

Enkadrain®

**DIVISION 7
DRAINAGE &
WATERPROOFING**

**Stoneview Guesthouse
520 sq. ft. Living Roof**

Designer / Builder:

*Rob Roy
West Chazy, NY*



Stoneview Guesthouse living roof

Living Roof Complements Cordwood Masonry Guesthouse

Earthwood Building School has been teaching workshops on cordwood masonry and earth-sheltered housing since 1981, when the school was founded by husband and wife team Rob and Jaki Roy. Although professional architects and builders sometimes attend the classes, most of the students are owner / builders, many without any previous building experience.

Cordwood masonry is an old building technique where walls are constructed of short logs — often called “log-ends” — laid up transversely, much as a cord of firewood is stacked. The walls are easy and inexpensive to build, often make use of “waste” wood, and have exceptional thermal characteristics thanks to the special insulated mortar matrix that weaves in and out between the log-ends.

All of the ten buildings on the Earthwood campus have living roofs, with the exception of the cordwood masonry garage. Two of these outbuildings are small guesthouses for students to stay in during workshops, and each of these have green roofs based on a hay bale substrate.

In 2004, the Roys decided to build a larger guesthouse that could sleep up to four students. There were several new building techniques that the couple wanted to test on this guesthouse, including cordwood masonry within an octagonal post-and-beam frame, the use of “lime putty mortar,” and construction of a light-weight living roof.

Totally saturated earth weighs about 110 pounds per cubic foot, almost ten pounds per square foot (psf) per inch of thickness. In the seventies, Roy developed a drainage system for his earth roofs using 2 inches of crushed stone beneath the soil and a 3-inch layer of loose hay or straw used as a filter to keep the drainage layer clean. Although the system worked, there were problems that made it less than ideal — such a drainage layer added another 20 psf to the roof load and tons of crushed stone had to be manually hauled up onto the roof.

Roy was familiar with Enkadrain subsurface drainage products and always made his students aware of this light-weight alternative to traditional gravel drainage. He contacted Colbond to provide a drainage solution that would help reduce the total weight of the roof and cut installation time by up to 70%. Colbond supplied Enkadrain 3615R for testing with Earthwood’s living roof system.

Enkadrain consists of a thick drainage core of fused, entangled filaments formed into an elliptical pattern made from post-industrial recycled polypropylene with a non-woven filter fabric bonded to one side or two sides. It was the first drainage composite introduced to the construction market over 25 years ago, and has proven and predictable flow rates — unlike crushed stone. Enkadrain is flexible and conforms to any surface profile — making it easy to install.

At Stoneview Guesthouse, the designer was looking at 10-foot clear spans for the radial



Interior cordwood masonry wall detail.

Roy’s new book *Earth-Sheltered House: How to Build an Affordable Underground Home* (New Society, March, 2006) contains a step-by-step photo essay detailing the construction of the Stoneview roof.

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The octagonal post and beam timber frame.

roof rafter system. With the stone drainage layer and the usual 7" of soil — plus the 70-pound snow load for the area — a saturated roof of this kind could weigh about 180 psf. Heavy and expensive five by ten (5" x 10") rafters would be needed to carry the load. In order to use more reasonably sized four by eights (4" x 8"), the load would need to be reduced to 130 psf — a little more than a 25% reduction in weight.

Enkadrain weighs only 2.27 ounces per square foot, so roughly 20 psf could be saved by substituting Enkadrain for the crushed stone. Further weight reductions needed to be made in order to cut an additional 30 psf off the roof load. A student introduced the Roys to sedum, a family of succulent plants with the ability to store moisture in their leaves, a characteristic that helps see them through drought without watering. Lush roof gardens of sedum have been grown on as little as an inch of soil. By reducing the soil mass from 7" to 3.5", the additional weight was saved.

Stoneview's roof decking consists of two-by-six (2" x 6") tongue-in-groove spruce planking nailed onto 16 four-by-eight radial rafters. The roof pitch is 1:12. Drainage is very good and the earth does not slump or travel to the edge. A 5" drip edge was fastened all around the octagon roof. Over the planking, W.R. Grace Bituthene® 4000 waterproofing membrane was applied. The designer's earth roof philosophy is that roof insulation should be placed *over* the membrane to protect it from frequent freeze-thaw cycling. "Along with ultraviolet (UV) damage, freeze-thaw cycling is one of the most severe causes of roofing substrate breakdown," stated Roy. A two-inch layer of R5 Dow® Blueboard™ polystyrene was chosen, R10 in all.

On top of the insulation, a 6-mil black polyethylene sheet was installed — the base of the all-important drainage layer. "Drainage is the better part of waterproofing, says Roy.



Jaki Roy tapes the Styrofoam together over the waterproofing membrane.

Water will always take the easiest path. It is poor strategy, no matter how good the membrane, to try to dam the water out of the building. The polyethylene sheet is not intended to be a waterproofing membrane. It simply helps shed most of the water to the edge of the building, and protects the insulation."

Next, Enkadrain 3615R was installed right to the edge of the roof. The filter fabric prevents soil fines and particles from entering the drainage core, keeping it free and clear for maximum flow. The Enkadrain 3615R was then covered with 5.5" of loose topsoil. Rain and the heavy snow load of the first winter compressed the topsoil to 3.5", the depth at which it has remained. Four-by-four pressure-treated landscaping timbers were used around the edge of the roof (placed right over the Enkadrain) as a means of retaining soil.

The roof was planted with sedum, chives, vinca, and wildflowers. During the summer of 2005, it was the most lush and beautiful of the nine living roofs at Earthwood. There have been no leaks through two winters, even though a well-drained stovepipe penetrates the various layers. "The combination of using Enkadrain and drought-resistant plants on shallow soil has allowed us to keep the load down to the 130 psf required for our rafter system. And it was infinitely easier than manually hauling tons of crushed stone onto the roof," said Roy.

"The only change I would make would be to use Enkadrain 3811R, which has fabric on both sides of the drainage core. The second layer of fabric would be added protection for the 6-mil polyethylene sheets, says Roy. Enkadrain met all of our expectations and certainly worked to our satisfaction. I recommend the Enkadrain line of composite drainage products to students and building colleagues, and look forward to trying Enkadrain 3811R on our next living roof."

In addition to Enkadrain, Colbond also manufactures other products used in green



Trapezoidal pieces of Enkadrain 3615 cover the octagonal roof.



Rob Roy spreads topsoil (400 pails in all) over Enkadrain.

roof construction. Enkarook VM is a one-inch thick 95% open matrix with a filter fabric bonded to one side used to pre-grow plants. The plant roots become entangled in the matrix which is then rolled up and delivered to the site as a ready-planted "instant" living roof. Enkamat is a three-dimensional matrix product used on steep slope roofs or in high wind conditions. It anchors plant roots and helps prevent soil loss during extreme hydraulic conditions.

For more information about these and any other products marketed and manufactured by Colbond Inc. visit www.colbond-usa.com or call 800-365-7391.

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