

# WHY ICF's?

## Insulated Concrete Forms

Green Haven Homes uses a Perimeter Insulated Raised Floor combined with a Controlled Ventilation Crawlspace and Insulated Concrete Forms to create a superior insulated crawlspace



### Energy Efficient

A combination of ICFs, PIRF and CVC creates a fully insulated crawlspace. ICFs allow a concrete crawlspace insulated to R22.



### Durability

Freezing ground and seismic pressure waves which would cause microcracks and long term deterioration are absorbed by the two inches of foam that ICF's leave on the foundation.

### Strength

By enclosing concrete permanently inside two layers of EPS foam it cures more slowly and a more uniform rate. The result is concrete that tests as much as 40% stronger than concrete cured inside traditional forms.



## ICFs, PIRF and CVC – Technical But Useful Construction Methods

Concrete foundations are cast in place between forms. The traditional forms are wood which is stripped off the bare concrete and the soil pushed back against it. We use Insulated Concrete Forms (ICFs) for a number of technical reasons but primarily because they allow us to use two superior methods of handling the energy losses of underfloor areas (the crawlspace).

These methods are called the Perimeter Insulated Raised Floor (PIRF) combined with the Controlled Ventilation Crawlspace (CVC). In a traditional crawlspace, there is no insulation in the short walls from the foundation to the first floor. The crawlspace is ventilated to the outside air by perforating the crawlspace walls with open screening. The cold, wet air of the outside is allowed to enter under your floor to condense moisture and is accompanied by insects of various kinds who build nests. Mold and insects, even other vermin, are encouraged by this ventilation system.

With PIRF and CVC, the insulation is put in the crawlspace walls and the crawlspace is sealed off from the outside. Ventilation of the crawlspace is provided with an electric ventilator when humidity and temperature detectors indicate that it is needed. The ICFs allow a concrete crawlspace wall insulated to R-22 – a warm, dry and clean crawlspace. Since we keep the floor system inside the SIP envelope, using ICFs allows a seamless insulation envelope for the entire house.

Insulating the floor the traditional way suffers from the same problems as insulating the walls of the house between wall studs. The insulation value is found only in the center of insulation batt and falls off to R-1 at the wood member. The resulting full wall (or floor) value is only about 40% of the insulation value. By letting cold air in through ventilation screens and full heat loss through the uninsulated walls of the crawlspace, traditional construction wastes a lot of heat. With ICFs, PIRF and CVC we do not waste this heat. The crawl space, like the home, is fully insulated. (The dry ground under your home is also a good insulator)

The technical reasons we mentioned? They relate to long term durability of the house. Each winter the ground freezes a little. Freezing ground pushes against the foundation walls and this cycle creates microcracks that can weaken the foundation over several decades. Likewise, in our region, there are dozens of small earth tremors every day.

We may not feel them but they are there sending seismic pressure waves against our foundation. They also create microcracks and long term deterioration. The two inches of foam that ICFs leave on each side of the foundation wall are compressed by these pressures and act as a cushion.

The other technical reason is the cure strength of the concrete in the foundation. By enclosing the concrete permanently inside two layers of EPS foam, we are creating an ideal curing condition for the concrete. It cures more slowly and at a more uniform rate since the outside of the concrete is inside the insulating envelope. The result is a concrete that tests as much as 40% stronger than concrete that cured inside traditional forms.

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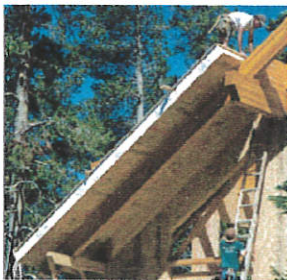
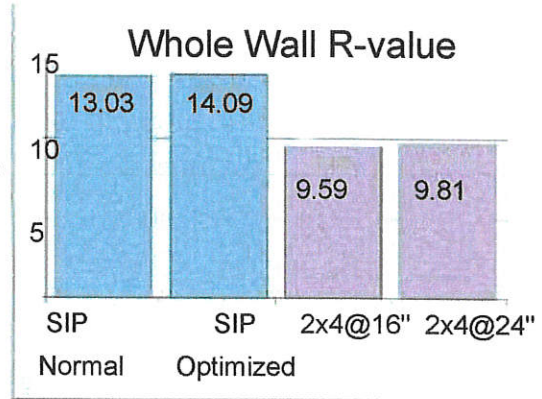
# WHY SIP NOT "STICK"?

