

# Enviro Building Systems

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## Introduction

The **Enviro Building Systems** division of **Smartboard** manufactures our patented **U-Channel- Light Steel Frame System™ (LSF)**. Our proprietary steel studs and joists are used in lightweight steel frame construction. The system is extremely versatile and can be used to create virtually any building. It gives the architect the freedom to design a building that suits the client's needs regardless of the structural constraints that must be respected with traditional construction. This system allows site erection and utilization of local labour with a rapid training program. Local labour can then be utilized with minimal supervision in larger construction projects where multiple dwellings are being built. Our Light Steel Frame (LSF) system assembly answers the big question that homeowners & insurance companies are asking today. Will my house still be in one piece, or more specifically, will it be still be standing after the hurricane?

Enviro Building Systems is dedicated to revolutionize the industrial, commercial and residential construction process. This is accomplished by applying our U-Channel- Light Steel Frame System™ (LSF) combining design, manufacturing, and onsite erection of any structure into a single, more efficient process.

### Disaster Resistant

The U-Channel- Light Steel Frame System™ (LSF) is designed with unsurpassed strength to withstand natural disasters such as earthquakes (measuring 8 points on the Richter scale), tornadoes, hurricanes (with winds up to 160 MPH) as well as being fire and termite resistant. This product can be used for interior or exterior applications and is able to accommodate all types of exterior finishes on top of **Smartboard** sheathing, such as brick, stucco, metal, and wood. The system allows building of up to five stories without use of heavy machinery, such as cranes, and without heavy gauge steel sections. If code deems it necessary, lightweight fibre cement can be poured between the studs once the building is erected.

## Building Applications

We have implemented the U-Channel- Light Steel Frame System™ (LSF) process in many large projects here at home, in Canada, and abroad in countries such as Angola, Africa, Spain, Russia, Chile, Guatemala, and the Ukraine.

Please see our PowerPoint presentation for drawings and details.

Typical applications of buildings that have been constructed using our system include:

- o Low Cost to Custom Luxury housing
- o Production Homes
- o Townhouses
- o Multi-Family Dwellings
- o Commercial Buildings
- o Industrial Buildings
- o Hotels
- o Hospitals
- o Multi-level Buildings up to 5 Stories high

The U-Channel- Light Steel Frame System™ (LSF) allows the production of a low cost process to meet all climatic and social requirements. It can be assembled quickly and with higher quality construction that will help lower the average cost compared to that of traditional housing methods

The **Light Steel Frame (LSF) Truss** system uses an interlocking, adaptable, metal truss construction useful for floor joists, roof trusses, roof rafters, wall studs, beams, posts, chords, and lintels and relates to a novel chord member consisting of interlocked two or more chord U-shaped framing channel/studs for use in standard truss construction of houses or similar structures. More specifically, the truss construction finds particular application in metallic light-weight structural framing and modular concrete forming for specific uses in the residential housing, commercial & warehousing pre-engineered building markets.

## Advantages

Our system is a distinctive procedure that allows both the builder and client many advantages over existing construction methods including strength, durability, precision and cost.

Due to precision engineering each piece joins together flawlessly which provides swift on site assembly. Materials are delivered pre-cut, partially pre-assembled, bundled and color coded for easy identification.

There is no need for cutting and drilling on site.

The "**Open Web Design**" is another major advantage.

It serves several purposes. It is designed to enable easy installation of utility services such as wiring, duct work and plumbing through the walls and joists.

Most importantly it reduces temperature conductivity and increases energy efficiency.

**COST EFFECTIVE:** Steel framing is competitively priced in today's construction market. Compared to the price of wood, steel prices have remained very stable over the past decade. Thanks to computer-aided design and manufacturing techniques, waste is kept to a minimum.

**STRENGTH & DURABILITY:** Light gauge steel framing has a long lifespan -- it will not rot or deteriorate. Steel's high yield strength and fire-resistant qualities enable steel framed structures to resist fire, earthquakes and high wind loads much better than wood framed structures.

**HIGH STRUCTURAL EFFICIENCY:** Steel has one of the highest weight to strength ratios of all construction materials. This strength advantage means better design flexibility, wider spans and better material usage.

