LEED for HOMES

The First Optimum Performance Home®

site and foundation preparation part XIV

Gary Reber

synopsis

- The particular site has been extremely difficult to excavate, due to the crumply nature of the sandy clay soil and the depth of dependable bedrock upon which to support the foundation, concrete slab, and the home's structure.
- The site's soil conditions have resulted in extensive additional excavation work, including digging trenches around and within the perimeter of each building in the three-building compound.
- A specially engineered Controlled Density Fill (CDF) concrete mix was designed to fill the voids and provide a strong, stabilized surface upon which to support the foundation footings.
- This first-stage concrete pour provided the necessary compaction strength to support the final-stage concrete-footing pour, upon which will be suspended the concrete slab.
- Prior to the granular mixture fill, the placement of the DELTA-MS UNDERSLAB membrane, the R-Control Perform Guard EPS, and the Uponor AQUAPEX-encased slab concrete pour, all the underground infrastructure for the home will be installed.

Introduction

After five years of design and plan development work, the first Optimum Performance Home® is now under construction.

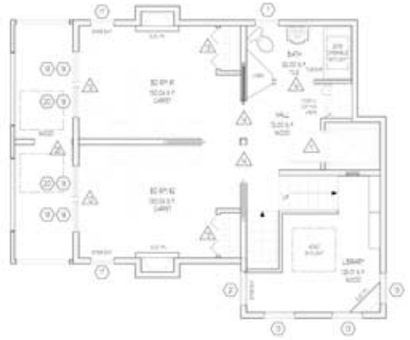
This is the fourteenth article in the series documenting the design and construction of the first Optimum Performance Home. The project has been selected by the U.S. Green Building Council (USGBC) for inclusion in the national Leadership In Energy & Environmental Design (LEED®) for Homes pilot program,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

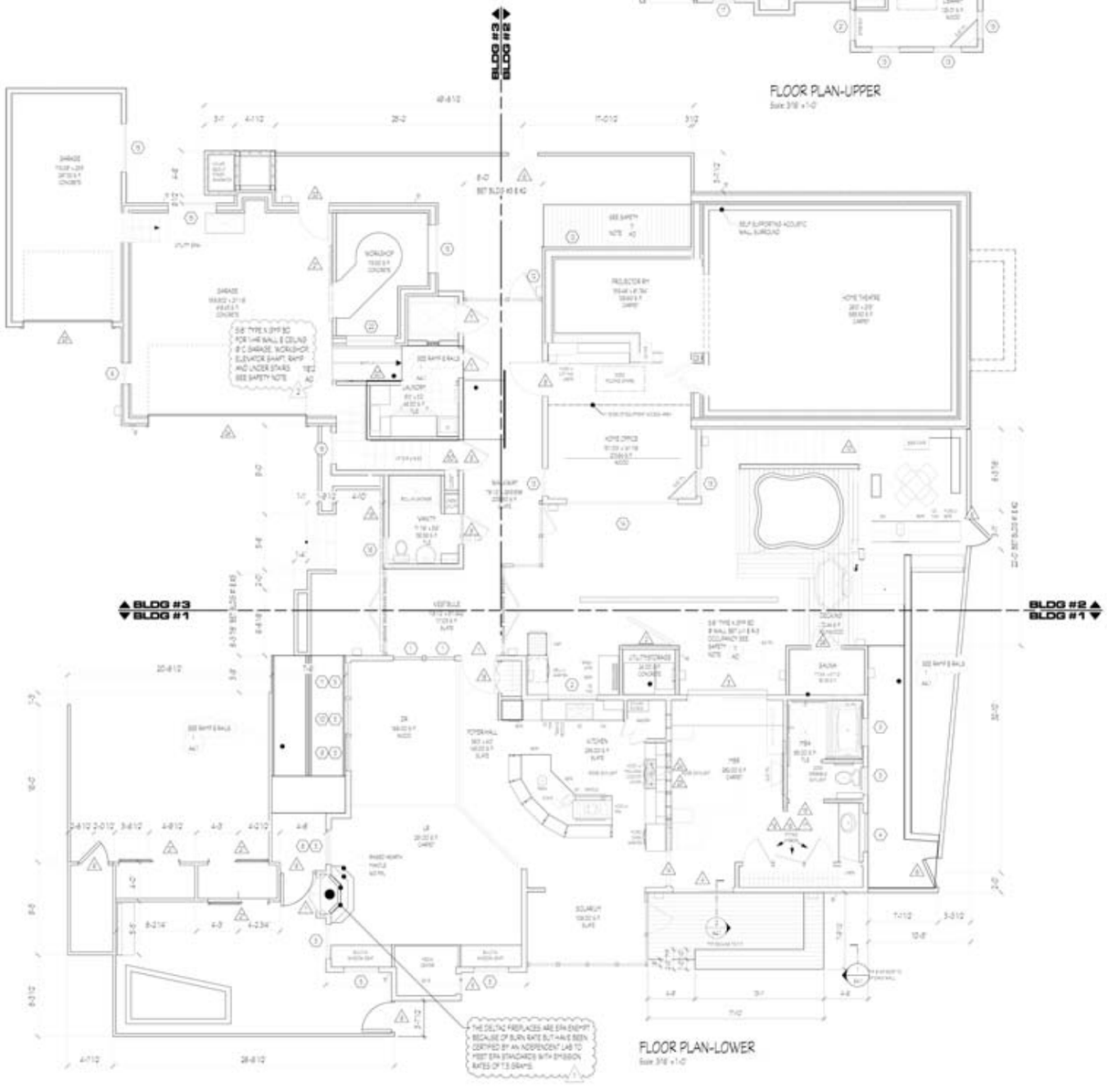
The home is being built at The Sea Ranch, located in Sonoma County, along the Northern California coastline of the Pacific Ocean, approximately 110 miles north of San Francisco.