Green Haven Homes uses Premier Structural Insulated Panels for exterior walls and roof. See their website [www.pbspanel.com](http://www.pbspanel.com)

## Energy Efficient

According to New Oak Ridge tests a SIP (Structural Insulated Panel) room showed almost 15 times less air leakage than an otherwise identical room built with 2x6 studs. SIP walls also have a significantly higher whole wall R-value.

[www.sips.oeg/technical/oakridge.html](http://www.sips.oeg/technical/oakridge.html)



## Superior Strength

A SIP wall panel tested nearly 3 times stronger in government tests than a conventional 2x4 stud wall.

[www.eren.doe.gov/consumerinfo/rebriefs/bd1.htm](http://www.eren.doe.gov/consumerinfo/rebriefs/bd1.htm)



## Fire Resistant



## Insect Resistant

SIP's meet all building codes and pass the ASTM standards of safety. Fire investigators found that SIP panels held up well. [www.eren.doe.gov](http://www.eren.doe.gov)

PBS uses borate treated foam which has proven to have high resistance to many wood boring insects. TimBor is non-toxic and registered with the EPA .

## Straight Walls

Unlike conventional "stick" walls SIP panels do not absorb moisture and do not twist and

warp causing nails to loosen which causes damage to your walls and reduces the strength of your home to resist wind and earthquake.



## What's Wrong With Traditional "Stick" Construction?

Mold, long term stability, warpage, water content, strength, environmental issues and energy conservation issues are but a few of the problems with traditional stick construction. Fifty years ago the lumber industry had millions of acres of old growth forests to log without restriction. Dimensional lumber of any size was inexpensive and readily available. Builders could select dry, straight materials. Go to the lumber yards today and you will find that this quality of lumber is no longer available. Instead you will find heavy, water soaked lumber streaked with black mold, warped and bowed

Lumber companies today grow special trees that reach a loggable size in 6 to 10 years. They are still small and yield only a few 2x4s or maybe a couple of 2x6's. Their tree rings are widely spaced so they do not have the same strength as the lumber from the old growth trees but the building codes based upon the old lumber have never been revised for the lesser strength of the new lumber. Larger timbers must come from old growth trees and there are fewer available every year. Society has come to value the forests more than inexpensive lumber. Increasingly over the past 30 years, larger timbers are manufactured from a composite of plastic and waste products from the lumber industry.

In addition to lower strength, the new lumber is not dimensionally stable because the tree rings are widely spaced and sharply curved by the small diameter of the harvested tree. They cannot be dried as easily without warping to an unusable degree and, after partial drying, re-absorb water faster because the material in the wider spaces between rings absorbs water readily. As these wetter "sticks" dry within the walls of your house, they twist and warp. This causes damage to your walls and loosens the nails holding your walls together, seriously reducing the strength of your home to resist earthquake and wind. If you measure the flatness of your walls, you will find a lot of distortion that increases every year.

The new lumber is also the source of the toxic mold problem that is so much in the news today. The lumber arrives at the construction site already streaked with black mold and goes into your walls the same way. The heat of your home, the water in the wood, and the sugar-like content of the drywall combine to create a near ideal growing place for molds.

In addition to the environmental issues of building with wood, energy conservation issues also reflect changing priorities of society that dictate against traditional construction. Wood has an insulation value of R-1. Current building codes require a wall to have a minimum insulation value of R-19. Traditional construction uses an insulation with a R-19 value between the 2x4's in a wall but this does not make the walls of a house have an R-19 value. Tests have shown that traditional construction provides the R-19 value only in a narrow band between the studs in the wall. Over 20% of the wall, the wood portion, has only an R-1 value and the bands on either side of the stud are also less than R-19. Taken as a whole wall, the insulation value of a traditionally built R-19 wall is only R-9 or less. Corners, around windows, the outside edge of the floor, where the ceiling and roof meet the wall – all of these areas of the house in a traditional construction cannot be insulated to an R-19 value since the wood doesn't provide space for it. In an infrared photograph of the house these areas flare brightly with heat escaping your home. Newer codes require a whole wall insulation value.