**DIMENSIONALLY STABLE:** Steel doesn't shrink, swell, warp or settle. Cracking gypsum walls, nail head popping and other common problems with wood framed structures are virtually eliminated.

**PRE-DESIGNED TO ELIMINATE WASTE:** Steel-framed structures are computer-designed, and manufactured to eliminate job site cutting and waste. This will ensure the rapid pre-fabrication of roof and wall assemblies and thus reduce labour expense.

**STEEL IS A "GREEN" STRUCTURE" -- ENVIRONMENTALLY FRIENDLY:** Steel-framed housing dramatically reduces the amount of trees consumed for residential construction, thus conserving one of nature's most precious resources.

- It is fact, that it takes 1 acre of forest to build a 2000 square foot home out of wood.
- That same house using light gage steel framing uses the material of 8 recycled mid-size cars!

- It is also mold and termite resistant.

**OPEN WEB DESIGN:** This patented design dramatically reduces the thermal bridging compared to other forms of steel structures. As well we apply a thermal gasket between the web and tube member which increases the thermal protection by 20%.

### Frequently Asked Questions

1. What savings can I expect with my home?
2. Are these homes energy efficient?
3. Does steel interfere with TV or radio reception or attract lightning?
4. Will my steel frame home rust?
5. Is it true a steel frame home is healthier?
6. Is a thermal break needed in the exterior walls?
7. Isn't it difficult to hang pictures in these homes?
8. Will my insurance be higher?

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### **Are these homes energy efficient?**

You'll enjoy big energy savings with your home's 6-inch, R-20 insulation. The high-strength framing of these homes creates wider exterior walls than typical wood framed construction, allowing installation of the much thicker insulation. The result is a quieter home, with reduced heating and cooling bills!

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### **Does steel interfere with TV or radio reception or attract lightning?**

No, to both. Sound waves pass through the area between the studs, so there's no interference with your radio, telephone or TV. As far as lightning, the steel frame gives you better protection than a traditionally constructed home. In fact, scientists recommend seeking shelter in a steel framed structure during lightning storms because the frame provides a path to the ground reducing the possibility of fire and injury.

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### **Will my steel frame home rust?**

Using galvanized steel protects your home against rust. The steel is also completely enclosed and protected from the weather.

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### **Is it true a steel frame home is healthier?**

These homes offer improved indoor air quality compared to homes using lumber only. Some lumber and wood products are treated with chemicals, such as arsenic and formaldehyde. Also, steel frames don't need to be treated for termites, and it is also mold resistant. This allows fewer chemicals into your home.

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**Is a thermal break needed in the exterior walls?**

We put a 6 mil polyurethane thermal break on the interior and Tyvek Housewrap rain screen on the exterior of the steel structures. And this can be as easy as taking some sill plate Styrofoam and cutting it into strips and using an automotive trim spray adhesive which works really well.

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**Isn't it difficult to hang pictures in these homes?**

Not at all, just as you would in a traditional home you can hang pictures on the drywall using toggle bolts or hangers. A screw attached directly into the studs can hold heavier objects.

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**Will my insurance be higher?**

No. In fact, because of steel's excellent performance in earthquakes, and because it is not affected by termites and is non-combustible, you may be looking at a lower insurance premium.

## Technical Documents

- ❖ Flooring System
- ❖ Steel Stud System Advantages
- ❖ Foundation
- ❖ No Heavy Equipment
- ❖ Changes to Design
- ❖ Reduced Labour
- ❖ Faster Construction Time
- ❖ Moisture Management
- ❖ No Weather Delays
- ❖ Reduced Electrical Costs
- ❖ Sound Deadening
- ❖ Engineering Certificate
- ❖ Freedom in Architectural Design
- ❖ Accuracy of Construction
- ❖ No Thermal Transfer

