



The First Optimum Performance Home™

structural aspects part VI

Gary Reber

synopsis

As with the mechanical infrastructure, the structural aspects of the Optimum Performance Home utilize several leading-edge building technologies to create the most energy-efficient and durable design possible.

The design of the foundations is such that each flooring surface is perfectly level with the other. This is an important aspect of the home's universal design floor plan that eliminates any challenging physical barriers such as steps, humps, bumps, edges, or uneven surfaces that could pose a potential accidental trip or fall.

Three types of wall system construction will be utilized in the Optimum Performance Home: Amvic Insulating Concrete Form Building System and ThermaSAVE Structural Insulated Panel Building System for exterior walls, and light-gauge (cold-formed) steel-frame construction for interior walls.

Introduction

This is the sixth article in the series documenting the design and construction of the first Optimum Performance Home™. The project has been selected by the U.S. Green Building Council (USGBC) for inclusion in the national Leadership In Energy & Environmental Design (LEED®) for Homes pilot program, their new green build certification initiative.

The home will be built at The Sea Ranch, located in Sonoma County, along the Northern California coastline of the Pacific Ocean.

The showcase project is exemplary of the "Ultimate Home Design™" concept, which integrates age-friendly universal design with the best sustainable building practices while exerting minimal impact on the environment. Universal design is the inclusive, non-discriminatory design of products, buildings, environments, and urban infrastructure, as well as information technologies that are accessible to and useable by (almost) all. With respect to home design, the idea is to design and build homes that have no physical barriers, thus sustaining people of all ages and all capabilities in a functional, comfortable, and aesthetic lifestyle.

A building science systems approach to home building is the cornerstone of the project with emphasis on the relationships



The Sea Ranch, Sonoma County, California

"The goal is to demonstrate how today's products and building methods can make life safer, more comfortable, and more enjoyable. The science of optimum performance homes is about building structures that use less energy, are quieter and more comfortable, have fewer problems with material degradation, provide clean air and water, and do less damage to the environment."

between the home's components and the envelope they create. Also paramount is good stewardship—proper regard and respect for the rights of neighboring homeowners, resource efficiency, and the surrounding natural setting. The goal is to optimize occupant health, comfort, and safety; maximize energy efficiency and structural durability; and minimize environmental impact. In addition, the aim is toward providing a nurturing home environment to support independent living and sustainable lifestyles.

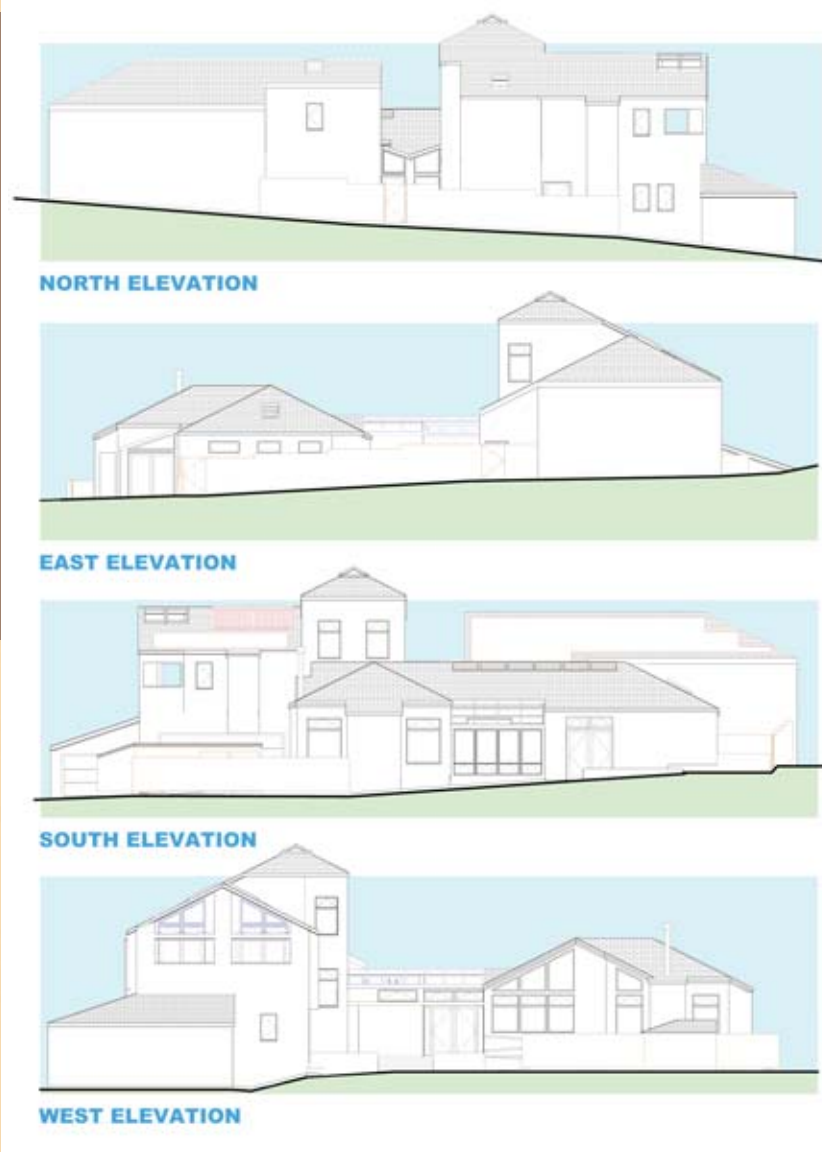
Part I of this case study series appeared in Issue 1, January/February 2006. The introductory article extended to 16 pages and covered extensively the project scope.

Part II appeared in the March/April issue and focused on site planning and preparation.

Part III expanded on the approach to Low-Impact Development (LID) for the site in the May/June issue.

Part IV appeared in Issue 4, July/August, and presented the Revised and Second Revised Final plan submittal to be reviewed by the Design Committee of The Sea Ranch Association. Part of the revisions included further refinement to the site plan and drainage design, which was hopefully the final condition to be met before the project would be permitted to be submitted to the Sonoma County Building Department for final structural and code approval, necessary to obtain a building permit.

Part V presented the initial approval by The Sea Ranch Association Department of Design, Compliance &



The elevations of the Optimum Performance Home at The Sea Ranch



A perspective of the southwest view created by architectural designer Ed Rose.

Environmental Management (DCEM) stating that the Revised and Second Revised Final plan submittal for the proposed home, and the associated grading/drainage and landscape plans were reviewed by The Sea Ranch Design Committee and that the architectural/ structural and grading/drainage submittals have been granted final approval with conditions that translate to clarifications on certain building components and material finishes. These conditions, with the exception of the need to acquire final approval for an on-site landscape plan, have now been satisfactorily addressed in the Third Revised Final plan submittal dated September 20, 2006, and have been removed by the Design Review staff. A letter indicating Final Approval for The Sea Ranch Association Construction Performance Permit was issued on October 11, 2006 for presentation to Sonoma County to obtain a county building permit.