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 natural 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 relationship between the home's components and the envelope they

The First Optimum Performance Home® At The Sea Ranch





The Sea Ranch

create. Also paramount is good stewardship—proper regard and respect for the rights of neighboring homeowners and the surrounding natural setting, and resource efficiency. 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 covered the project scope. Thereafter, each issue has contained a part of the continuing series by working through site planning and preparation; Low-Impact Development (LID); further refinements to the site plan and drainage design; The Sea Ranch Design Committee-approved architectural/structural and grading/drainage submittals with conditions that translated to clarifications on certain building components and material finishes; particular aspects of the home's mechanical plan; structural aspects of foundations, structural walls incorporating Insulating Concrete Forms (ICFs) and Structural Insulated Panels (SIPs), as well as roofing; the acoustical design of the dedicated Optimum Performance Home Theatre™ and rear-projection room; interior design approaches and materials; kitchen, bath, and home fixtures; universal design architecture; fire-risk mitigation; energy generation; and courtyard experience. "Breaking Ground" was the title of Part XIII, along with "Courtyard Experience."

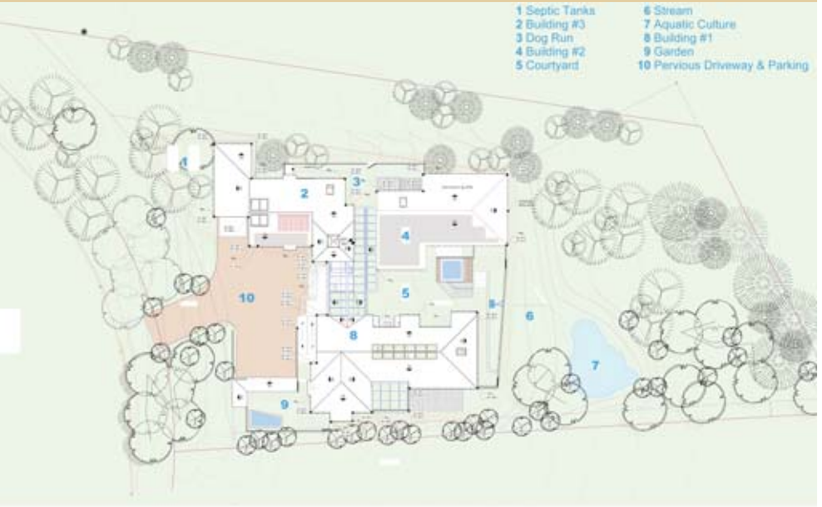
Commencement of construction with initial site grading, foundation, and mechanical infrastructure is now underway. Mother Nature has presented us with significant challenges in dealing with the unexpectedly extensive rainstorms throughout January and into mid-February that have drenched the site with over 30 inches. This created tons of mud on the site that had to be temporarily stored until needed for excavation fill and pad compaction.

Completion of the home is anticipated for November 2008. It is our intent to stage a full-on presentation at the November 19 to 21, 2008 U.S. Green Building Council's Greenbuild International Conference and Expo in Boston. Our presentation will reveal the step-by-step process for creating our first Optimum Performance Home—expected to be one of the highest rated, if not the highest, LEED for Homes Platinum residential home in the world!

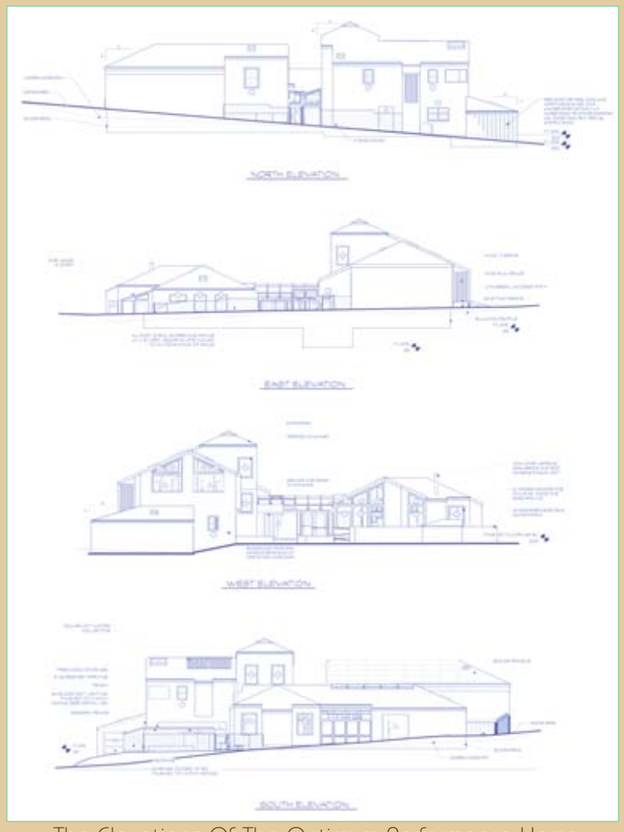
Construction Scheduling

Below is the breakdown of the initial site preparation and grading process and foundation work completed. An

> "The science of optimum performance homes concerns itself with 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."



LANDSCAPE/SITE PLAN



The Elevations Of The Optimum Performance Home At The Sea Ranch

outline will be provided in Part XV for the next stage of construction above the slab consisting of the Amvic ICF (Insulating Concrete Form) and ThermaSAVE SIP (Structural Insulated Panel) walls and roofing.

Pre-Construction Start Meetings

Site Work
- Clear Lot Vegetation
- Lay Out House Pad
- Install Curtain Drain Around Pad
- Excavate Optimum Performance Home Theatre, Alcove, Wine Cellar
  Lay Out Footings
- Temporary Electrical Power
- Install iBeam Systems Time-Lapse Pro Construction Camera (See Part XIII)
- Activate Water Service
- Form Underground ICF Home Theatre, Alcove, And Wine Cellar Walls
- Prepare For In-Floor D-Box™ Technologies Custom Motion Platform In Home Theatre (see Part VII)
- Verify Foundations' Site Placement/Inspection
- Dig Large Pond, Septic And Cistern Areas
- Place Underground Cistern
- Place Underground Septic Tank
- Seal Pond With Seepage Control Environmental Soil Sealant (See Part II and III)
- Install Smart Drain Subsurface Horizontal Geotechnical Drains At The Pond (See Part III)
- Drill Geothermal Bore Holes, Place Piping And Grout (See Part V, XII, and XIII)
- Run Spunstrand HVAC Ducks For Home Theatre (See Part V)
- Install StormTech Infiltration Chambers (See Part II, III, and IV)