## LSF : Flooring System

The flooring system has an engineered design live load of 60 to 100lb / SF. All the electrical, mechanical, plumbing, security, telephone, video, audio & intercom house systems can be run (or installed) through the joists, walls and roof trusses with ease without having to lose valuable time on the owners building schedule & additional unnecessary expensive labour costs cutting through materials (i.e.. wood). There is an added advantage obvious to the trained professional or builder; no loss in ceiling heights, and no soffits. More importantly, in a residential application we can span up to 32 feet wide with **no columns** and **no bounce** (using up to a 16" web height joist) allowing the designer to create open spaces. The system can even span up to

100 feet wide for commercial applications (i.e., Hotel lobbies, warehouses, gymnasiums, etc.). The design possibilities are limitless! The wall systems ingenious geometry lends itself to a designed thermal wall (air-cavity) barrier capable of naturally insulating (without using actual insulation materials) the building at a rating of R-8. Additional insulation can be easily added to significantly improve the R-value up to and including R-40 in the walls, and R-60 in the ceiling and floor. Each structure comes with a specific foundation plan approved by our factory engineers so the owners can build their foundation - footprint on site with piece of mind as per factory specifications &/or dimensions prior to receiving the truck-crane delivered house in easy to assemble sections (e.g., walls with sheathing & furring strips / roof trusses / floor joists). The installation time per unit is fast tracked to 3-7 average working days with a typical carpentry crew of 4-6 workers (contingent upon training and supervision), appropriate hoisting equipment, and typical screw guns with self tapping 1/4" screws, and anchors bolted to the foundation. This system provides a modern pre-engineered structurally sound building that's efficient, maintenance free and simple to erect. The LSF Truss assembly system can reduce the owner's typical building costs by as much as 30%.

### **LSF : Steel Stud System Advantages**

Traditional construction in North America and many other parts of the world today is being done with wood and / or concrete blocks. This method is very time consuming and not necessarily precise. It is our intention to ensure that the average home owner and the experienced builder has an appreciation of the many benefits and advantages of the **Enviro Building Systems** patented LSF building system. Our system has been successfully used in over a dozen different countries all over the world. From a number of different perspectives, our LSF system is superior to many other building systems. While others use steel studs ("C" Channel) as a part of their construction method, our LSF system is the only system that uses galvanized corrugate steel, which produces a building that is capable of withstanding category 5 hurricanes and seismic activity up to 8.0 on the Richter scale. Our system was designed to give architects total freedom in

assembling structures that are going to last for many years under the most adverse conditions. The system places all of the bearing walls on the perimeter of the building. Buildings can have an open span of up to 32 feet without any supporting walls which makes it ideal for open concept homes, and up to 100 feet for gymnasiums, restaurants, and theatres. This can be extended to greater lengths with some minor engineering modifications. Looking at the four appendices attached to this document, you will quickly see how the system protects the structural steel contained in the wall sections and floor panels from the elements. In addition, the steel itself has been coated with Galvalume which is proven to be a very effective way to protect the steel. Galvalume is an alloy composed of 55% aluminum and 45% zinc by weight that is applied to cold-rolled steel using a precise hot dip process.

Collectively, this means that the air is not able to interact with the bare metal which can cause the metal to deteriorate over time. As shown in our appendices, you will see that although our system may give the impression to need special training and techniques, the contrary is true, it is very easy to work with. Once the structure is erected, you can install **Smartboard** or drywall on the inside and **Smartboard** on the outside. The surface can be finished in a variety of ways including stucco, plaster, or paint creating a continuous wall that simply does not move. This means that you will not have to repair cracks that can occur over time due to settling as occurs with conventional building methods. Behind the **Smartboard** is a layer of Tyvek® house wrap from DuPont to envelope the building. This is installed at the factory as a part of our manufacturing process. DuPont notes in an article about Tyvek on their Web site, one of the most popular and widely known applications of Tyvek® is in the construction industry, where it is used to increase air and water resistance, helping to lower heating and cooling costs in buildings

Another advantage of the LSF system is the total integration of our system with conventional existing buildings, the entire building starting from the foundation to the walls and the floors and finishing with the roof trusses. Every component is strapped and screwed with screws that have been coated with Galvalume. Every interconnected part is fastened with multiple screws resulting in a building that is incredibly strong. Between floors, in commercial buildings, we typically use a 3" layer of concrete poured into our patented corrugated steel pan that is supported by high strength floor joists. This produces a floor that has been engineered for a structural strength ranging from 50 to 300 lbs per square foot depending on the application and requirements. Although this may sound very complex and difficult to erect, on the contrary, our patented LSF system cost less, goes up faster, is more accurate and performs better, rest assured, these steel frame buildings when completed, do not look any different than conventional structures.