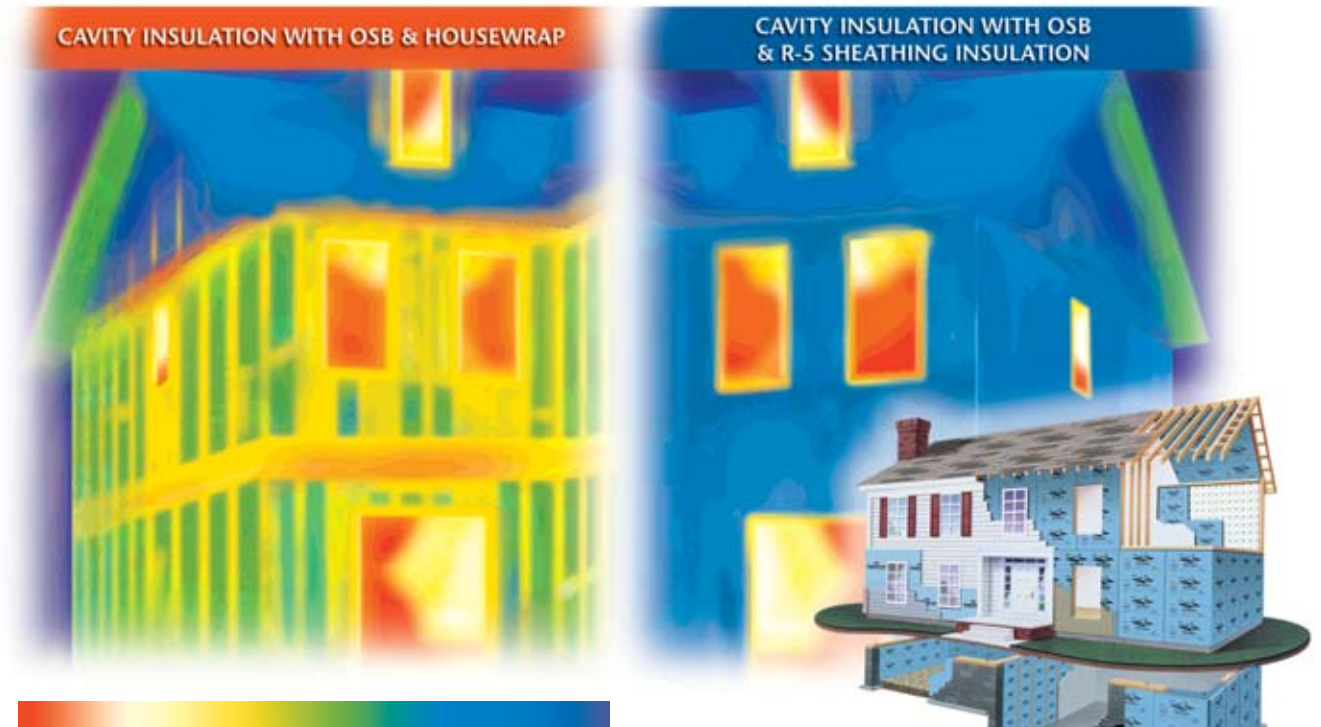
Also covered in Issue 5 were particular aspects of the home's mechanical plan.

The necessary work to address the remaining architectural/structural, grading/drainage, and landscaping concerns is nearly complete. This work includes the structural and mechanical plans for the Optimum Performance Home, necessary as part of the construction plans submittal to Sonoma County. Final construction plans are now in the review process with the Sonoma County Building Department and Third Party Plan Check Review. Assuming no further delays, the issuance of permits, the commencement of construction, site grading, foundation, and mechanical infrastructure could start by late November 2006.

In this, Part VI of the case study series, the focus will be on certain structural aspects of the Optimum Performance Home.

SCIENCE SAYS

it's time for
builders to cross
the thermal bridge.

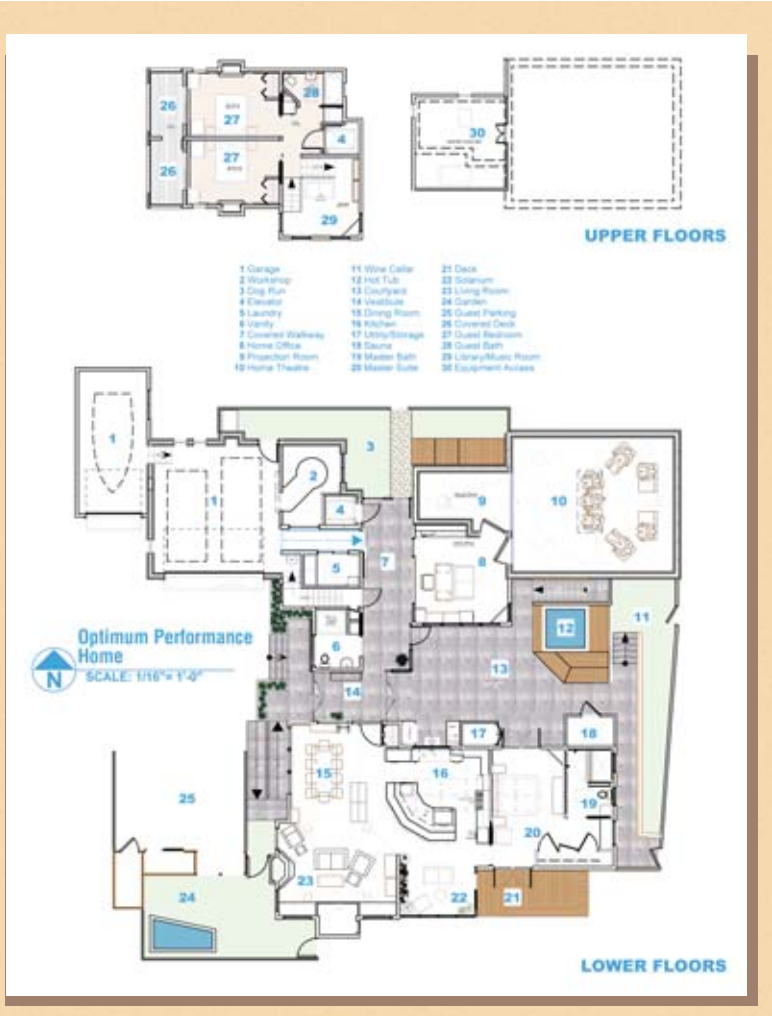


Graphic re-creation of thermal bridging in a typical building wall envelope. Heat loss is indicated on a scale of red, the most heat loss, to purple, no heat loss.

STYROFOAM™ extruded polystyrene and polyisocyanurate insulation from Dow reduce thermal bridging with a continuous layer of insulation.

It's called "thermal bridging." You can actually see how heat moves through studs and other uninsulated parts of a wall, causing higher utility bills for your customers. To learn how STYROFOAM™ extruded polystyrene and polyisocyanurate insulation from Dow prevent thermal bridging and reduce the potential for moisture, call your Dow sales representative or visit our website.