Foundations
- Dig Initial Stage Foundation Footings And Install French Drain
- Pour First Stage Engineered Controlled Density Fill (CDF) Concrete With Portland Cement and Headwaters Resources Fly Ash (See Part VI)
- Set Forms, Tie Rebar Steel, Hold Downs And Anchor Bolts
- Place Zurn Flo-Thru Trench Drain System Through Courtyard
- Form Foundations With Energy Edge
- Pour Final Stage Foundation Footing Concrete With Portland Cement, Headwaters Resources Fly Ash, and Kryton's KIM Admixture (See Part VI)
- Conduit Trenching For Uponor PEX Plumbing (See Part V and X)
- Run Plumbing Waste
- Run Underground Water Line From Pond To The Boat Garage For Fire Hose Connection (See Part XI)
- Install Gravel Around Plumbing
- Run Plumbing Conduit And Supply
- Run Electrical And Low-Voltage Conduit
- Lay out NuTone Central Vacuum System (See Part IX and X))
- Place Gravel and Sand Underslab
- Finalize Underslab Infrastructure and Zurn Flo-Thru Trench Drain
- Underslab Inspection

- Install AMF Corporation R-Control Perform Guard EPS Insulation
- Install Cosella-Dörkin DELTA-MS UNDER-SLAB
- Install Slab Rebar
- Install Uponor AQUAPEX Radiant Floor Tubing
- Pour Concrete Slab
- Treat Concrete Slab With Nisus Corporation Bora-Care Termite Barrier Pretreatment
- Waterproof Home Theatre, Alcove, And Wine Cellar Walls With Carlisle Coatings
- Backfill Foundation

The initial site preparation work is being done by Sonoma County Builders, Inc. under the direction of Noble and Loyal Davis. This company, based both in Santa Rosa and Point Arena, California, has had extensive experience in excavation for both residential and commercial/civic projects for over the past 35 years. They are very supportive of the project and sensitive to the environmental concerns and protections that are in place for the project. Prior to the start of their excavation work, the tall grasses were cut down to dirt by Steve Glaze (Steve Glaze Backhoe). This top layer of roots is being stockpiled along with the extensive mud excavated and allowed to form a "top soil" compost for later spreading back over the site, just prior to landscaping with indigenous vegetation and trees. John Feeney, our supervising contractor and his team consisting of Jerry Feeney, John Michael Feeney, Brad Estele, and Aaron Phillips will perform the foundation work. Sebastopol California-based Weeks Drilling & Pump Company, under the direction of Chris Thompson, CEO, will drill the five 310-feet-deep geothermal bore holes after the foundation work is completed. Don Bartlett of Bartlett Mechanical Services will install the WaterFurnace® geothermal and Spunstrand® underground acoustically damped air-conditioning duct system. Bill Wilson Environmental Planning and Design, LLC with Dylan Coleman, principal in Mt. Shasta, California-based Wonderwater, are responsible for the on-site water-management systems, including the pond and drains. Aqua Harvest International's Terry McMains, based in Rio Rancho, New Mexico, designed the site application of the EcoRain™ Stormwater Tank Modules underground water cistern manufactured by Stormwater Solutions, LLC.

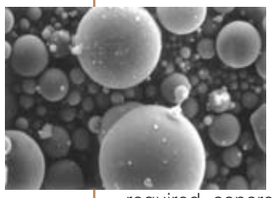
Spunstrand® Filament-Wound Fiberglass Underslab Duct

- Spunstrand HVAC duct is designed for direct burial applications and is manufactured using the filament-wound method to provide the greatest strength.

Stormwater Solutions EcoRain™ Tank Modules

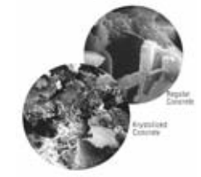
- Underground modular water cistern tanks manufactured with 100 percent recycled plastic. The modular tanks can be used to create any size void space underground by just butting them to one another. A 40-millimeter thick membrane encases the tanks to hold the recycled water harvested from the roofs.

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.

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 un-hydrated cement particles to form millions of needle-like crystals to permanently block the pathways for water and waterborne contaminants.

Euclid Eucon A+

- Euclid Chemical Company's Eucon A+ Type A admixture serves as a fast-setting, water-reducing and plasticizing admixture for concrete that does not adversely affect concrete set times.

December 2007
And January 2008

Using iBeam's technology, one will be able to view on a daily basis a high-resolution photo archive of the entire project, including stunning 1920 x 1080p (progressive) high-definition time-lapse movies each month.

Photos will be captured and automatically uploaded to iBeam's secure server every 15 minutes from 6:00 am to 6:00 pm each day and will be viewable through a link from the *Ultimate Home Design* Web site. Furthermore, the images can easily be e-mailed or printed to document job site conditions.

At the conclusion, the entire construction photo archive will be featured as a 1080p high-definition time-lapse movie and will become part of a high-definition television program and educational documentary that Steve Michelson Productions and I are producing.

iBeam® Systems Time-Lapse Pro Camera

• The iBeam® Systems Time-Lapse Pro all-weather on-site construction camera provides the means to build a high-resolution photo archive of the entire project, including stunning 1920 x 1080p (progressive) high-definition time-lapse movies each month.

WildBlue™ Satellite Speed Internet®

In order to facilitate capturing the high-resolution images taken on-site by the iBeam Time-Lapse Pro construction camera, we are using the "always on" WildBlue™ Satellite Speed Internet® system developed by WildBlue Communications, Inc. and offered as part of EcoStar's DISH Network satellite services. The offer is provided separately under the EchoStar brand name, and sub-branded as "powered by WildBlue." The new WildBlue Enterprise Solutions™ satellite services system offers business-class broadband connectivity via state-of-the-art satellite technology using a 26-inch satellite mini-dish equipped with both a transmitter and receiver for two-way satellite connectivity to the Internet. See Part XIII for a full description of the service.

This Issue

In this issue, the focus is on the various construction elements related to site preparation.

iBeam® Systems Time-Lapse Pro Construction Camera

The iBeam® Time-Lapse Pro all-weather on-site construction camera, described in Part XIII, is expected to be installed and operational as one reads this Part XIV.