### **What are SIPS and Why Are They Better?**

Structurally Insulated Panels, or SIPS, are a sandwich of Oriented Strand Board (OSB) and Expanded Polystyrene foam (EPS). OSB is an engineered composite material of plastic and wood waste in which the strands of wood fibre are lined up to create strength. EPS is a recycled product that takes discarded plastic out of the environment. This plastic has no emissions, even in a fire, and will not fuel a fire applied to it.

Compared to the traditional wood structure, SIP walls test three to four times stronger. SIP walls will not support the growth of molds nor do they retain moisture. They are flat and straight and remain that way without warping or dimensional changes. They also do not lose strength with time and are far more durable. We don't know how durable because no SIP built house has yet worn out in the more than 50 years since SIP homes have been built. Earthquake tests rate SIP construction in the highest category, Category 4, but a real world test was conducted in Kobe, Japan, during the 1995 magnitude 7.2 quake. Six homes in a badly hit neighborhood had been built with SIPS only months before the quake. After the quake, they were structurally undamaged while the other homes in the neighborhood were a pile of sticks.

In side-by-side tests conducted on whole houses by the Florida Solar Energy Center and by the Federal Government Testing Laboratory at Oakridge, 4 inch SIP panels outperformed 6" stick framing by 17% and 25% respectively in annual energy savings. When compared to traditional homes built with 4 inch walls, the saving was more than 60%.

From an environmental perspective, SIPS are champions. The energy cost to build a panel is no more than the energy cost to recycle the waste products.

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# WHY STEEL FRAMING?



Green Haven Homes uses steel floors and walls within the SIP envelope



## Durability



Durable enough to meet the highest seismic and windload specifications and impervious to termites.



## Resistant to Fire

Steel is non-combustible and complies with fire codes and regulations



## Environmentally Sound

Steel framing components are made from recycled steel, mostly old cars, and replaces old growth lumber used to meet loading requirements in most floors.

## Healthy Interior Environment

Mold and bacteria can't grow on steel like it did on this example of a wood framed house.



## Dimensionally Sound

Steel has no moisture content so it doesn't shrink and warp causing nails and screws to "pop" and joists to separate and your drywall to crack.

# Green Haven Homes

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A Design/Build Company

## Steel floor and walls

Steel is an ideal material for both a builder and an environmentalist. Steel framing components are made from recycled steel, mostly old cars, that would otherwise be in our landfills or rusting away in a field somewhere. Over 66% of steel is recycled making it one of the best waste usage industries around.

From a builder's perspective, steel is a product that is much stronger than wood, durable enough to exceed the highest earthquake and hurricane specifications, fire resistant, impervious to termites and other damaging insects, and dimensionally stable forever. Steel walls and floors are flat and corners are right angled – ideal for drywall, flooring, cabinets and finish trim. And, they stay that way – no call backs for cracks produced by the twisting of drying wood. Plus, steel walls and floors offer no support for the growth of molds and bacteria. Unlike wood, they do not carry molds and bacteria into your home either.

Long used in commercial buildings, steel floors, walls and trusses came into the residential construction business during the middle-1990s. HUD and Dietrich Industries developed the first residential light gage steel framing systems in the 1992 through 1996 time frame.

Steel conducts heat far too well to use in exterior walls but we can gain the strength and stability of steel without compromising insulation by building with steel inside the insulation envelope of the SIP exterior walls. We use a steel floor system designed by the steel industry called Trade Ready. Interior walls are also built in steel. In addition to the strength, building with interior steel walls and floors gives us a house with flat, straight walls like the SIPs.