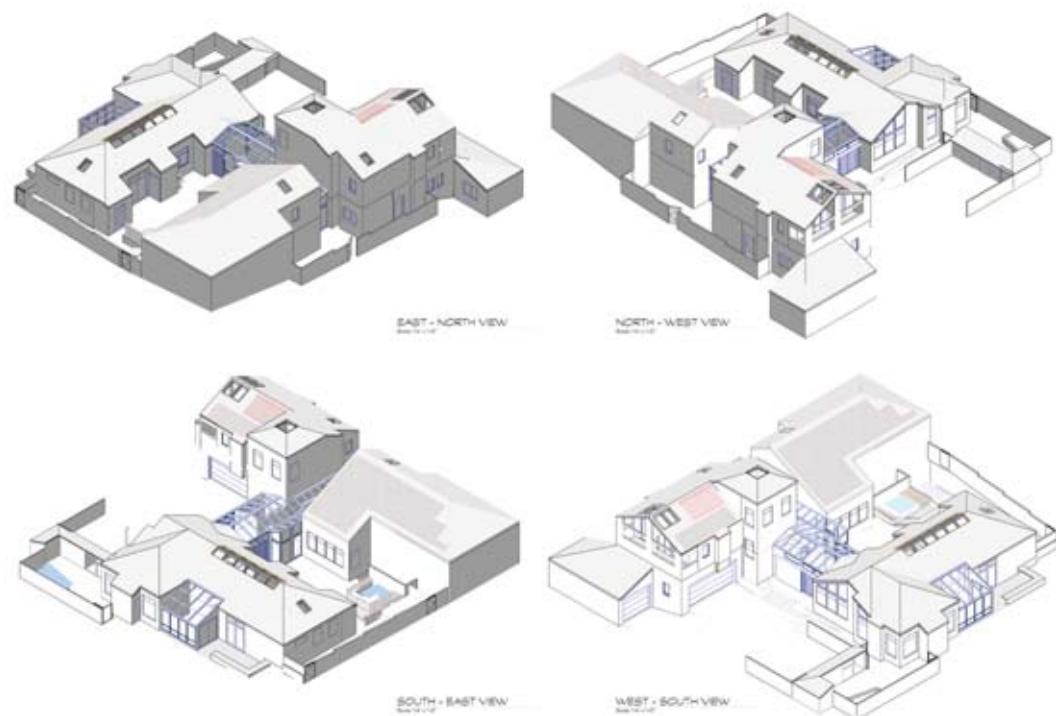


Structural Aspects

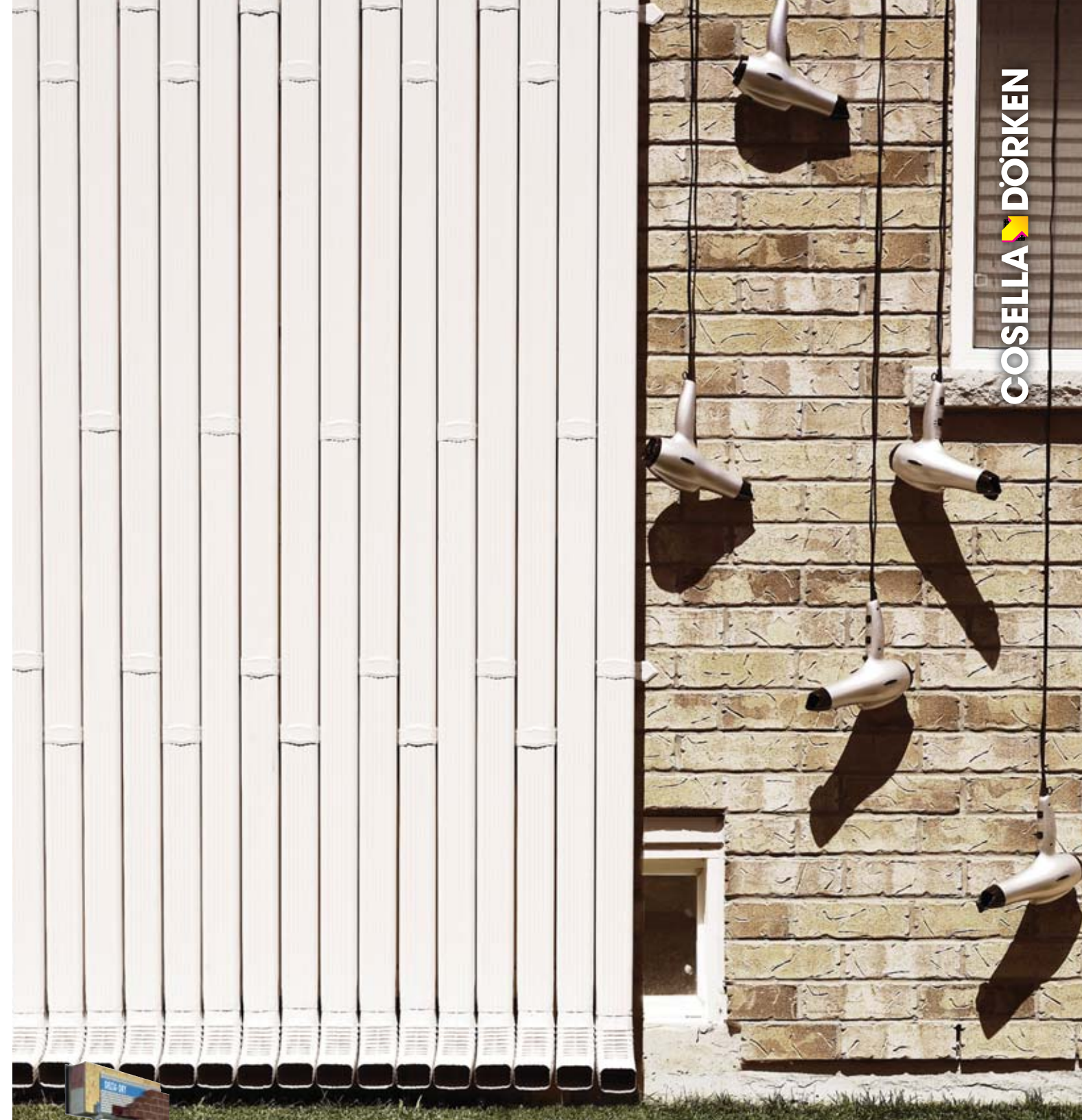
As noted in the previous articles in this series, the home design integrates all of the concepts advocated in *Ultimate Home Design*. The goal is to demonstrate how today's products and building methods can make life safer, more comfortable, and more enjoyable. The science of optimum performance homes is about building structures that use less energy, are quieter and more comfortable, have fewer problems with material degradation, provide clean air and water, and do less damage to the environment. As an integrated holistic design, the house will serve as a home for many people and serve in many phases in one's life.

The Optimum Performance Home's site plan is designed to strongly support the efficient use of the community's water supplies, equitable allocation of water resources provided by the community and harvested on-site, elimination of water pollution and contamination from poorly designed or failing septic systems, and general land use patterns that conserve and protect water resources within the overall ecosystem at The Sea Ranch. The water-efficient site plan and drainage design promotes "smart water use."

As with the mechanical infrastructure, the structural aspects of the Optimum Performance Home utilize several leading-edge building technologies to create



Four perspective views of the Optimum Performance Home at The Sea Ranch



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the most energy-efficient and durable design possible. The home is designed to cut its energy use with efficiency, and then meet the remaining needs with renewable energy sources.

Foundations

The home's 3,272 square feet of living space (4,899 square feet including garages, covered walkways, courtyard, and decks) will be arranged in a three-building compound using a well-sealed, well-insulated, super-tight building envelope that reduces temperature fluctuations and enhances overall energy efficiency.

The slab foundations are designed as two structural elements: one foundation to support the main residence and guest quarters, including the garages and insulated- and solar-gain-reduced-glass vestibule and covered walkway. The second foundation is dedicated to

support the home office and state-of-the-art Optimum Performance Home Theatre™ and integral rear-projection room. This foundation is physically separated from the main residence/guest quarters foundation by an inch. The purpose is to isolate the acoustical vibrational properties of the home theatre complex from the living quarters.