#### **LSF : Foundation**

**Our LSF system requires a less comprehensive foundation as compared to traditional construction methods. This results in a substantial savings of material and time in the creation of foundations. Enviro Building Systems will forward the client a copy of the design of the foundation. We can work with the construction team to provide them with all of the information that they need to properly prepare the site prior to our arrival with the prefabricated building components. On construction sites where the land is not flat, the builder has to decide if they want to make the site level by digging into side of the hill. This can be both time consuming and expensive. With our Steel Stud building system, we can offer a real alternative. Our system has been used in areas where the building needed to stay dry regardless of the tides. This was accomplished by putting the building on stilts which ensured the house was dry that regardless of the swell. This same construction technique can also be used when construction is being done on a hillside. By properly supporting the building with additional steel posts, we are able to build the home without incurring the expense of digging into the hillside.**

#### **LSF : No Heavy Equipment**

### **LSF : Changes to Design**

Since the system puts bearing walls at the perimeter of the building, most if not all interior walls will be non-load bearing. This means that changes in floor plans, if required, can be achieved with relative ease.

### **LSF : Reduced Labour**

Steel frame construction eliminates the need for some construction trades and reduces the required time for others since the building sections are factory assembled. On site assembly is achieved with a supervisor and a limited number of local labourers (usually 4 or 5). Once a crew has assembled two or three buildings, they understand how these buildings are assembled and are able to work with little or no supervision. Stand-up time is measured in days not weeks or months.

### **LSF : Faster Construction Time**

When traditional buildings are erected, the last phase of the project is to finish the interior and exterior. With wood, block, or poured concrete construction, the process of running plumbing, heating / cooling ducts, and electrical wiring is done by drilling holes into the walls which carry the pipes, ducts, or conduit. This is not necessary with our system as the open web joists are easily threaded without the need to drill holes in the wall. This is another significant potential for time and cost reductions and increased daily productivity.

### **LSF : Moisture Management**

Buildings that use poured concrete or concrete block trap moisture in the building. This typically leaves the

barrier by DuPont.

### **LSF : No Weather Delays**

Weather days are not as critical. Pouring concrete or laying concrete block cannot be done in bad or cold weather. **Enviro Building Systems** construction can continue as long as the crew wants to work. The building components are delivered to the site in prefabricated panels so there is no cutting on site or cleanup of unused steel beams. This dramatically reduces haulage and disposal costs associated with construction.

### **LSF : Reduced Electrical Costs**

Because of the Open Web Joists, it is possible to introduce a central air conditioning system which manages the temperature of the entire apartment from a central unit. This may or may not be desirable as individual room air conditioning units can also be installed. Regardless of the type of air conditioning system that is selected, our system can substantially reduce the electricity consumption by air conditioning units. This is accomplished by insulating the exterior walls which keep the heat out. In a construction project in Guatemala which used our system, our customers were able to reduce the size of the air conditioning units from an estimated 20 tonnes per building to a mere 2 tonnes per unit.

### **LSF : Sound Deadening**

Features such as “sound deadening” can be easily and effectively introduced into our system if required. Poured or block walls do not allow for such additions. Since our walls are “cavity” style walls, thermal bats or sound attenuation blankets can be used to create the desired thermal or acoustic level. It is very hard to put a value on this feature because the cost of the sound blankets is minimal but the difference to the resident is huge. One of the most annoying things regardless of where you live is to be able to hear noise from your neighbour. With our system, we virtually eliminate this problem.

### **LSF : Engineering Certificate**

Our buildings come with engineering certificates. These

units are designed to give the features and appearance according to client requirements, but also are engineered to withstand a category 5 hurricane and class 8 seismic activities. This kind of assurance and security is not available in on site construction.

