



PREFABULOUS + SUSTAINABLE

BUILDING AND CUSTOMIZING AN AFFORDABLE, ENERGY-EFFICIENT

SHERI KOONES

FOREWORD BY ROBERT REDFORD

Contemporary Farmhouse

Structural Insulated Panels (SIPs)

PHOTOGRAPHER:

Eric Roth Photography
(unless otherwise noted)

MANUFACTURER:

Winterpanel

ARCHITECT:

Christian Brown, Christian Brown Design

BUILDER:

Leach Construction of Vermont, LLC

LOCATION:

Jericho, Vermont

SIZE:

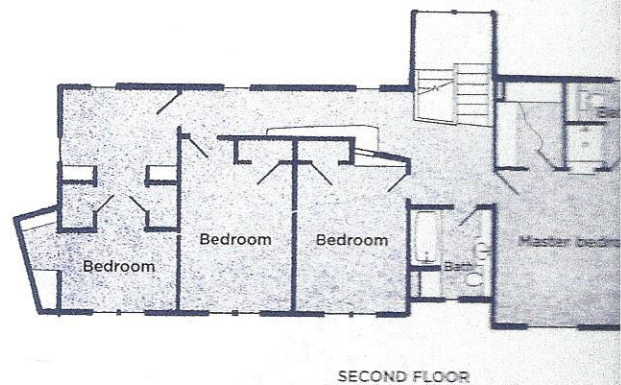
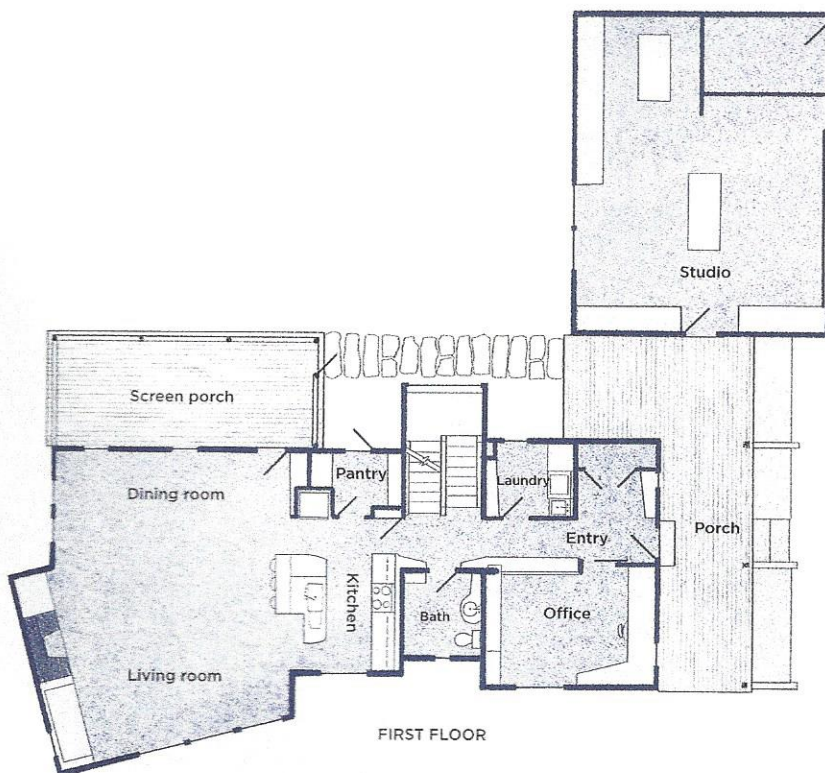
2,600 square feet

RATINGS:

ENERGY STAR—five star plus

GREEN ASPECTS:

Passive solar design
ICF (Insulating Concrete Form) foundation
Fiber cement siding
ENERGY STAR windows
ENERGY STAR appliances and lighting
High-efficiency heating system
Direct-vented gas fireplaces
Heat recovery ventilator
Standing-seam metal roof
Wheatboard cabinetry
Resin doors made from post-industrial reclaimed material
Bamboo flooring
Rubber flooring
Ecoresin panels for kitchen cabinets
Low-VOC (Volatile Organic Compound) paint finishes



The house was oriented for maximum solar gain and to leave as many trees as possible undisturbed. Trees within the footprint of the house were dug up and and replanted. All plants are native and require minimal water.