The design of the foundations is such that each flooring surface is perfectly level with the other. This is an important aspect of the home's universal design floor plan that eliminates any challenging physical barriers such as steps, humps, bumps, edges, or uneven surfaces that could pose a potential accidental trip or fall. Where steps are required at the home's entrance, a ramp is also provided as an alternative approach. The second story guest quarters are accessible by either stairs or a residential elevator.

As the home's site is subject to wet or moist soil conditions most of the year, the foundations are designed to be water impenetrable. Working with concrete admixture technology companies and the local concrete mix supplier, Bed Rock of Point Arena/Gualala, a unique mix formula will be utilized for the foundations' pour and for the interior concrete web of the Amvic Insulating Concrete Form (ICF) walls.

Kryton's KIM® Admixture System will be used to create waterproof concrete and replace expensive external waterproofing membranes. KIM admixture renders hardened concrete impermeable to water penetration, reduces drying shrinkage, protects steel reinforcements from corrosion, and improves concrete durability.

KIM admixture is part of Kryton's Krystol™ Concrete Waterproofing System, a complete system for tanking

below-grade foundations and water containment structures. An advanced integral crystalline technology, Krystol chemicals react with water and unhydrated cement particles to form millions of needle-like crystals. Over a period of weeks and months, these crystals grow, filling the naturally occurring pores and voids in concrete, and permanently blocking the pathways for water and waterborne contaminants, even against extremely high water pressure. Krystol will not deteriorate. It lasts the lifetime of the concrete structure.

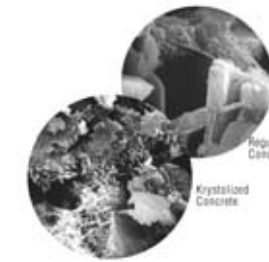
The ability to reactivate in the presence of water gives Krystol-treated concrete the ability to "self-seal." When cracks form due to curing shrinkage, settling, seismic activity, etc., water entering through them causes new crystals to form and grow, blocking and filling the cracks. Its ability to self-seal cracks is one of crystalline technology's most unique and useful features and can help to dramatically reduce the long-term maintenance and repair costs of a concrete structure.

Additionally, the concrete foundation surface for the garages will be treated with Kryton's Hydrostop water-repellent sealer. It contains a blend of silane and siloxane compounds that react with silicates below the surface of the foundation. This reaction forms an insoluble, water-repellent barrier that won't crack, peel, or fade away with time. Hydrostop is resistant to moss, mildew, rust stains, and efflorescence. It dries to an invisible finish, meaning the concrete's original appearance is maintained. As it is breathable, Hydrostop won't contribute to condensation problems.

Headwaters Resources is America's largest manager and marketer of coal combustion products, including fly ash. Fly ash, a residual material produced principally at coal-fueled electric power plants (which is captured from the exhaust of the boiler), will be an ingredient in the ready-mixed concrete admixture for the foundations. Fly ash improves the performance of concrete foundations, making them stronger, more durable, and more resistant to chemical attack, while creating significant environmental

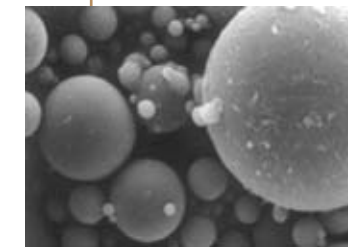
Kryton's KIM® Admixture System

- KIM admixture renders hardened concrete impermeable to water penetration, reduces drying shrinkage, protects steel reinforcements from corrosion, and improves concrete durability. The advanced integral crystalline chemicals react with water and unhydrated cement particles to form millions of needle-like crystals to permanently block the pathways for water and waterborne contaminants.



Headwaters Resources

- Fly ash improves the performance of concrete foundations, making them stronger, more durable, and more resistant to chemical attack, while creating significant environmental benefits through stewardship of an abundant industrial resource. Because the tiny fly ash particles fill microscopic spaces in the concrete, and because less water is required, concrete using fly ash is denser and more durable. And concrete containing fly ash becomes even stronger over time compared to concrete made only with cement.



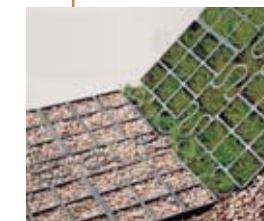
Cosella-Dörken Products, Inc.

- Based on a uniquely formed air-gap membrane, water is kept from ever touching walls on its way through the soil to the footing drainage tile. The DELTA-MS Clear system ensures permanently dry foundations. DELTA-MS Underslab waterproofing and underslab vapor-retarder membrane is designed to improve the floor performance below concrete slab foundations.



Rehbein Environmental Solutions, Inc.

- Netpave 50 is manufactured from 100 percent recycled polyethylene to provide an attractive, easy-to-use, durable solution for permeable parking and access routes.



LANDSCAPE/SITE PLAN

Amvic Insulating Concrete Forms

- The Amvic ICF 5-in-1 system incorporates structure, insulation, vapor barrier, sound barrier, and studding attachments for drywall and exterior siding in one easy step. AmDeck is designed for floors.



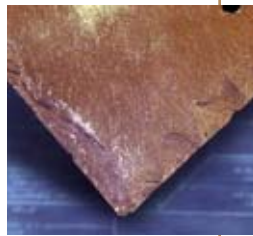
ThermaSAVE

- The ThermaSAVE Structural Insulated Panel Building System consists of an inner and outer skin and a core of super-insulating expanded polystyrene (EPS) or Dow Styrofoam® cores glued together with a special high-strength glue and dried under extreme pressure, resulting in a stressed-skin panel that has amazing capabilities.



EverGreen Slate Company

- EverGreen's 11 natural slate colors and textures afford many architectural effects, contributing to a building's appearance. Slate quarried for roofing stock is of dense, sound rock, exceedingly tough and durable. It is also fireproof and waterproof and resistant to climatic changes, with absolutely no disintegration. EverGreen slate has the highest designation for durability in excess of 75 years.



Revere Copper Products, Inc. & CopperCraft

- Revere Copper Products, Inc. is one of the oldest, if not the oldest, manufacturing company in the United States. Founded in 1801 by Paul Revere. Revere's products include copper and copper alloy sheets, strips, plates, bar, and extruded profiles.
- CopperCraft was established with the goal of preserving the high quality and craftsmanship found in old world metalworking, while enhancing techniques with computerized layout, cutting, and forming.

Image Not Available

Gutter Helmet

- The Gutter Helmet gutter protection system is a multi-patented, flow-limiting, ribbed design that slows and spreads water, causing it to flow easily into the gutters, while debris falls to the ground.



benefits through stewardship of an abundant industrial resource.

In making concrete, cement is mixed with water to create the "glue" that holds strong aggregates together. Fly ash works in tandem with cement in the production of concrete products. Concrete containing fly ash is easier to work with because the tiny, glassy beads create a lubricating effect that causes concrete to flow and pump better, to fill forms more completely, and to do it all using up to ten percent less water. Because the tiny fly ash particles fill microscopic spaces in the concrete, and because less water is required, concrete using fly ash is denser and more durable. And with time, fly ash reacts chemically, giving off cement hydration and creating more of the glue that holds concrete together. That makes concrete containing fly ash stronger over time than concrete made only with cement. And when fly ash is added to concrete, the amount of cement that is necessary can be reduced. As a result, fly ash also reduces the need for cement production—a major energy user and source of "greenhouse gas" emissions.