### **LSF : Freedom in Architectural Design**

Unlike other building systems, we can provide any architectural style you might require. We are not restricted in providing you with the look and features you want. We can insert arches above any door or window, walls can be curved and we can also create huge open areas suitable for large restaurants, auditoriums or gymnasiums without the requirement of using supporting posts.

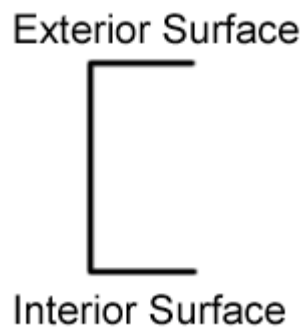
### **LSF : Accuracy of Construction**

All of the wall sections, floor joists and roof trusses are built in our factory. This ensures that all wall sections are flat and square, roof and floor sections the same. As the building is assembled, we are able to construct a building where such accuracy is not often achievable using conventional methods. Windows, doors and other features are “exactly” in the right place and the proper dimension. Openings for windows and doors are accurate and there is no need for using concrete to fill in a gap that exists between a window frame and the wall. From a cost standpoint, our steel buildings are brought to the “ready to close in and finish” condition faster than any other construction method. This speed, and accuracy, allows occupancy of units faster than any other method. Our steel frame building cost is very competitive by any standard. Finishing costs and times vary according to client requirements but at this point are entirely up to the client. This system will successfully create very inexpensive “affordable” housing in areas of economic depression, or, it can also create elaborate “estate” homes of great size and value.

### **LSF : No Thermal Transfer**

A typical criticism of steel stud construction is that they transmit hot/cold where an exterior wall stud touches an interior wall. With many steel stud systems this is definitely a true statement and the explanation of how this happens is quite simple. Thermal transfer from the outside to the interior is directly related to the construction of the steel walls. Many of these systems

use “C” channel as a fundamental component to their walls as shown in the diagram below:

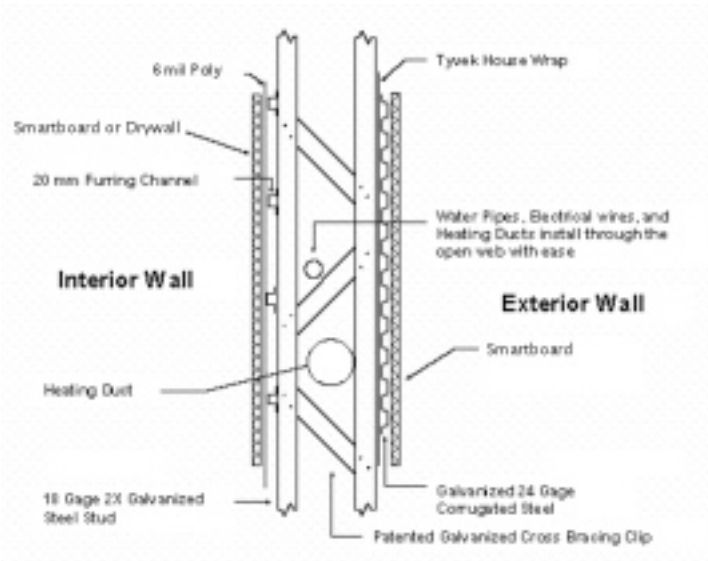


“C” channel is a solid metal plate about 4” - 6” wide with a short flange on each side. The flange becomes the flat surface that is used to secure the exterior and interior wall board. When any thermal transfer occurs through the exterior surface to the exterior surface flange, it can easily migrate to the corresponding flange on the interior surface which becomes a hot/cold strip on the interior walls.

**Enviro Building Systems** do **NOT** suffer from this problem because of the thermal breaks that are introduced into the wall sections. By referring to the diagram on the next page in Appendix “A” the reader will quickly see that the system introduces thermal breaks at several points between the exterior and interior wall. Any cold that does manage to get beyond the exterior wall to the furring channel is dispersed by the air gap and the insulation that has been installed into the wall. At the junction between the furring channel and exterior surface of the wall, there is the opportunity to transmit some cold. Again, the thermal break which forms the walls and the insulation that is inside the wall will disperse the cold. Cold is not like a virus that constantly seeks new pathways to the interior surface. Either there is a pathway or there is not.