When it came time to design a house for his own family, architect Christian Brown faced the hardest-to-please client of his career—himself. He wanted his own home to be beautiful, highly energy efficient, contemporary in design, but not so modern that it wouldn't fit in with the traditional regional style of rural Vermont. Thus he decided to build a contemporary farmhouse.

A Composition in Green

Christian was amazed by the variety of green building materials that were available, and realized that designing his own house would provide an excellent opportunity for experimentation. In his workshop, out back behind the house, he fabricated many of the interior elements for the house using these new materials.

With energy efficiency as his top priority, Christian knew that the choices of materials for the "shell," or the exterior envelope of the house, were critical. The foundation he chose was Insulated Concrete Form (ICF) (see Insulated Concrete Form Foundations sidebar, opposite), which created a heavily insulated, waterproof, and airtight basement, with a temperature variance of only a degree or two throughout the year.

Christian decided that the outer walls should be SIPS, because of their strength, excellent energy performance, and environmental friendliness. SIPS create little waste, provide a beefy R-38 insulating capacity (an excellent ability to resist the escape of heat) and are made from ori-

ented strand board, which is manufactured using small-diameter, fast-growing trees, rather than mature trees.

Christian produced computer generated designs for the house and submitted them to his local SIPs manufacturer, Winterpanel. There, computer-controlled high-tech machines cut window and door openings in each finished panel. The SIPs were delivered to the site on a flatbed truck. Leach Construction put the panels together and topped the house off with a roof of 2 x 12 lumber insulated with R-50 closed-cell foam insulation.

Unlike an average house, a structure this tight doesn't leak air, and therefore needed mechanical ventilation to exhaust moisture and stale air and draw in fresh air. Fortunately, a heat recovery ventilator (see Heat and Energy Recovery Ventilation Systems sidebar, page 85) does all this, while also saving (recovering) the heat from the expelled air.

For roofing, Leach Construction installed a durable standing-seam metal roof. Red and brown fiber cement clapboards and panels (see Fiber Cement Siding sidebar, page 233) cover the exterior. This material is fire-, moisture-, and impact-resistant, in addition to being extremely durable.

Experimenting with New Materials

In the kitchen, Christian built concrete countertops (see Concrete Countertops sidebar, opposite) for the first time. It was a challenge building the forms because of all the curves in the design, but Christian appreciated the opportunity to

OPPOSITE ABOVE Forms fit together like Legos, assembled in rows with windows and doors cut out to fit the ICF foundation. (Photographs by homeowner)

OPPOSITE BELOW The house was oriented for maximum solar gain to leave as many trees as possible undisturbed. Trees within the footprint of the house were dug up and replanted. All plants are native and require minimal water.



Insulated Concrete Form Foundations

ICFs are reinforced Styrofoam forms, or molds, into which concrete is poured. These are stacked, held together by plastic or metal connectors and, as in a traditional foundation, steel rebar is placed inside the forms before the concrete is poured. The Styrofoam is left in place and once the concrete cures, the outside is waterproofed and the interior is covered with drywall. The result is a strong, airtight, well-insulated, and waterproof foundation. The density of the concrete keeps basement temperatures stable. ICF concrete often contains a high content of recycled fly-ash, a residue produced during the combustion of coal at coal-fired electrical plants. The rebar is made from eighty percent recycled steel. ICFs are quickly assembled and allow for a high indoor air quality thanks to the watertight walls. To learn more, visit www.forms.org.