As an added protective measure, the foundations will be wrapped with DELTA®-MS, an effective foundation waterproofing and protection system developed by Cosella-Dörken Products, Inc. Based on a uniquely formed air-gap membrane, water is kept from ever touching walls on its way through the soil to the footing drainage tile. The system ensures permanently dry foundations. DELTA-MS Clear will be used for the Amvic ICF portion of Building Two that is earth-banked. DELTA-MS Underslab waterproofing and underslab vapor-retarder membrane will be used to improve the floor performance below the concrete slab foundations.

Permeable Driveway, Guest Parking, And Exterior Walkways

Netpave 50, a Netlon Turf Systems product of Rehbein Environmental Solutions, Inc., will be used as the paving

system for the driveway, guest parking, and exterior walkways around the home. Netlon Turf Systems, a brand name of Conwed Plastics, LLC, is an acknowledged leader in the development and application of mesh products for horticulture, civil engineering, landscaping, and storm water management. These products process storm water naturally, prevent erosion and soil migration, and clean water of contaminants.

Netpave 50 is manufactured from 100 percent recycled polyethylene to provide an attractive, easy-to-use, durable solution for permeable parking and access routes. The resulting surfaces are American's With Disabilities Act (ADA)-compliant, while enhancing the environment.

Netpave 50 units are two inches thick and are connected by a rapid fastening system (lugs and slots). These unique flexible elements can be easily installed on irregular surfaces and gradients. Netpave 50 can be filled with turf in the cellular structure. Alternatively, it can be filled with gravel, and the cellular structure will retain the stone and prevent loss or displacement. Netpave 50 can be used in permeable high load-bearing areas, as is the application at the Optimum Performance Home.

Netpave 50 units installed in the guest parking area will cover the WaterFurnace (see Issue 5, September/October 2006) vertical closed-loop geothermal system underneath. This system circulates water through a "loop" of small-diameter, underground pipes made of high-density polyethylene. The ground-loop portion of the geoechange system uses the constant temperature of the earth as a heat source instead of natural gas or propane, for increasing the efficiency of an electric ground-coupled heat pump. The ground loop replaces the "outdoor unit" of a conventional air-to-air heat pump.

Spunstrand special underslab low-velocity insulated ducts (see Issue 5, September/October 2006) will be installed under the dedicated home theatre/rear-projection room building foundation to provide air conditioning to those spaces.

Nordic Structures, LLC



- The advantages of light-gauge (cold-formed) steel framing is that in addition to being recycled and recyclable, steel has a significantly higher strength-to-weight ratio than wood and thus has greater earthquake resistance. Steel framing also is impervious to rot and termites. Steel is non-combustible and does not contribute fuel to the spread of a fire, and steel is an inorganic material, which does not provide an environment on which mold can grow.

Quiet Solution



- QuietRock® 525, a patent-pending CPG (ceramic-polymer-gypsum) composite drywall panel that reduces sound transmission and vibration, weighs about the same as standard drywall and provides superior sound isolation at a lower total cost than other methods.

Bonded Logic, Inc.



- Bonded Logic's UltraTouch insulation product is 100 percent post-industrial recyclable and environmentally friendly cotton fiber insulation that provides maximum health and superior R-value thermal performance. It is Class-A fire rated, offers excellent thermal and acoustical properties, and is treated with a non-toxic mold, mildew, and pest inhibitor.

Latitude



- The natural wool used in Latitude's insulation is from wool-processing in New Zealand. Wool, unlike synthetic materials, actually reacts to changes in temperature and atmospheric moisture. Insulation made with natural wool fibers not only achieve impressive R-value thermal performance, but because of wool's thermoregulation properties, wool insulation has the ability to absorb and release water vapor and has been proven through independent laboratory tests to help keep buildings cool in summer and warm in winter.

James Hardie® Building Products

- James Hardie® provides a 50-year limited transferable product warranty on its lap and panel siding. The products are dimensionally stable and resist cracking, rotting, and delamination. As well, they resist damage caused by extended exposure to moisture, humidity, UV rays, and salt air.

No-Burn®

- No-Burn® fire retardants and reactants are a highly advanced line of non-toxic, non-carcinogenic liquids that render a vast array of materials incapable of burning, as well as inhibiting the growth of toxic black mold. No-Burn removes the fuel a fire needs to burn when applied to wood, drywall, fabric, carpet, and furniture.



OSI Sealants, Inc.

- OSI Sealants is a leading manufacturer of caulks, sealants, adhesives, and wood-patching products with more than four decades of experience in developing and supplying the highest quality products. The company's Green Series features low-VOC construction adhesives, caulks, and sealants.



Carriage House Doors

- Carriage House Doors manufacturers fully modern functioning garage doors and barn doors that are meticulously handcrafted and are made from the finest materials, with hardware available to ensure long-lasting beauty, reliable performance, and low maintenance.



Natural Cork

- The highly durable natural cork floor product is made of natural and renewable material, improving health conditions in homes. Cork floors create a warm, comfortable, resilient surface that is gentle underfoot, is anti-microbial, will not spread flame, and is inherently resistant to molds, mildews, and common pests such as termites.



LP Building Products & Weyerhaeuser iLevel™

- These high-quality OSB structural products are engineered for optimum strength, stiffness, uniform straightness, and level surface performance.



Wall Systems

Three types of wall system construction will be utilized in the Optimum Performance Home.

Amvic ICF Building System

The home theatre and rear-projection room in Building Two, and the first floor of the guest quarters and library/surround music/home theatre in Building Three, which houses the two-car garage, workshop, and laundry room on the ground floor, will be constructed with Amvic Insulating Concrete Forms. The Amvic 5-in-1 system incorporates structure, insulation, vapor barrier, sound barrier, and studding attachments for drywall and exterior siding in one easy step.

An ICF is simply a hollow, lightweight, "stay-in-place" form. Amvic ICFs combine closed-celled expanded polystyrene (EPS) insulation and concrete thermal mass, which evens out temperature fluctuations by absorbing and storing heat. This prevents air movement in or around the cellular structure, creating an airtight seal around the entire perimeter of the building. Rooms enclosed with Amvic ICFs maintain consistent temperature from floor to ceiling, providing superior temperature control and exceptional comfort. This highly effective combination equates to an average of approximately 30 to 50 percent in monthly savings on heating and air conditioning, which translates to an equivalent reduction in harmful emissions. Building with Amvic ICFs generates only one percent of construction waste on average, greatly reducing land filling, which produces methane emissions. Furthermore, Amvic uses steam and cold water to produce ICFs. No CFCs (Chlorofluorocarbons), HCFCs (Hydrochlorofluorocarbon), formaldehyde, or any chemicals are used in Amvic's manufacturing process and no off-gassing is present. An Amvic home saves a lot of trees, which absorb carbon dioxide and emit oxygen.

Because the Amvic Building System uses EPS insulation, all airborne glass fibers and

insulation settlement caused by traditional fiberglass insulation is eliminated. The impermeable walls prevent the entry of dust, pollens, and pollution.

Amvic ICFs use the unique FormLock™ interlocking system. The system ensures a tight and secure interlock between forms, due to deep grooves that virtually align themselves, thus providing greater connection strength without the need for gluing, taping, or tying. This means that an Amvic ICF wall system will not lose its structural integrity over time, as with conventional wood frame construction.

Amvic ICFs are manufactured using 2-1/2 inches of 1.5 pound/cf density EPS foam on each side of the form. These panels are very rigid and, therefore, maintain shape, remain straight and plumb, and require less bracing during concrete pouring and curing to create a strong and structurally superior wall.