The use of steel floors and walls, or to put it another way, by not introducing mold and bacteria riddled lumber inside the home, we create a home that is particularly healthy to its occupants. A substantial majority of Americans suffer from allergic reactions to pollutants. According to the FDA, the inside of a typical home is up to 15 times more polluted with allergens than the outside air and we spend almost 70% of our time inside the home. In contrast, a Green Haven Home starts out free of allergens. SIP exterior walls, controlled ventilation crawlspace, steel interior walls and floors, radiant heating, air-to-air energy recovery ventilators are all parts of a Green Haven Home that contribute to a safe, healthy interior environment.

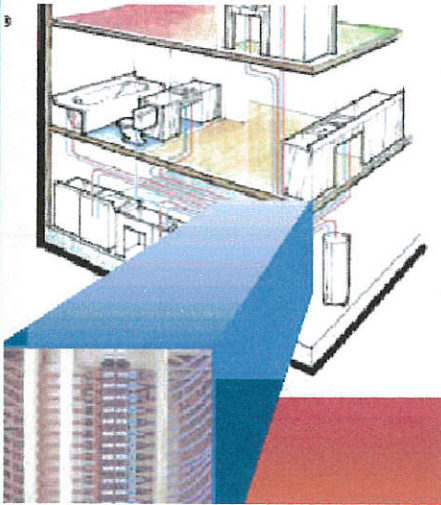
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# WHY A MANIFOLD Plumbing System ?



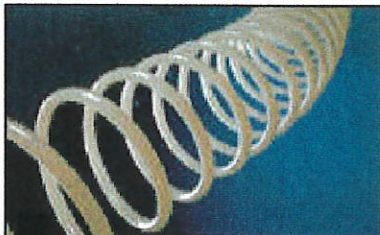
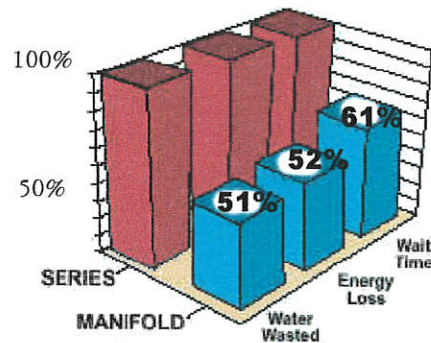
## Faster Hot Water Delivery

Because every fixture has it's own distribution line, less water is needed to "flush" the line of cool water before the hot water is delivered. By having direct lines to each fixture you can run multiple fixtures at the same time without experiencing temperature or pressure changes.

## Water & Energy Efficient

Less time waiting for hot water means less water and less energy loss. A manifold plumbing system reduces water and energy loss by half. See Davis Energy Group report [www.vanguardpipe.com](http://www.vanguardpipe.com)

MANIFOLD vs. SERIES Plumbing System



## Freeze & Corrosion Resistant

Unlike copper tubing PEX tubing does not corrode even in areas with aggressive water. The smooth interior eliminates scale build-up. PEX tubing is freeze resistant because it expands to accommodate the expansion of freezing water.



## Quiet, Clean & Healthy

No more pinging pipes or water hammer. PEX tubing is quiet. And, PEX tubing is completely non-toxic. Lead (used to solder copper pipe) and other harmful substances do not leach into the drinking water from the plumbing system.

## Water Distribution System

With a life expectancy of 100 years, a 25 year warranty, hospital grade purity and a 51% saving in water usage, the Pex water distribution system was an easy choice for Green Haven Homes. Three decades of independent testing attest to the superiority of Pex as a water distribution system. Since pipes are hidden in the walls, most home owners do not know how the water gets to their sink. It is a curious story. If your sink is the last fixture in your house plumbing, all of the water in the pipes from the utility meter to that sink must be pushed out to provide water to you. If you have metal plumbing and want hot water, not only must all the water in the pipes be pushed out to drain down your sink waste but also all the piping must be heated by the water before it reaches useful temperature in your sink. When you think about it this way, it seems a pretty silly way to distribute house water, doesn't it? The waste is pretty obvious.

Green Haven Homes us a different system, called a manifold system. If your remote sink was plumbed with a manifold system, a single 1/2 inch PEX tube would run from the hot water heater manifold directly to your sink faucet. Only the water in that slim tube would need to be drained down your sink so you would have hot water almost immediately. No metal piping would have to be heated so your water heater would not have to use energy just to heat pipes. Tests by Davis Energy Group show that a manifold system uses 51% less water and 52% less energy in a typical house – and you spend 61% less time waiting for hot water.