Rubber Flooring

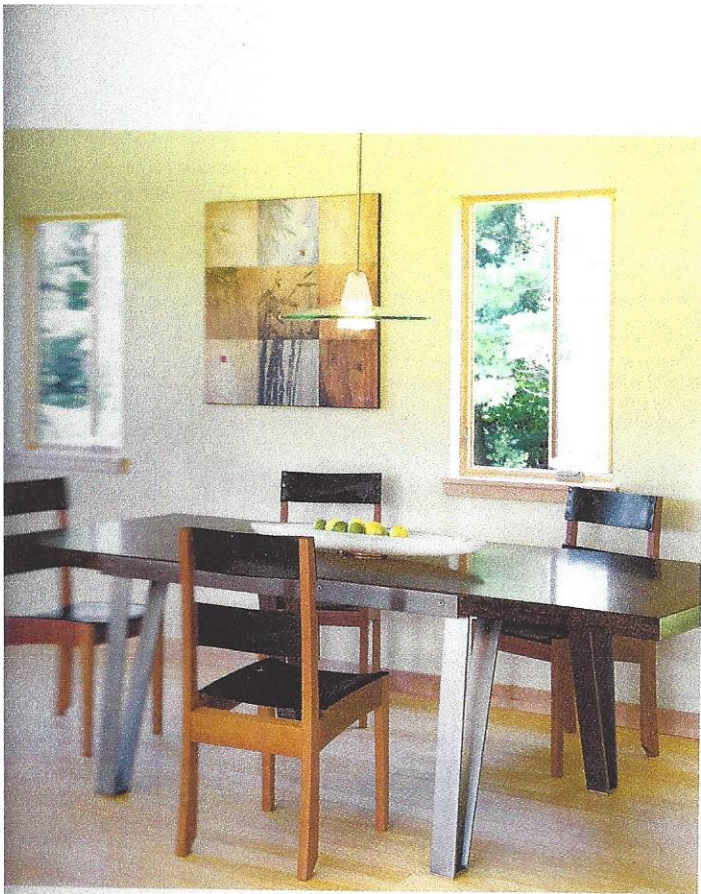
The rubber flooring used in the master bathroom and main entryway contains recycled rubber made in a process that uses a minimal amount of water and little or no heat. The flooring is low in VOC emissions, extremely durable, nonflammable, available in lots of colors, and less expensive than many other flooring materials. Christian says it is not slippery when wet, and practically indestructible. To learn more, visit www.Ecosurfaces.com.

Concrete Countertops

Concrete is practical, versatile, and can be customized in an infinite number of ways with a combination of grinding, polishing, stamping, staining, and imbedding objects. The ancient material (the Romans built with it) is also less expensive than many other types of countertop materials and can adapt to any style of kitchen or bath. Plenty of instructions are available for do-it-yourselfers. Christian bought colors and mix for his concrete countertop from Cheng Design Products. He chose concrete because of its earthy appeal, reassuring density, and ease of customization. To learn more, visit www.chengdesign.com.



Christian fabricated the stairs from Laminated Strand Lumber (LSL), which he sanded thoroughly and finished with a urethane sealer. The engineered lumber is incredibly strong, saved him money, and has a unique look. The handrails are cherry wood with stainless steel cables.



LEFT Christian designed and built most of the furnishings in the house, including the dining room table and chairs.

BELOW Except for the upholstered pieces, Christian built all the living room furniture. The fixed, or inoperable, windows were designed to open the house to the beautiful views while not impeding them. The awning windows below, open for ventilation. Here the flooring is bamboo, a highly renewable material.



customize their color, shape, and design. He had aluminum scraps that were found at a scrapyard embedded into the concrete countertops for visual interest.