Amvic polypropylene webs are placed six inches on center and have a unique steel rebar holding system with built-in clips that hold rebar securely in place without tying, for a superior reinforced wall. During construction, the forms are first stacked together into the desired shape then filled with concrete in order to make stable, durable, and sustainable walls.

Three wall thicknesses will be used. For walls that serve as below-grade retaining walls in Building Two the wall thickness is 15 inches. For above-grade walls in Building Two, the thickness is 13 inches. Interior walls in Building Three are 11 inches thick. All interior wall surfaces are rated for 198 pound pullout strength.

The EPS insulation used in Amvic ICF is comprised of a collection of closed plastic cells that together with concrete walls prevent air movement around the perimeter of a structure, creating an airtight seal and providing performance equivalent to an insulation level of R-40 to R-50. An assembled Amvic ICF wall of a six-inch concrete

core or greater has a fire rating of three hours plus. In addition, while conventionally built structures have a sound transmission class (STC) rating of 36 to 38, an Amvic structure has an STC rating of 50 plus. And the reinforced concrete walls provide resistance to high winds and storms. The non-organic materials in Amvic ICFs prevent insect damage, as well as mold and mildew growth. The latter two benefits are desirable along the Pacific coastline where the Optimum Performance Home is located.

Please see the interview with Amvic Pacific President, Bill Juhl, on page 38.

ThermaSAVE SIP Building System

The ThermaSAVE Structural Insulated Panel Building System will be used for the main residence in Building One, the home office in Building Two, and the second floor guest quarters, library/surround music/home theatre, and boat garage in Building Three.

Structural Insulated Panels, or SIPs, are composed of a continuous core of rigid foam insulation, which is laminated between two layers of structural board to form a solid panel.

The system consists of laminated building panels called ThermaSAVE panels. Consisting of an inner and outer skin and a core of super-insulating expanded polystyrene (EPS) or Dow Styrofoam® cores glued together with a special high-strength glue and dried under extreme pressure, the result is a stressed-skin panel that has amazing capabilities. The inner and outer skins can be of a variety of materials that can form the inner and outer finish or act as an underlayment for the final surface. The panels can be pre-cut and custom fabricated, and are available with pre-cut wire chases and window and door openings. The result is a uniform single panel that has proven strength, durability, and thermal efficiency.

The ThermaSAVE patented spline connection system joins together four-foot wide panels to build walls, floors, and roofs that are lightweight, yet can withstand high wind loads (110 to 200 mph), earthquakes, and the twisting and flexing that slowly deteriorates conventional buildings.

ThermaSAVE wall panels can be finished with either cellulose-reinforced fiber-cement board or oriented strand board (OSB). In the case of the Optimum Performance Home, James Hardie® Building Products will be used for the exterior, and smooth Hardie panel board for the interior. In cases where siding or brick is the desired exterior finish, OSB panels will accept nailing of siding or brick wall ties. Virtually any type of sheet material can be applied. The system gives unlimited design possibilities to the architect for almost any project.

Fiber-cement board used as skins will not rot, burn, support toxic black mold (stachybotrus chartarum), or absorb moisture. No wall board is necessary. Other advantages are that the fiber cement board can be obtained with different finished looks, such as a wood grain, stucco, or smooth, which just needs seams sealed and painted. Using a smooth finish allows stucco, vinyl siding, brick, or stone to be applied.

SIPs provide higher R-values, reduced air infiltration, less thermal bridging, and greater stability. Energy savings with ThermaSAVE SIPs are dramatic—40 to 60 percent.

ThermaSAVE SIPs are rot- and vermin-resistant and are not affected by water vapor and high moisture content. They are produced with a minimum amount of wood products (to be eliminated entirely) and are manufactured using non-toxic products that do not create toxic wastes or affect the ozone layer. The expanded polystyrene used is fire retardant with a flash point between 600 and 650 degrees Fahrenheit. These were important considerations for building with ThermaSAVE SIPs at The Sea Ranch.

Due to ThermaSAVE's unique patented spline fastening system, there are no wood parts extended through the panels from face-to-face except at openings, corners, beams, and roof edges.

Structures built with these panels will have up to 75 percent less heat loss or gain.

Please see the interview with ThermaSAVE Founder and President, Hoot Haddock, on page 46.

Interior Walls

The third form of wall construction will be steel framing of the interior walls. The advantages of light-gauge (cold-formed) steel framing is that in addition to being recycled and recyclable, steel has a significantly higher strength-to-weight ratio than wood, and thus has greater earthquake resistance.

Steel framing also is impervious to rot and termites. Steel is non-combustible and does not contribute fuel to the spread of a fire, and steel is an inorganic material, which does not provide an environment on which mold can grow. The steel framing will be fabricated by Nordic Structures, LLC.

Interior drywall paneling will extensively consist of Quiet Solution's QuietRock® 525, a patent-pending CPG (ceramic-polymer-gypsum) composite drywall panel that reduces sound transmission and vibration unlike any other construction material on the market today. QuietRock weighs about the same as standard drywall and provides superior sound isolation at a lower total cost than other methods. The panel is fire rated for one hour without No-Burn® (see sidebar) added treatment. The rated 51 to 72

STC value far exceeds 5/8-inch gypsum, cinder block, and soundboard panels. And it hangs and finishes like standard drywall. It is also available in a mold-resistance form, the version to be used in the Optimum Performance Home.

Wine Cellar

The underground wine cellar at the Optimum Performance Home will be constructed entirely with cast-in-place reinforced concrete using the same admixture used for the foundations. The wall thickness will be ten inches for structural strength and uniform insulation. A barrel-vaulted formed concrete ceiling will be a feature, as well as textured wall treatment. The natural cork flooring will be supplied by Natural Cork. This highly durable natural cork floor product

is made of natural and renewable material, improving health conditions in the home. Cork floors create a warm, comfortable, resilient surface that is gentle underfoot, is anti-microbial, will not spread flame, and is inherently resistant to molds, mildews, and common pests such as termites. Since cork flooring is protected by five coats of highly durable UV-cured acrylic finish, the floor can be easily maintained.

As well, Cosella-Dörken waterproofing products will be used to seal out moisture. Above the wine cellar will be a living roof.

Garage Doors And Entry Barn Door

Garage doors and an entry sliding barn door will be provided by the Carriage House Door Company. The

custom design of the doors will complement the James Hardie board-and-batten architectural exterior look of the home. These fully modern functioning doors are meticulously handcrafted and are made from the finest materials, with hardware available to ensure long-lasting beauty, reliable performance, and low maintenance.

Roof Systems

ThermaSAVE SIP roof panels will be used for all roofs on the Optimum Performance Home. These panels have the same attributes as the ThermaSAVE wall panels.

Exterior roofing will be comprised of fine natural Vermont slate from the EverGreen Slate Company, Inc., the largest producer and supplier of slate in

the U.S. EverGreen's 11 natural slate colors and textures afford many architectural effects, contributing to a building's appearance. Slate quarried for roofing stock is of dense, sound rock, exceedingly tough and durable. It is also fireproof and waterproof and resistant to climatic changes, with absolutely no disintegration. Evergreen slate has the highest designation for durability in excess of 75 years. The roof slate will be Welsh Black, a rich, textured natural black slate.