The particular site has been extremely difficult to excavate, due to the crumply nature of the sandy clay soil and the depth of dependable bedrock upon which to support the foundation, concrete slab, and the home's structure. Excavation work began in late December and was interrupted by strong rainstorms throughout the month of January and through mid February. There were very few days that the weather permitted working on the site. In the month of January alone, the site received over 20 inches of rain, and still more through mid February, which caused mud conditions, which had to be alleviated. Thus, much of the initial excavation work was dealing with the topsoil mud accumulation. This work is completed and the topsoil is being stored for later reintroduction to the site to restore the original grades and as use for ground cover and landscaping to restore the indigenous vegetative site conditions in accordance with The Sea Ranch Vegetation Management Plan (see Part III and IV).

The site's soil conditions have resulted in extensive additional excavation work, including digging trenches around and within the perimeter of each building in the three-building compound. Deep trenches were necessary to reach the deeper laying bedrock. A specially engineered Controlled Density Fill (CDF) concrete mix was designed to fill the voids and provide a strong, stabilized surface upon which to support the foundation footings (see http://www.flyash.com/data/upimages/press/TB.12%20Fly%20Ash%20for%20Controlled%20Density%20Fill.pdf).

CDF (controlled density fill), is an engineered, controlled, concrete-fill material, which is self-placing, self-leveling, self-compacting, and non-settling. Our particular formula required a concrete mix consisting of equal amounts of Portland Cement and fly ash, water, and 3/8-inch aggregate and

December 2007
And January 2008 (continued)

WildBlue™ Satellite Speed Internet®

• The "always on" WildBlue™ Satellite Speed Internet® system developed by WildBlue Communications, Inc. and offered as part of EcoStar's DISH® Network satellite services offers business-class broadband connectivity via state-of-the-art satellite technology.

concrete sand. The so-called "two-sack mix" consisted of 200 pounds of fly ash and 188 pounds of Portland Cement per cubic yard in the final concrete mix. This would be considered a 4.13-sack cementitious-equivalent mix design. One sack of Portland Cement weighs 94 pounds. The mix design was formulated by Doug Yeggy at Headwaters Resources.

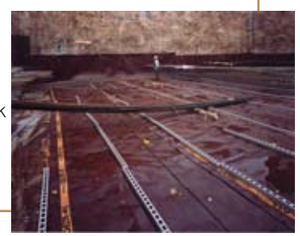
December 2007
And January 2008 (continued)






Cosella-Dörkin DELTA-MS UNDERSLAB

• DELTA-MS UNDERSLAB is a tough, impermeable vapor-retarding membrane that is placed on the earth or granular prior to placing the concrete slab. The membrane provides a full-capillary break and vapor retarder that prevents the upward migration of moisture through the capillaries that exist in all concrete.



Headwaters Resources is the source of the fly ash that will be used in the concrete mixes designed for the project. The Portland Cement Association and the California Portland Cement Company are the sources of the cement used in the project. Delivery of the Portland Cement and fly ash to the concrete production facility was handled by Conti Materials. The local concrete production facility is Bed Rock Products, based in Point Arena, California. Bed Rock Concrete Pumping is providing the concrete pumping service for the project.

Doug has designed three other concrete mixes for the project: standard foundation footing, slab-on-grade, and the concrete poured into the Amvic ICFs. These mixes use Portland Cement, Kryton's KIM admixture, Euclid Chemical's Eucon admixture, and up to 40 percent fly ash. The mix design for the standard foundation footings will use 324 pounds of Portland Cement and 216 pounds of fly ash, or 40 percent, per cubic yard. The slab-on-grade mix design will use 362 pounds of Portland Cement and 155 pounds of fly ash, or 30 percent, per cubic yard. The Amvic ICF mix design will use 564 pounds of Portland Cement and 226 pounds of fly ash, or 40 percent, per cubic yard.

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

Euclid Chemical Company's Eucon A+ Type A admixture serves as a fast-setting, water-reducing and plasticizing admixture for concrete that does not adversely affect concrete set times.

This first-stage concrete pour provided the necessary compaction strength to support the final-stage concrete-footing pour, upon which will be suspended the concrete slab. The slab will be five inches thick. Under the slab, covering a granular mixture compacted over the soil, will be a Cosella-Dorkin® DELTA®-MS UNDERSLAB waterproofing and vapor-retarder membrane designed for slabs on or below grade and a rigid Type II R-4 (per inch) 1-1/2-inch R-Control® Perform Guard EPS (expanded polystyrene) insulation from AFM Corporation.

DELTA-MS UNDERSLAB is a tough, impermeable vapor-retarding membrane that is placed on the earth or granular prior to placing the concrete. DELTA-MS UNDERSLAB prevents the early loss of hydration water, thus producing a concrete that meets design strength and provides more even curing characteristics in concrete. The membrane provides a full-capillary break and vapor retarder that prevents the upward migration of moisture through the capillaries that exist in all concrete. Additionally DELTA-MS UNDERSLAB can act as a barrier to soil gases. This will provide a healthy and dry environment.

A 2-3/4-inch thick R-Control Perform Guard EPS will be placed over the DELTA-MS UNDERSLAB to provide superior thermal mass for uniform heat transfer of the WaterFurnace geothermal/heat pump heated water through the Uponor® 1/2-inch AQUAPEX® in-floor tubing encased in the five-inch thick concrete slab.

Prior to pouring the slab concrete, suspended over the final stage concrete footings, the Zurn® Flo-Thru trench drain that runs the full length of the courtyard will be installed. The modular Zurn molded-slop drain is designed for load-bearing strength, hydraulics, chemical resistance, and structural integrity.

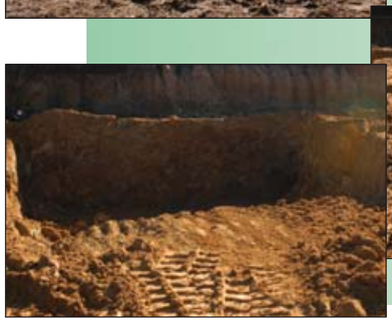
The radiant-floor portions of the five-inch thick concrete slab and under-slab insulation will be encased at the perimeters with the EnergyEdge eight-inch Frame Building Rail (EE8fb). The PVC channel provides full-rigid insulation coverage from the top to bottom of an eight-inch slab edge to prevent radiant-floor heat loss through the edges of the concrete slab.