Christian chose wheatboard, a product made from recycled wheat straw, to handcraft the kitchen cabinets and built-ins throughout the house. Panels made with strands of wild grasses pressed between sheets of a translucent resin were inset into the kitchen cabinet doors and the divider that separates the living room from his home office. Christian selected an engineered material—laminated strand lumber—for the stairs. People generally use this material for heavy framing, and rarely as an exposed surface, but Christian was not deterred. He sanded it thoroughly and finished it with a water-based urethane. The results speak for themselves: The treads and stringers (the sides of stairs) cost far less than if they'd been built with finish lumber, and the stairs are incredibly strong and have a terrific look that is both rustic and contemporary. To highlight the stairway, Christian decided on cherry wood handrails and stainless steel cable rails.

In the entrance and master bathroom, floors are a colorful rubber, which Christian sought out because it is immensely eco-friendly (see Rubber Flooring sidebar, page 25). Even with three small children in the house, these floors have proven to be virtually indestructible. What is more, they are comfortable to the foot and do not get slippery when wet.

Comfort and Light

Christian oriented the house in such a way that would best capture sunlight and aligned it with a long stretch of tall pines on the property, which make a beautiful backdrop. Large roof overhangs block the high summer sun but let the lower winter sun shine inside. The overhangs also allow the

family to leave windows open even when it rains.

Thanks to its solar orientation and narrow footprint, the family rarely has to turn the lights on during the day. Christian was careful to plan the lighting scheme with many task lights, situating light just where needed (which saves electricity), instead of installing larger fixtures as general lighting. Because the house is built so tight and energy efficient, the family's electric bill is very low compared to similar size houses in the area.

Jutting out at the rear of the house is the stair tower, which includes highly efficient, top-to-bottom Kalwall panels. These panels are thick sandwiches of reinforced, translucent fiberglass with insulating material in between, which let in lots of light without sacrificing energy efficiency. Christian likes the panels because they form what looks like a huge shoji screen.

The stairs have no risers, so the abundant light streaming through the Kalwall panels is able to pass into the house. The family leaves two hopper windows at the top of the tower open from April through October, as they are protected from the elements by the deep overhang. The stair tower acts as a chimney, letting hot air rise up and out, providing the house with a natural cooling source.

To heat the first two floors, Christian had hydronic radiant floor heating (see Hydronic vs. Electric Radiant Heating sidebar, page 125) installed. To save money, radiators heat the top floor. The water for both hydronic systems is warmed by a small, on-demand boiler, which satisfies all the hot water needs of the family, though it's only the size of a small suitcase. A super insulated holding tank can prioritize water distribution for showering, rather than for other uses. A direct-vented gas fireplace in the living room provides extra heat on the coldest Vermont winter days.

OPPOSITE ABOVE LEFT: Christian incorporated junkyard aluminum into the kitchen countertops. The biggest challenge he faced creating the countertop was curves in the forms.

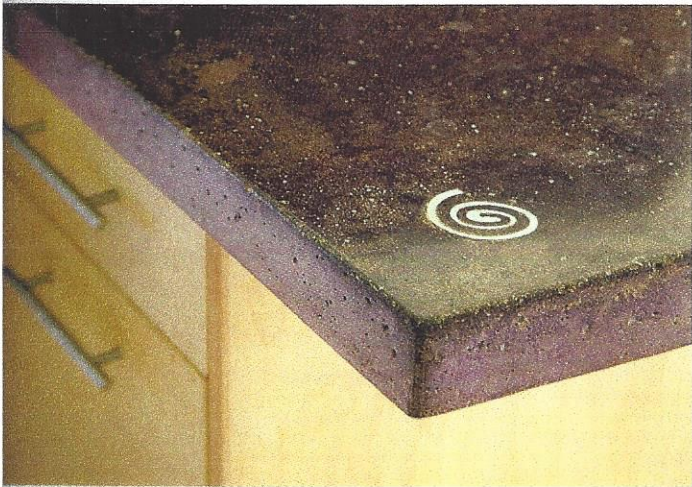
OPPOSITE ABOVE RIGHT: The countertops are made of concrete. Flooring is an eco-friendly material which Christian says is nearly indestructible.