The material for the all-copper rain gutters will be supplied by Revere Copper Products, Inc., one of the oldest, if not the oldest, manufacturing companies in the United States. Founded in 1801 by Paul Revere, a prominent silversmith and maker of cast bronze bells and marine hardware. Revere's products include copper alloy

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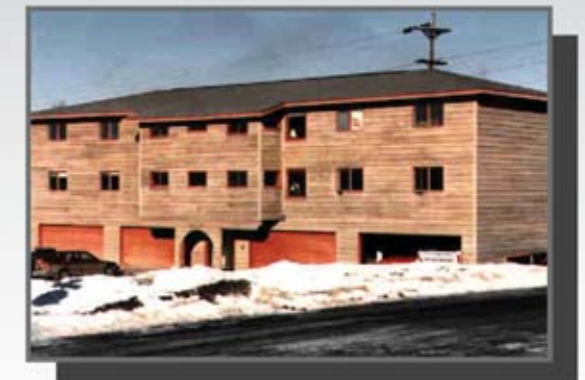


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sheets, strips, plates, bar, and extruded profiles.

Gutter design and fabrication will be provided by CopperCraft. CopperCraft was established with the goal of preserving the high quality and craftsmanship found in old world metalworking, while enhancing techniques with computerized layout, cutting, and forming. This insures quality, consistency, and competitive pricing.

The Gutter Helmet gutter protection system will be installed on all of the full-size copper rain gutters. The multi-patented, flow-limiting, ribbed design slows and spreads water, causing it to flow easily into the gutters. The simple physical law of surface tension forces water around the Gutter Helmet nose and into the gutters, while debris falls to the ground. A 3/8-inch horizontal gap handles the

heaviest rains but keeps out animals and debris. Gutter Helmet's patented Perma-Life™ coating will not fade or chalk and is not affected by corrosive acid rain. A black Perma-Life coating has been chosen to complement the EverGreen Welsh Black natural slate roofing.

Floor Systems

The second-floor system in Building Three will be constructed with the Amvic AmDeck Floor System. This is a modular, lightweight, stay-in-place form made of expanded polystyrene (EPS) that is used to construct concrete floors and roofs. The system provides structural strength through reinforced concrete and insulation through EPS. The AmDeck Floor System uses ten-inch lightweight steel framing studs, which

carry the temporary construction loads until the concrete gains its required strength and acts as furring strips to which interior finishes can be attached.

The second level over the rear-projection room and home theatre in Building Two will be constructed with engineered lumber using either Weyerhaeuser iLevel™ TJI® Trus Joist and/or LP Building Products. These high-quality OSB structural products are engineered for optimum strength, stiffness, uniform straightness, and level surface performance.

Insulation

UltraTouch Natural Cotton Fiber Insulation

In addition to recyclable expanded polystyrene used in the Amvic and

ThermaSAVE Building Systems, interior wall insulation inserted between the steel framing studs will consist of ENERGY STAR®-qualified UltraTouch natural cotton fiber insulation by Bonded Logic, Inc. The UltraTouch natural cotton fiber insulation product is Class-A fire rated, offers excellent thermal and acoustical properties, and is treated with a non-toxic mold, mildew, and pest inhibitor. This 100 percent post-industrial recyclable and environmentally friendly insulation provides maximum health and superior R-value thermal performance. It is the healthy choice, as the high-quality fiber contains no chemical irritants or harmful airborne particulates that can enter living areas and the surrounding environment, causing health problems. UltraTouch has no VOC out-

gassing concerns and contains no formaldehyde or fiberglass. Every natural fiber used to manufacture UltraTouch is treated with an Environmental Protection Agency (EPA)-registered, non-toxic, borate solution to offer complete and safe mold and mildew protection.

Acoustically, UltraTouch natural cotton fiber insulation has an extremely high Noise Reduction Coefficient (NRC) to effectively reduce airborne sound transmissions. The natural fibers that are used to make UltraTouch contain excellent sound absorbing qualities and are manufactured to effectively trap, isolate, and control sound waves. The result is a quiet, comfortable environment between rooms, walls, and floors.

Latitude Natural Wool Insulation

In the dedicated Optimum Performance Home Theatre and rear-projection room, a floating inner-wall and ceiling system will be constructed one-inch out from the interior of the Amvic ICF structural walls. This resilient channel-designed inner room wall system will optimize the sound performance quality in the home theatre. In this case, we intend to use Latitude natural wool insulation.

The natural wool used in Latitude's insulation is from wool-processing in New Zealand. Wool, unlike synthetic materials, actually reacts to changes in temperature and atmospheric moisture. Insulation made with natural wool fibers not only achieves impressive R-value thermal performance, but because of wool's thermoregulation properties,

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wool insulation has the ability to absorb and release water vapor and has been proven through independent laboratory tests to help keep buildings cool in summer and warm in winter.

Latitude is made with 100 percent post-industrial natural recycled sheep wool fibers joined together using an advanced resin-bonding process. Latitude is biodegradable and contains no permethrin, pyrethroids, or formaldehyde. At the end of a building's life, Latitude can be recycled for other environmentally friendly applications. To keep away insects and rodents, Latitude is treated with naturally occurring non-toxic elemental boron salts. Advantageously, wool has higher fire resistance than cellulose and cellular plastic insulations; it does not burn, but rather melts away from an ignition source and extinguishes itself. Latitude is treated with a fireproofing agent to improve its intrinsic fire resistance and complies with the appropriate Class A industry standard.

Acoustically, Latitude properties promote the baffling of unwanted exterior noise and can reduce the level of environmental noise pollution considerably. In sound quality applications, as in the Optimum Performance Home Theatre, natural wool insulation provides desired low-frequency absorption.

Exterior Siding

The exterior siding on the Optimum Performance Home will be exclusively fiber-cement panel siding by James Hardie, manufacturers of one of the world's most durable sidings. James Hardie provides a 50-year limited transferable product warranty on its lap and panel siding. The products are dimensionally stable and resist cracking, rotting, and delamination. As well, they resist damage caused by extended exposure to moisture, humidity, UV rays, and salt air; an extremely important consideration in selecting this siding

product for The Sea Ranch coastal location.

James Hardie panel siding provides durability and low maintenance without sacrificing the beauty and character of wood. And it retains its beauty for decades with very little care. To enhance the beauty and integrate perfectly with the historical architectural look of redwood and cedar siding on homes at The Sea Ranch, Hardipanel® Vertical Siding will be applied to the exterior of the home. A board-and-batten look will be achieved using the Cedarmill® panel (vertical cedar grain look) and trim planks. All James Hardie fiber-cement siding products are pre-primed with the PrimePlus® sealer and primer.

James Hardie fiber-cement panels are composed of Portland cement, ground sand, cellulose fiber, select additives, and water. The siding products contain no asbestos, glass fibers, or formaldehyde.

James Hardie siding holds up against the effects of temperature swings in cold weather climates and resists rotting and cracking, even in extremely damp climates. As well, it resists shrinking and swelling and holds paint or stain longer than wood. Strength and thickness provide impact resistance against hail and flying debris caused by wind. And the siding can be installed to withstand hurricane-force winds. The fiber-cement siding is Class A fire rated and is non-combustible. And the siding resists damage from termites and other wood-eating insects.

