall and the train depot feature composting toilets. In addition, wastewater is treated on-site by a septic treatment/nitrogen removal system.

Highland Lodge features room for 120 guests. All guest-room windows can be opened to the great views of the beautiful land that beckons. Because visitor air quality is a concern, paints used in guest rooms and throughout the project are low- or non-VOC. Carpeting also was specified to avoid allergens.

Landscaping was an important part of the Highland Center's design. Because the area

has remained in disarray since Crawford House burned, landscape architects, Halvorson Design Partnership, Boston, determined the landscape should look as though it was in a "perpetual state of forest regeneration," according to Dick.

"Various parts of the site are landscaped in various stages of a forest's transitional life cycle, from post-fire meadow to deciduous forest to more mature evergreen forest," Dick explains.

Halvorson Design Partnership specified indigenous plants in its landscaping design. Many existing trees were dug up and transported to a holding nursery until construction was completed; they later were replanted on the site. Because of the harsh weather conditions in the area, indigenous trees grow in odd shapes and often are twisted and stunted. The replanted trees portray these features better than nursery trees would.

AMC worked with a local organization to choose and plant flowers in the main portion of the site; their choice was native wildflowers that do not need irrigation.

In addition, the landscape architects created paths and installed interactive signs to teach visitors about the White Mountains' ecosystems. Boulders placed throughout the site also are educational tools that remind visitors of the glaciers that once moved across the land.

environmental good

From early 2000 until the grand opening in October 2003, the Highland Center was in a state of planning, design, and construction. It's easy to see why Dick has so much pride in the work his firm completed.

"The most rewarding aspect of the project was working with AMC, a client that was totally dedicated to creating a building that supports its mission statement to protect, enjoy, and wisely use the Appalachian region. By creating a lodging and education center that exemplifies this statement, much environmental good can come from this project."

Historically billed as a destination to enjoy the cool summer climate, dramatic landscapes, and outdoor activities, the White Mountains at Crawford Notch undoubtedly also will teach visitors about the importance of sustainable design, thanks to AMC and the Highland Center's dedicated project team.

sustainable materials and sources

building envelope

Highland Lodge wall and roof insulation and Thayer Hall roof insulation
INSULSPAN ▸ CIRCLE NO. 64
Blissfield, Mich., www.insulspan.com

Thayer Hall cellulose wall insulation
NU-WOOL ▸ CIRCLE NO. 65
Jenison, Mich., www.nuwool.com

Highland Lodge and Thayer Hall triple-glazed, low-E fiber-glass windows
ACCURATE DORWIN ▸ CIRCLE NO. 66
Winnipeg, Manitoba, Canada
888-982-4640

Highland Lodge and Thayer Hall thermally broken aluminum entry doors
EFCO ▸ CIRCLE NO. 67
Monett, Mo., www.efcocorp.com

Highland Lodge and Thayer Hall polyurethane foam sealant on doors and windows
ILLBRUCK ▸ CIRCLE NO. 68
Minneapolis, www.illbruck.com

Highland Lodge and Thayer Hall mineral wool sound batts
ROXUL ▸ CIRCLE NO. 69
Milton, Ontario, Canada, www.roxul.com

flooring

Carpeting, 89 percent recycled content
SHAW ▸ CIRCLE NO. 70
Dalton, Ga., www.shawfloors.com

Quarry tile
AMERICANOLEAN ▸ CIRCLE NO. 71
Dallas, www.aotile.com

Engineered hardwood flooring
MANNINGTON ▸ CIRCLE NO. 72
Salem, N.J., www.mannington.com

Epoxy flooring
PALMA INC. ▸ CIRCLE NO. 73
Bloomfield, N.J., www.palmainc.com

Fluff-cord strip tile (recycled tires)
MUSSON RUBBER CO. ▸ CIRCLE NO. 74
Akron, Ohio, www.mussonrubber.com

roofing

Coated steel standing seam roof system
INTEGRIS ▸ CIRCLE NO. 75
Minneapolis, www.integrismetals.com

interior products

Low-VOC paints in guest rooms
BENJAMIN MOORE ECOSPEC ▸ CIRCLE NO. 76
Mont Vale, N.J., www.benjaminmoore.com

Formaldehyde-free medium-density fiberboard (MDF) cabinets
MEDEX ▸ CIRCLE NO. 77
Medford, Ore., www.sierrapine.com

Plastic laminate veneer on MDF cabinets
WILSONART ▸ CIRCLE NO. 78
Temple, Texas, www.wilsonart.com

Gypsum wall board, 95 percent recycled content
USG ▸ CIRCLE NO. 79
Chicago, www.usg.com

Locally quarried stone
FLETCHER GRANITE ▸ CIRCLE NO. 80
Westford, Mass., www.fletchergranite.com

Mechanical ventilation system
VENMAR CES INC. ▸ CIRCLE NO. 81
Onalaska, Wis., www.venmarces.com

Recycled wood for Highland Lodge dining room
BENSON WOODWORKING CO. ▸ CIRCLE NO. 82
Walpole, N.H. www.bensonwood.com

heating/ventilating/air cond.

Biomass central boiler
GARN ▸ CIRCLE NO. 83
www.garn.com

Heat recovery boilers and water heaters
GEA-ECOFLEX ▸ CIRCLE NO. 84
Louisville, Ky., www.gea-ecoflex.de

HUBBELL ELECTRIC HEATER CO. ▸ CIRCLE NO. 85
Stratford, Conn., www.hubbellheaters.com

water conservation

Low-flow toilets in Highland Lodge and Shapleigh Studio
CRANE PLUMBING ▸ CIRCLE NO. 86
Evanston, Ill., www.craneplumbing.com

Composting toilets in Thayer Hall and Crawford Notch Railroad Depot
CLIVUS MULTRUM ▸ CIRCLE NO. 87
Lawrence, Mass., www.clivusmultrum.com

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