Prior to the granular mixture fill, the placement of the DELTA-MS

February 2008





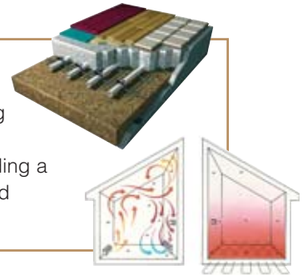



R-Control® Perform Guard EPS

• Rigid Type II R-4 (per inch) 2-3/4-inch R-Control® Perform Guard EPS (expanded polystyrene) insulation from AFM Corporation provides superior thermal mass for uniform heat transfer of slab-encased radiant floor systems. Photos courtesy of AFM Corp.

UNDERSLAB membrane, the R-Control Perform Guard EPS, and the Uponor AQUAPEX-encased slab concrete pour, all the underground infrastructure for the home will be installed. This will include Uponor 1/2- and 3/4-inch red and blue pre-sleeved corrugated AQUAPEX tubing with outer insulation, the NuTone® VX1000 central vacuum system, and the complex electrical and low-voltage wiring system encased in conduit.

Uponor® Radiant Floors



• Warm water circulates under the floors throughout the Optimum Performance Home using Uponor's durable, flexible, and resilient crosslinked polyethylene AQUAPEX tubing, providing a comfortable, even heat without stirring up dust and pollutants.

NuTone® Central Vacuum System

• A NuTone® Central Vacuum System will be featured in the home to help maintain healthy interior air quality. NuTone's central vacuum power units feature a space-saving sleek oval-shape design, internal sound suppression system, and a status light on the hose handle and power unit, which indicates when the VX™ unit's bag or canister is full and needs emptying.

Zurn® Flo-Thru Trench Drain

• The modular Zurn® molded-slop Flo-Thru trench drain is designed for load-bearing strength, hydraulics, chemical resistance, and structural integrity.

EnergyEdge

• The EnergyEdge Frame Building Rail (EE8fb) is designed to provide insulation at the radiant-floor perimeters of the concrete slab. The PVC channel provides full-rigid insulation coverage from top to bottom of the slab edge to prevent radiant-floor heat loss through the edges of the concrete slab.

Uponor® Pre-Sleeved Corrugated AQUAPEX®

• Uponor® 1/2- and 3/4-inch red and blue high-density polyethylene (HDPE) pre-sleeved corrugated AQUAPEX® tubing is designed for durability and provides protection for installation in the soil and allows for easy removal over time.

Bora-Care®

• Nisus Corporation's Bora-Care® is a primary termite barrier pre-treatment that creates a continuous barrier that termites cannot cross, eliminating their food source.

Uponor's red and blue high-density polyethylene (HDPE) corrugated pre-sleeved 1/2- and 3/4-inch AQUAPEX tubing provides protection for installation in the soil and allows for easy removal and replacement of the tubing if required over time. In addition, the red and blue color-coded sleeves easily identify hot and cold water lines.

The NuTone 1,040 watt-cyclonic central vacuum power unit features HEPA-rated filtration, Microban protection, and Teflon anti-stick technology.

A three-inch filtered underground water line will be installed to serve as a surplus supply of water available from the pond. A standard 2-1/2-inch value red-painted standpipe hydrant with a male National Hose fire-thread fitting will be located at the driveway entrance at the front of the boat garage, to which a fire hose can be connected.

Following the curing of the concrete slab, Nisus Corporation's Bora-Care® will be applied directly to the finished surface slab as a primary termite barrier pre-treatment. Bora-Care creates a continuous barrier that termites cannot cross and eliminates their food source.

The next installment in this series of case-study articles will cover the actual work being done to accomplish the tasks described, as well as the start of the above-slab Amvic ICF wall construction. In the meantime, photos will continue to be posted on the *Ultimate Home Design* Web site (www.ultimatehomedesign.com/oph/php) depicting progress in the construction of the first Optimum Performance Home.

Design Concept

As previously noted in this series, the home design integrates all of the concepts advocated in *Ultimate Home Design*. The goal is to demonstrate how modern building products and methods can make life safer, more

comfortable, and more enjoyable. The science of optimum performance homes concerns itself with 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 and holistic design, the house will serve as a permanent residence that allows its occupants to age in place.

The high-performance building systems to be employed are designed to exceed California building code requirements and resist natural disasters more effectively than a code-minimum house, even with the new California code requirements that require use of non-combustible or fire ignition-resistant building materials. Built with stronger building materials and superior techniques, the home will be safer, allowing homeowners greater peace of mind. The Optimum Performance Home qualifies for the Fortified…For Safer Living® program of the Institute for Business & Home Safety (www.ibhs.org/business_protection). This program specifies construction, design, and landscaping guidelines to increase a new home's resistance to natural disaster.

In addition, the home will meet the guidelines and qualifications for the U.S. Department of Environmental Protection's ENERGY STAR®, the EPA's (Environmental Protection Agency) WaterSense™, and the American Lung Association® Health House® programs. It also will meet the requirements of the National Association of Home Builders' (NAHB) Model Green Home Building Guidelines, the Sustainable Buildings Industry Council (SBIC) Green Building Guidelines, and the "Green Points" program. Sonoma County and The Sea Ranch Association are now considering this program for adoption.

Furthermore, the home's design was the subject of a case study analysis

February 2008 (continued)

presentation before the Custom Residential Architects Network (CRAN), Full Spectrum Practice Convention of the American Institute of Architects on October 20, 2007 in Chicago, Illinois.

The home is also a case study of the California Energy Commission in terms of energy-efficiency applications and an advanced water-saving plumbing plan.

Finally, the home is a national showcase for CEDIA (Custom Electronic Design and Installation Association), and is the subject of a series of articles on the design and installation of the electronic lifestyle components in the home. These articles are featured in CEDIA's *Electronic Lifestyles*® quarterly magazine.