In addition to the energy and water saving, PEX tubing is safer than copper piping. It does not react with chlorine or minerals in the water. It can be a little sickening to look at a piece of used copper water pipe and see all the corrosion and pitting that has been feeding contaminant into your drinking water. PEX tubing is hospital and restaurant tested by the FDA and a number of other testing agencies. It is a form of the same plastic that is used to make food storage containers. No adhesive is used to create connections in the Pex system.

While water pipes should never be exposed to freezing temperatures in a Green Haven Home (see why in the radiant and solar section), it is nice to know that Pex tubing is freeze resistant. The tubing expands to accommodate the expansion of freezing water and will survive dozens of freezing cycles.

# WHY ERV?

## Energy Recovery Ventilation

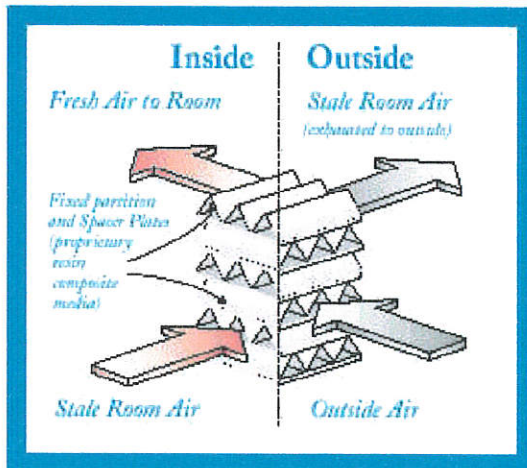
### Healthier Homes: Ventilation

Eliminating wasteful air leaks is very desirable in helping to control energy costs but it doesn't allow a house to "breathe". Indoor air pollutants and moisture trapped in your well insulated home may be harmful to your health. That is why Green Haven Homes uses Carrier ERV systems in their homes. [www.carrier.com](http://www.carrier.com)



### Exchange of Air

Stale room air loaded with air pollutants is exhausted to the outside and fresh outdoor air is brought in. Heat and moisture are exchanged through the core but do not mix.



### Exchange of Energy

An ERV efficiently transfers both heat (sensible energy) and water vapor (latent energy), from inside the house to the incoming fresh air. This enthalpic energy transfer preserves about 80% of the heat and humidity. The air doesn't mix but the temperatures do.

### Quiet

Powerful enough to generate ample airflow,  
yet virtually silent when operating

## Energy Recovery Ventilators

Over 70% of Americans suffer from some form of allergy to air-borne pollutants. EPA studies show that most of that pollution is found inside the home. While older homes can become so saturated with allergens that they are labeled "sick homes", new homes are also targets for interior pollution build-up because they are built to restrict air leakage as an energy conservation measure.

Imagine a modern, high-tech window that you could open in the winter. Air from the house would flow out and air from the outside would flow in, giving you that clean, mountain air inside your home. Because it is a high-tech window, it magically warms and humidifies the incoming air so you are always comfortable. Quite a window, isn't it! Well, except that you cannot see out of it, that is what we have installed in your home. It is called an Enthalpic Energy Recover Ventilator (ERV).

The ERV exchanges the inside air with the outside air many times a day and circulates clean, warm air throughout the house. Both the heat of the inside air and its humidity are preserved (about 80% anyway) by a clever invention called , imaginatively, the core. The exhausted stale air and the clean exterior air pass through small air passages separated by a composite resin that allow both heat and water vapor to transfer from the warmer, more humid air to the colder, less humid air but blocks pollutants.

During the heating season, the heat and humidity of the indoor air is preserved by the magic open window of the ERV. When the temperature is high outside, the ERV temperature exchange flows in reverse. It is certainly not an air conditioner but with the high insulation levels of your Green Haven Home, it will make as much as a 20 degree difference in temperature while retaining indoor humidity to safe levels. We do not often need a full 20 degrees and the ERV is not a chiller. As outside temperatures moderate, so does the difference between outside and inside temperatures. This automatically changes the efficiency of the ERV system to lock in on the most comfortable temperature and humidity.