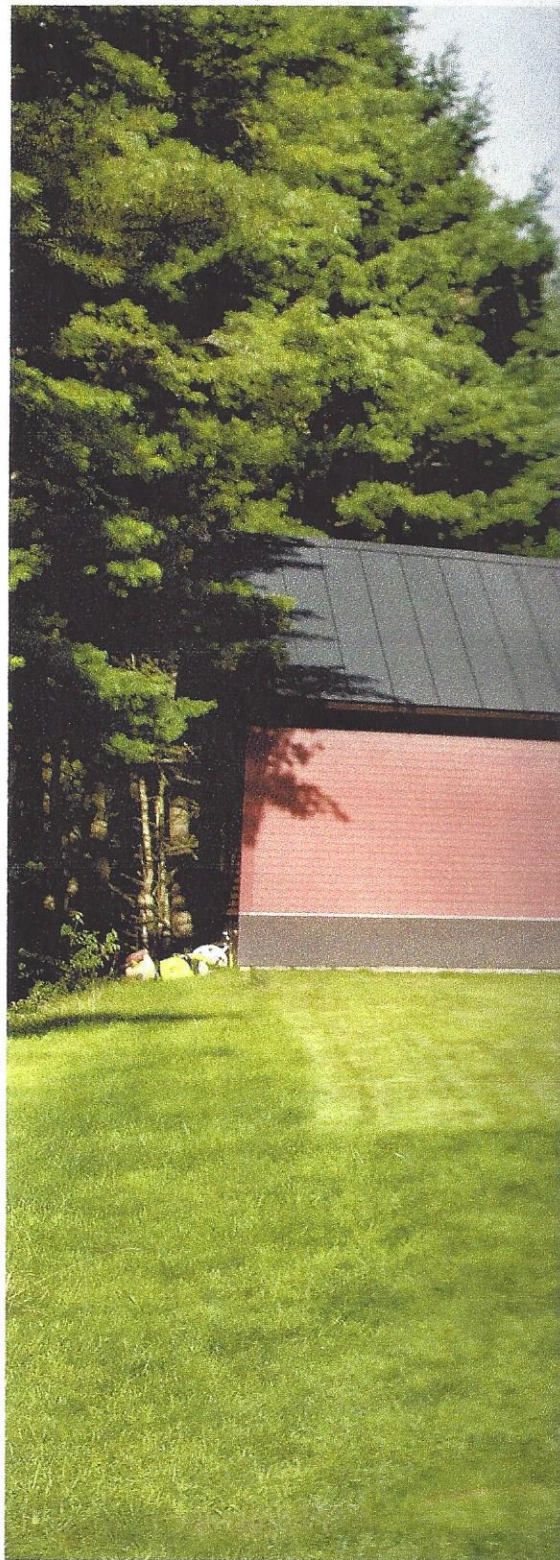
OPPOSITE BELOW: The kitchen cabinets are made of wheatboard, a plywood-type material made out of ground wheat stalks, together with a formaldehyde resin. Strands of grass are inset within the layers for an earthy natural look. Christian also inset the concrete countertops and added stainless-steel tiles as a backdrop.

OVERLEAF LEFT ABOVE: Worked a SIP wall into place with the aid of an aluminum wall jack, an apparatus that allows builders to lift much larger sections of wall than they could by hand. (Photograph by homeowner)

OVERLEAF LEFT BELOW: Christian designed these rusted planters and his neighbor constructed them. These plants, as well as those on the rest of the landscape, are native to the area.

OVERLEAF RIGHT: Connected to the house by an open walkway is a workshop/garage. The stair tower jutting out on the rear includes insulated translucent panels that let in light without sacrificing energy efficiency.





A Work in Progress

It was a dream come true for Christian to design and build a house for his own family. The end result of his self-described “relentless curiosity” is a house that is a compelling and attractive mix. Its SIPs walls, textures, colors, and creative design come together to form a home that is, inside and out, an extremely energy-efficient and sustainable home structure.