March 2008

The Setting

The Sea Ranch is an internationally renowned 5,000-acre environmentally protective residential development situated within a pastoral and forested coastal enclave and nature preserve approximately 110 miles north of San Francisco, California. This stunning development, now celebrating its 43rd anniversary, straddles a ten-mile stretch of Highway 1 along a stretch of uniquely beautiful rugged coastline, ending at the northern tip of Sonoma County and the south bank of the Gualala River.

The Sea Ranch is widely regarded as a unique and remarkable residential development. During the 1960s and 1970s, The Sea Ranch was at the forefront of environmentally responsible development. It was conceived and designed by architects and landscape architects who wanted to provide a harmonious mixture of custom homes and pristine natural Northern California landscape in oceanfront, meadow, and forest environments. In fact, The Sea Ranch concept and its architecture are recognized in schools of architecture around the world, and it is frequently used for case studies in environmental and architectural design. The first condominium complex to be built on the southern coastal bluffs of The Sea Ranch is now a registered national architectural site.

Single-family development occupies approximately 2,500 acres without borderline fences or other visible delineation of property lines. The remaining acres are permanent green-scape commons with 45 miles of nature trails for walkers, bicyclists, and equestrians. Each home is custom designed by an architect/architectural designer following site-specific design guidelines and is situated off a private road network without curbs, sidewalks, or streetlights. The Sea Ranch is a very unique residential development woven into a tapestry of buildings and nature and committed to environmental preservation. The development includes 2,288 lots for single-family custom homes, with 531 remaining to be developed (1,757 already developed and 26 under construction).

The Sea Ranch is managed by The Sea Ranch Association, a Common Interest Development (CID) with an elected volunteer Board of Directors, and supported by numerous volunteer committees. All development on The Sea Ranch is subject to design review and the approval of a Board-appointed autonomous Design Committee. The Design Committee is presently comprised of architects and landscape architects, though it does not include anyone with experience in vegetation management or “green” sustainable building design. A legal set of Covenants, Conditions, and Restrictions (CC&Rs) govern the development and are designed to protect The Sea Ranch concept.

The Home

The Sea Ranch Design Committee imposes upon designers architectural building blocks derived from the original rural structures found on the northern California coast. Designers are expected to apply their creativity to render various arrangements and deviations to arrive at a custom solution that specifically responds to the site. Successful proposals submitted to the Design Committee address the issues of passive solar positioning, wind, glazing (window) layout, privacy between neighbors, vegetation protection, view preservation, topography and grade changes, roof slopes, appropriate exterior materials and finishes, and other exterior design considerations—all within the building and site design.

A focus of the Optimum Performance Home’s design is to stand as a showcase for the “green” movement and demonstrate means of reducing a home’s impact on the planet through the use of Low-Impact Development (LID) and environmentally responsible and sustainable building materials. It is hoped that the home will become a case study for a “Green Points Program” suited to the scale of The Sea Ranch.

March 2008 (continued)

The home’s 3,272-square-feet living space (4,441-square-feet total building “footprint,” 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. This arrangement provides for an alcove courtyard protected from the prevailing wind from the northwest. The home is designed with differing spatial experiences throughout to encourage exploration. The home will display innovative interior design and be furnished in a contemporary Frank Lloyd Wright style appropriate to its dimensions. The home design connects the indoors and the outdoors with covered walkways, a courtyard, decks, and a garden to

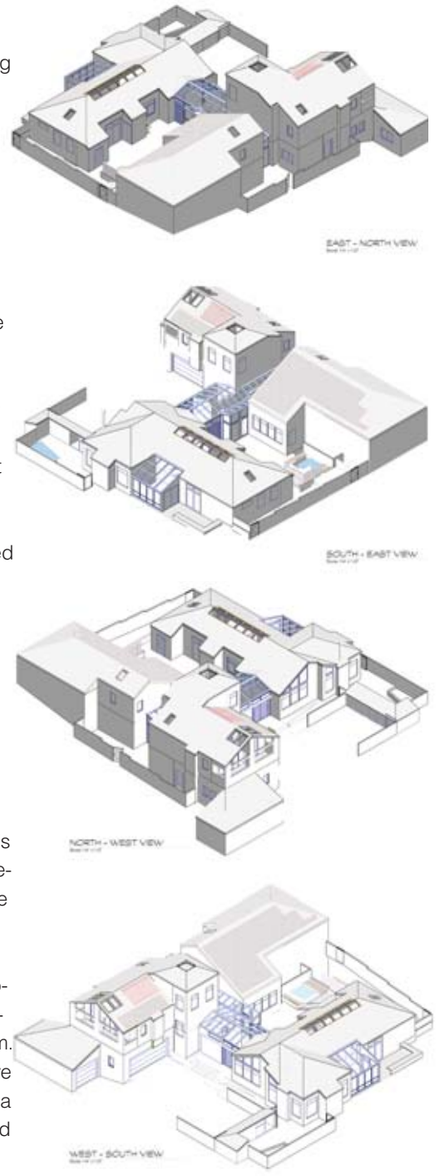
expand livable space, without requiring heating or air conditioning. The home is designed in accordance with biophilic design principles with abundant and excellent use of natural light and natural indigenous landscaping planned. (For an in-depth analysis of the biophilic attributes of the home, please read “Biophilic Design,” “Biophilic Design Attributes,” and “The Interior Design Process, Part I: Synthesizing Sustainability, Universal Design, And Technology” authored by Julie Stewart-Pollack in Issue 3 (May/June 2006), Issue 4 (July/August 2006), and Issue 10 (July/August 2007), respectively.

The main-floor living area is designed to accommodate the capabilities of all occupants without any challenging physical barriers, even for the elderly and disabled. The home design features a ground-level open plan for the living room, dining room, master bedroom suite, and spacious kitchen with solarium, exhibition cooktops, and home management system.

The second building in the compound is designed to accommodate a large state-of-the-art Optimum Performance Home Theatre™ with integrated rear-screen projection room and a home office.

The third building will include a two-car and boat garage, workshop, main-level guest bathroom, and laundry room. The second level of this building will have two guest bedrooms, a bathroom, and a dedicated library/home theatre/surround music room distinguished by a high-tower feature. To insure universal access to this floor, the design provides for an Otis® Gen2 residential elevator.