From an energy point of view, enthalpic ERVs improve the efficiency of heating and cooling systems. Ventilation is required by both building codes and common sense. In comparison to non-ERV ventilators, the ERV recovers about 85% of the energy that would be lost through other systems.

# FIRE RESISTANT EXTERIOR

Green Haven Homes are built for your PROTECTION, COMFORT & ENJOYMENT.  
EXCEEDS NAFPA-299 WILDFIRE RESISTANT STANDARDS



## FIBER CEMENT Siding

Fiber cement siding/ shingles. when stained in a cedar, redwood, maple or mahogany finish looks so real you can't believe it's not wood. The difference? Beauty with no maintenance and a non-combustible surface.

ONE HOUR FIREWALL RATING ON ALL EXTERIOR WALLS.

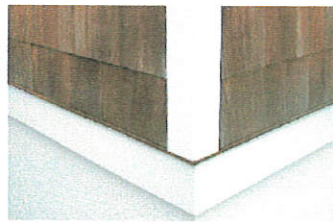
## Cultured

## Stone

The beauty of real stone in a durable lighter weight veneer

## AZEK TRIMboard

Solid PVC trim



## Evergrain

Composite decking

## Contego Paint

Class A rated intumescent primer option



## Elk Premium Roof

CLASS "A" FIRE RATED Fiber laminate roofing with 40 year warranty.



And as an added bonus

# MINIMUM MAINTENANCE

## Low Maintenance Exteriors

Maintenance of your home is not a sexy topic to write about. But, it is very important!

Our buyers tell us that having a home that requires very little or no maintenance for decades is a major reason for buying our homes. And, maintenance costs are one of the three top costs for a home buyer after the purchase (the others being utility bills and interest on the purchase mortgage). So maybe zero maintenance design is sexy after all.

The largest surface is the exterior walls. Here we use a product with a 50 year limited warranty, James Hardie fiber cement siding. Vinyl siding is the more popular exterior siding but it does not have the long life of fiber cement; and, more importantly, it is not fire resistant. Fiber cement not only provides a non-combustible surface but also inhibits flame spread. Vinyl siding melts off of the walls from the radiant heat of a wildfire well before the fire itself arrives to find the exposed surface of your wall.

Fiber cement siding provides a near zero maintenance surface without sacrificing the beauty and character of wood grain. It is vermin and termite proof; won't rot or crack; resists damage from ice, hail and wind-borne debris; and can be stained or painted any color at any time. There are many manufacturers of fiber cement siding but we like to use the local businesses and James Hardie & Co. is located in Colton. ([www.jameshardie.com](http://www.jameshardie.com))