No-Burn® Fire Retardants

The Optimum Performance Home will be additionally protected against fire with the structure and whole-house application of No-Burn fire retardants and reactants, a highly advanced line of non-toxic, non-carcinogenic liquids that render a vast array of materials

incapable of burning, as well as inhibiting the growth of toxic black mold. No-Burn removes the fuel a fire needs to burn when applied to wood, drywall, fabric, carpet, and furniture. During construction, all wood components will be treated with No-Burn Wood Gard Mih, a dual-action Class A fire reactant and toxic black mold inhibitor. The interior walls will be treated with No-Burn Plus Mih. Plus Mih provides the same intumescent fire reactant and mold-resistant protections as Wood Gard Mih, but is suitable for applications on the interior surfaces of a structure, such as drywall or in various applications where moisture poses a potential mold problem. Plus Mih is an interior latex paint product that can be used as a base primer or tinted to match the finish coat. When introduced to heat or flame, the surface foams up, providing a protective char barrier that shields the underlying materials from heat and fire. Because No-Burn Plus Mih does not allow the treated surfaces to be readily used as a fuel source for the fire, it can actually reduce the production of deadly toxic smoke by up to 80 percent.

In the Optimum Performance Home, Plus Mih will be applied as a primer coat, applied directly to new drywall surfaces, providing a solid, bright white surface for the application of mold- and mildew-resistant natural clay earth plaster and zero-VOC (Volatile Organic Compounds) paint finish coats. Used on the structural framing, components will give the entire structure a Class A rating, the best possible protection against fire, especially in areas where a high fire hazard exists, such as urban areas with homes in close proximity to each other or in woodland areas, such as The Sea Ranch. No-Burn Original will be used on the ornamental engineered oak wood ceilings throughout the home's open architecture and on all wood cabinetry before stain finishing.

Adhesives, Caulks, And Sealants

OSI Sealants, Inc., now part of the Dusseldorf, Germany-based Henkel Group's North American Consumer Adhesives Businesses, is a leading manufacturer of caulks, sealants, adhesives, and wood-patching products with more than four decades of experience in developing and supplying the highest quality products. The company's Green Series low-VOC construction adhesives, caulks, and sealants has been chosen to help meet the LEED for Homes ratings guidelines.

Next

As stated previously in past articles, the design review process itself has no doubt weighed us down over this unexpectedly long period of time—nearly four years. But now that the Design Committee has granted final approval, with the exception of the remaining need to acquire final approval of an on-site landscape plan, the project is moving forward in a hastened manner, so that commencement of construction can, hopefully, begin by late November, subject to avoiding any serious rainstorm.

The next series of articles will continue to focus on each stage of construction and the design approach taken, and the technologies and building systems and materials used to create the first Optimum Performance Home. **UHD**

The Author

Gary Reber is the President of Ultimate Home Design, Inc. and the founding Editor-in-Chief and Publisher of *Ultimate Home Design* magazine. His diverse background in several fields includes an undergraduate, graduate, and postgraduate university education in architecture, community planning, and economic development planning. For years he was a consultant on community and economic development planning. For the past 15 years he has been an editor and publisher of magazines in the consumer electronics field. Gary can be reached at 951 676 4914 or gary@ultimatehome design.com.

Acknowledgements

Ed Rose is a residential architectural designer. His company is Rosebud Studios based in Monte Rio, California. Ed has been designing homes and remodels on The Sea Ranch and surrounding areas since the late 1980s. His skill in listening to and understanding his client's architectural program and then translating that into a workable and pleasing design acceptable to the rigorous philosophy of The Sea Ranch Design Committee is responsible for the final successful approval of the First Optimum Performance Home™ at The Sea Ranch. This included the fairly new design concepts of universal access and aging-in-place, use of "green" materials, and meeting the exacting guidelines for a residential LEED® designation. It wasn't until Ed joined our team that we began to make progress with the Design Committee in this challenging process. Ed provided all of the images of the site plan, floor plans, elevations, and isometric perspectives for the magazine. His extensive education and experience span numerous disciplines from architecture to industrial and graphic design to technical illustration, photography, and painting. Ed can be reached at 707 865 1146 or 707 785 9180 or rosebud@thegrid.net.

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Scott Simpson is a pilot and aerial photographer. His company is West Of One, based in Gualala, California. Scott resides at The Sea Ranch and provided the aerial photos depicted in this article. Samples of his work can be viewed at www.westofone.com. Scott can be reached at 707 785 9445 or scott@westofone.com.

Product Information

- Amvic, Inc., 501 McNicoll Avenue, Toronto, Ontario, Canada 877 470 9991, www.amvicsystem.com
- Amvic, Pacific Inc., 12531 Lowhills Road, Nevada City, Nevada 95959, 530 265 9085, www.amvicsystem.com
- Bonded Logic, Inc., 411 East Ray Road, Chandler, Arizona 85225, 480 812 9114, www.bondedlogic.com
- Carriage House Door Company, 1421

Richards Boulevard, Sacramento, California 95814, 916 375 0575, www.carriagedoor.com

- Copper Craft, 4995 Keller Haslet Road, Keller, Texas 76248, 817 490 9622, www.coppercraft.com
- Cosella-Dörken Products, Inc., 4655 Delta Way, Ontario, Canada L0R 1B4, 905 563 3255, www.cosella-dorken.com
- EverGreen Slate Company, Inc., 68 East Potter Avenue, Granville, New York 12832, 866 872 7528, www.evergreenslate.com
- Gutter Helmet/Southeastern Metals (SEMCO), 11801 Industry Drive, Jacksonville, Florida 32218, 904 757 4200, www.gutterhelmet.com
- Headwaters Resources, 7006 Regents Park Boulevard, Toledo, Ohio 43617, 419 842 8084, www.headwaters.com
- iLevel, Weyerhaeuser Company, 33663 Weyerhaeuser Way, Federal Way, WA 98003, 888 453 8358, www.ilevel.com
- James Hardie Building Products, 26300 La Alameda, Suite 250, Mission Viejo, California 92691, 800 348 1811, www.jameshardie.com
- Kryton Canada Corporation, 8280 Ross Street, Vancouver, B.C., Canada V5X 4C6, 604 324 8280, www.kryton.com
- Latitude/Live Edge, LLC @ Joinery Structures, 2500 Kirkman Street, Oakland, California 94607, 510 451 6345, www.latitudeinsulation.com
- LP Building Products, 414 Union Street, Suite 2000, Nashville, Tennessee 37219, 615 986 5659, www.lpcorp.com
- Natural Cork, 150 Connector 3, Dalton, Georgia 30720, 800 250 6690, www.naturalcork.com
- No-Burn, 1392 High Street, Suite 211, Wadsworth, Ohio 44281, 330 336 1500, www.noburn.com
- Nordic Structures, LLC, 536 Alcoa Circle, Corona, California 92880, 951 493 7770, www.nordicstructures.com
- OSI Sealants, Inc./Henkel Corporation, 32150 Just Imagine Drive, Avon, Ohio 44011-1355, 800 321 3578, www.osisealants.com
- Quiet Solution, 1250 Elko Drive, Sunnyvale, California 94089, 408 541 8000, www.quietsolution.com
- Rehbein Environmental Solutions, Inc., 8651 Naples Street, NE, Blaine, Minnesota 55449, 763 784 0614, www.rehbeinsolutions.com
- Revere Copper Products, Inc. One Revere Park, Rome, New York 13440-5561, 800 448 1776, www.reverecopper.com
- ThermaSAVE, 2470 County Road, Florence, Alabama 35633, 256 766 3378, www.thermapanel.net