The entrance and walkways that connect the three buildings and the solarium will be enclosed with insulated- and solar gain-reduced-tempered glass. There will be a seating area at the vestibule entrance to the home. The main entrance vestibule will serve as an oversized mudroom. The driveway, area around the garage, guest parking, and entrance to the home—as well as all paths—are designed in accordance with The Sea Ranch guidelines governing exterior hard-surfaced paths. All such surfaces are pervious to virtually eliminate water runoff. The surface will be packed with decorative gravel to enhance the natural appearance of the home’s setting. There also will be a dedicated equipment room off the courtyard, which accommodates the Uponor and WaterFurnace radiant-heating apparatus, TrendSetter® solar hot water storage tanks, Navien’s 98 percent condensing on-demand propane-fired tankless water heater, and other equipment. The backup Kohler® generator is housed within a separate weather-resistant tower located off the north wall of the two-car garage and guest bedroom, within the fenced dog run. This tower is designed to optimize the northwest wind performance of the PacWind® Seahawk® vertical-axis Savarrieus™ wind turbine disguised within (see Part XII, November/December, Issue 12).



Four Perspective Views Of The Optimum Performance Home At The Sea Ranch

The home site is nestled on an almost-acre parcel at the edge of a forested area of the southern section overlooking the Pacific Ocean, offering distant water views. Some of the home’s features will include a Benissimo® slate-floor outdoor courtyard, two thick solid hardwood Ipé deck areas, in-ground Dimension One Spa® Amoré Bay hot tub, Finnelo® Finnish sauna, and underground wine cellar. The orientation of the home on the site is designed to take advantage of natural lighting and passive solar heating and cooling. Good site and land planning will result in minimal land disturbance and preservation of natural features and environments.

Landscaping will consist of The Sea Ranch-approved indigenous vegetation with low-water requirements and unique water conservation features, including two ponds and a stream supported by rainwater catchment and captured runoff. Site grading has been specifically planned to enhance the project’s placement in the watershed, and the design incorporates the principles of Low Impact Development to minimize runoff from impervious surfaces and mimic the natural hydrology in overall effect. The resultant water harvesting will then minimize the use of irrigation, and the increased infiltration and retention will passively support the native landscape. Additionally, a gray water system will be used for undersurface plant irrigation.

Next

Now that we have commenced site preparation, this continuing series of articles will focus on the design elements as they pertain to each stage of construction, and will include coverage of the technologies and building systems and the materials used and applied to construct the first Optimum Performance Home. UHD

The Author

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- Amvic, Inc., 501 McNicoll Avenue, Toronto Ontario Canada M2H 2E2, 416 410 5674, www.amvicsystem.com
- Aqua Harvest International, 3628 Greystone Ridge Court, Rio Rancho, New Mexico 87124, 505 975 5008, www.aquaharvestonline.com
- Bartlett Mechanical Services, 6755 Oak Street, Anderson, California 96007, 408 313 2486, www.bartlettmechanical.com
- Bed Rock Concrete Pumping, P.O. Box 503, Point Arena, California 95468, 707 882 2637
- Bed Rock Products, Inc., 135 Hay Parkway, Point Arena, California 707 882 2323
- Bill Wilson Environmental Planning & Design, LLC, 71 Del Casa Drive, Mill Valley, California 94941, 415 383 2919, 805 689 7639
- Broan-NuTone, 926 West State Street, Hartford, Wisconsin 53027, 800 548 0790, www.nutone.com
- California Portland Cement Company, 2025 East Financial Way, Glendora, California 91741, 800 272 9119, www.calportland.com
- Conti Materials, P.O. Box 30248, Stockton, California 95213, 209 467 0626, www.contimaterials.com
- Cosella-Dörken Products, Inc., 4655 Delta Way, Beamsville, Ontario, Canada L0R 1B4, 905 563 3255, www.cosella-dorken.com
- EchoStar DISH Network, 9601 South Meridian Boulevard, Englewood, Colorado 80112, 888 825 2557, www.dishnetwork.com
- Energy Edge, 7701 East Kellogg, Suite 722, Wichita, Kansas 67207, 316 618 1983 www.energyedgeform.com
- Euclid Chemical Company, 19218 Redwood Road, Cleveland, Ohio 44110, 800 321 7628, www.euclidchemical.com
- Feeney Construction, 14660 McCourtney Road, Grass Valley, California 95945, 530 477 7647, 707 884 9458
- Hacker Industries, Inc., 610 Newport Center Drive, Suite 250, Newport Beach, California 92660, 800 642 3455, www.hackerindustries.com
- Headwaters Resources, 10653 South River Front Parkway, Suite 300, South Jordan, Utah 84095, 888 236 6236, www.flyash.com
- iBeam Systems, Inc., 280 North 8th Street, Suite 30, Boise, Idaho 83702, 800 403 0688, www.ibeamsystems.com
- Kryton Canada Corporation, 8280 Ross Street, Vancouver, B.C., Canada V5X 4C6, 604 324 8280, www.kryton.com
- Portland Cement Association, 5420 Old Orchard Road, Skokie, Illinois 60077, 847 966 6200, www.cement.org
- Seepage Control, 7301 West Boston Street, Chamdler, Arizona 85226, 800 214 9640, www.seepagecontrol.com
- Smart Drain, P.O. Drawer 2219, Columbia, Maryland 21045, 800 638 8582, www.smartdrain.com
- Sonoma County Builders, Inc. 6280 Old Redwood Highway, Santa Rosa, California 95403, 707 837 2997 / P.O. Box 244, Point Arena, California 95468, 707 684 9144
- Spunstrand Incorporated, 620 North Post Street, Post Falls, Idaho 83854, 208 665 7444, www.spunstrand.com
- Steve Glaze Backhoe, 2766 Parkview Drive, Lakeport, California 95453, 707 263 3055
- Steve Michelson Productions, Lobitos Creek Ranch, 2800 Lobitos Creek Road, Half Moon Bay, California 94019-2547, 650 726 2460, www.lobitoscreekranch.com
- StormTech, 20 Beaver Road, Suite 104, Wethersfield, Connecticut 06109, 888 892 2694, www.stormtech.com
- Stormwater Solutions, LLC, 3940 Laurel Canyon Boulevard, Suite 856, Studio City, California 91604, 866 786 7690, www.stormh2osolutions.com
- ThermaSAVE/IHSN, Inc, 4002 Helton Drive, Florence, Alabama 35630, 256 766 3378, www.thermapanel.net
- Uponor North America, 5925 148th Street West, Apple Valley, Minnesota 85254, 800 321 4739, uponor-usa.com
- WaterFurnace International, Inc., 9000 Conservation Way, Fort Wayne, Indiana 46809, 800 222 5667, www.waterfurnace.com, www.stormh2osolutions.com
- Weeks Drilling & Pump Company, 6100 Highway 12, Sebastopol, California 95472, 707 823 3184, www.weeksdrilling.com
- WildBlue Communications, Inc., Greenwood Corporate Plaza, Building. 1, 5970 Greenwood Plaza Boulevard., Suite 300, Greenwood Village, Colorado 80111, 866 945 3258, www.wildblue.com
- Wonderwater, P.O. Box 1510, Mt. Shasta, California 96067, 530 926 5050, 530 925 2586, www.wonderwater.net
- Zurn Flo-Thru Operation, 116 Molly Rex Lane, Mooresville, North Carolina 28117, 704 799 7087, www.zurn.com