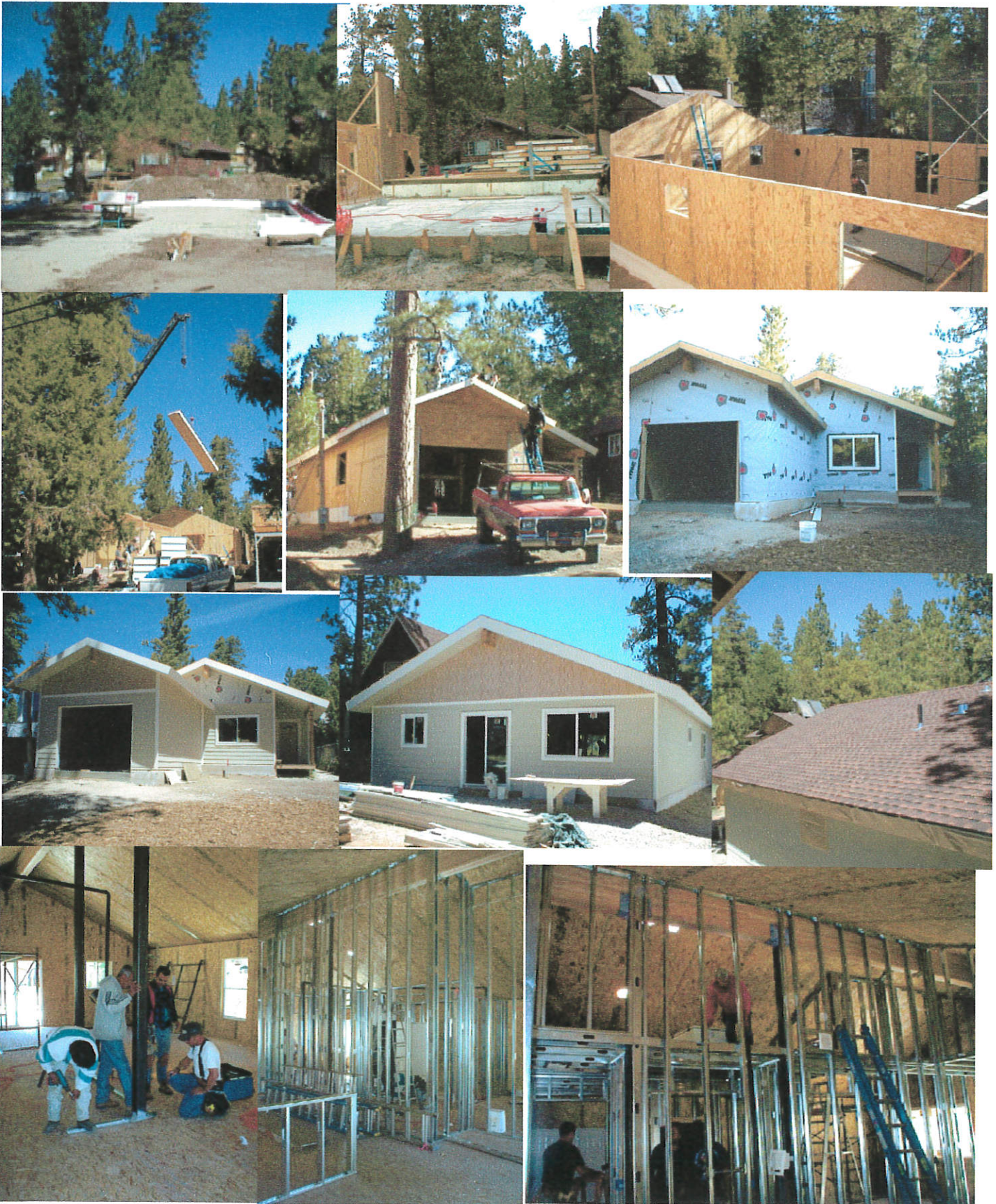
Duckback Products, manufacturer of the SuperDeck line of stains, produces Mason's Select Woodperfect series of fiber cement coatings. This line of stains in popular colors was developed to take advantage of the stability of fiber cement. Fiber cement sidings, unlike wood sidings, do not swell or shrink, twist or warp, or support the growth of mold. Thus, a fiber cement stain can be formulated that will last 4 to 6 times as long as a painted wood siding. ([www.superdeck.com](http://www.superdeck.com))

One area of maintenance that most homeowners hate is the painting of trim boards around windows, corners, and soffits. The trimboards used for Green Haven homes are made of cellular PV composites, called Azek Trimboards ([www.azek.com](http://www.azek.com)). While they look and feel like prime trim wood, they can never rot, warp, mold or twist. They never have to be painted (well, they have a 25 year warranty anyway).

The second largest area on the exterior is the roof. Here we have an industry award winner – Elk Prestique 40 year laminate roofing. This is a class A fire rated roof – the highest rating. Did you know that even a metal roof does not have a Class A rating? ([www.elk-roofing.com](http://www.elk-roofing.com))

Where decks and railings are a part of your house, we use Evergrain composite decking. This material will not spread a flame and will not deteriorate in the sun, snow and rain. While it looks like redwood, it is three times stiffer and requires no annual staining. Maintenance of this decking material consists of washing the dust off with a hose. ([www.evergrain.com](http://www.evergrain.com))

# Your Home Under Construction



# Your Home Under Construction