High Volume Fly Ash—A Tool For The Concrete Designer's Belt

Doug Yeggy, Headwaters Resources

When taking into account designing with higher volumes of fly ash, we need to look at fly ash as a tool in the designer's tool belt. The added workability that higher-than-typical volumes of fly ash (20 to 35 percent) impart in a concrete mix design allows the designer to increase the total coarse aggregate content of a typical concrete mix design while at the same time decreasing the fine aggregate content. This in turn reduces the water requirement due to a decrease in aggregate surface area. The higher-than-typical fly ash content acts as a water reducer, in a sense, by allowing the designer to increase or optimize the coarse aggregate content over what is typically used with any given combination of coarse and fine aggregates.

Oftentimes 3/8-inch x #8 aggregate, or pea gravel, is introduced depending on the continuity of the top size aggregate. This 3/8-inch material will fill in the spaces between the larger sized aggregate, allowing the fine aggregate and cementitious materials to extend or become more workable.

A very important aspect of designing with higher-than-typical volumes of fly ash is the addition of a Type A water reducer, such as Euclid's Eucon A+ or a mid-range water reducer at a Type A dosage rate, such as Masterbuilder's Polyheed 997. These admixtures allow the cement particles to deflocculate (push away from each other), allowing the water to combine more evenly around each individual cement particle, making the cement more efficient through the various chemical reaction phases. At low-dosage rates, these types of admixtures do not retard the concrete set times as dramatically as one might think. Be aware that more is not always better when it comes to admixtures and high-volume fly ash concrete. The best admixtures, used incorrectly, can retard the set of conventional concrete for hours or even longer. Check the manufacturer's suggested dosage rates on the admixtures that you are going to use and see if the particular admixture has a set regulating characteristic built into it. Then use the admixture at the lowest suggested dosage rate. Remember, you should have already gotten quite a bit of water reduction from the increased amount of fly ash and optimization of the coarse aggregate.

When placing and finishing higher volume fly ash concrete, there are many variables that need to be addressed. First of all, fly ash will impart greater workability to a concrete mix. What the eye would lend you to believe is a four-inch slump WILL PROBABLY SLUMP OUT TO 5 ½-INCHES OR GREATER. Make sure that when adding water at the jobsite, you add water in small increments until the desired slump is attained. Ten gallons of water in a nine-cubic yard batch can dramatically affect the slump of this type of concrete, and what you saw as a three-inch slump can very quickly become a six-inch slump.

Another variable that is oftentimes misunderstood is concrete set times. The set times of concrete are directly related to the temperature of the concrete, as well as the ambient temperature, and to some extend humidity. At 70 degrees, a concrete mix should attain initial set within five hours or so. This is a rule of thumb that I have used successfully for quite some time. For every 10-degree decrease in concrete temperature, and to some extent, ambient temperature, most five-sack concrete mix designs will take twice as long to attain initial set based on the 70-degree temperature guideline. If the concrete temperature dips below 40 degrees, then the concrete can sit indefinitely as long as direct sun does not hit the concrete or ambient temperatures do not increase for an extended period of time above 40 degrees.

Next, the importance of correct finishing techniques for higher volume fly ash concrete, as well as straight cement concrete, cannot be emphasized enough. Most finishers tend to use magnesium float on concrete after striking off of the surface. In just about all cases, a wood bull bloat and hand floats should be used in the initial finishing sequence. Here is the reasoning: "When placing concrete, you can count on one thing always happening, the lightest part of the concrete mix will want to come to the top." This means the water or water vapor typically migrates up through the concrete as the heavier aggregates and cementitious materials settle into place. Using a magnesium float at the beginning of your finishing sequences and intentionally or unintentionally turning it on edge can trap water below the surface of the concrete and results in a higher-than-wanted water/cement ratio in the top wearing surface of the concrete. This can also happen during the finish trowel sequence and is evidenced in either case by a blotching of the concrete surface.

Use a wood float to lay the concrete down and wait until the surface starts to dull as the water sheen comes off of it. This is especially important when using higher volumes of fly ash in your concrete, as the concrete will not bleed as readily as a finisher is used to it doing. Once the water sheen starts coming off the surface of the concrete, use the magnesium float to clean up the humps, dishes, or fins that were left behind during the more plastic wood float sequence. Proceed from here with your typical finishing sequences until the desired finish is attained. "If the concrete is air entrained, special precautions must be taken to not seal the surface with the magnesium float, as wood floats should not be used on air-entrained concrete."

Lastly, and most importantly, Cure Your Concrete. All exposed concrete needs to be kept wet for a minimum of three, and more preferably seven days, by running intermittent sprinklers on the concrete or by covering the exposed surfaces with wet burlap, plastic, or hay. If a curing compound is used, make sure to use a high-quality, high-solids curing compound, and be sure to hit all exposed surfaces with the curing compound from two separate coverage points with at least a 45-degree separation from each of these points. I can not emphasize the importance of curing enough. Once your concrete is correctly placed and finished, curing will be the most important deciding factor to ensure your concrete will look, wear, and outperform your expectations.UHD