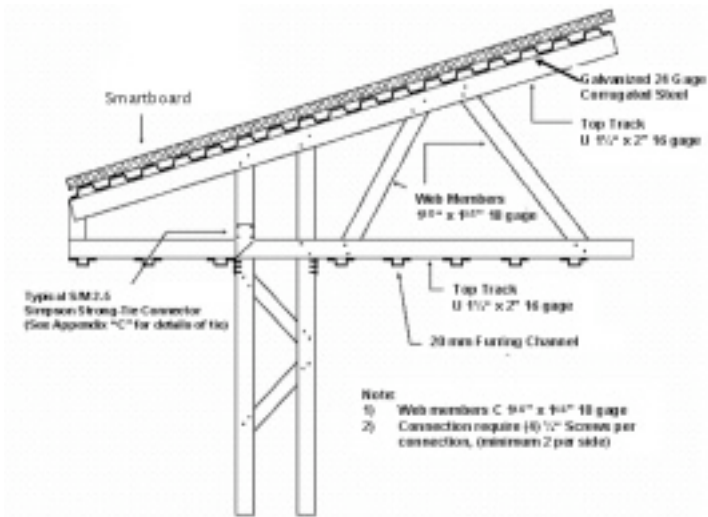
**Enviro Building Systems** in conjunction with the Tyvek Housewrap, insulation and furring channel ensure that the exterior walls do not transmit any thermal differences regardless of the temperature outside.

## Appendix A



The diagram above shows a typical cross section of an exterior bearing wall. The combination of the corrugate steel and **Smartboard** creates an effective barrier against hurricanes. Behind the corrugate steel, we are including a layer of Tyvek Housewrap which lets moisture escape but does not allow it to re-enter the cavity wall. Together the Tyvek Housewrap and **Smartboard** will isolate the steel from the elements. It is recommended that the wall cavity be filled with insulation. This will help to moderate the temperature inside the building. If it is the intention of the client to add heating or air conditioning, then the insulation will substantially reduce costs. A variety of different finishes such as Stucco, Plaster, Wall board, etc. can then be applied to **Smartboard** to create a visually appealing exterior surface. On the inside walls, we use furring channel, a layer of 6 mil poly, and a layer of drywall or if extra protection or enforcement is required, **Smartboard**. The drywall and 6 mil poly act as a barrier against moisture which can enter the wall cavity from the inside.

## Appendix B

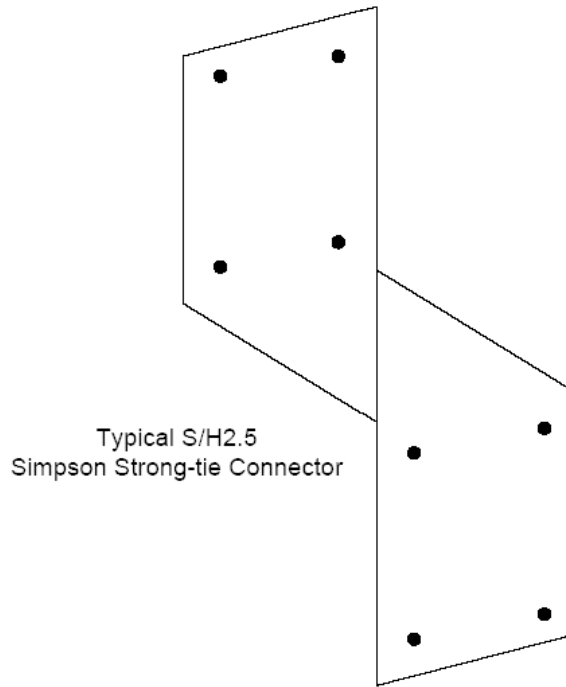


This is a drawing of a typical **Enviro Building Systems** steel truss. This drawing depicts the basic format of the unit. All trusses are engineered and designed according to each project requirements with few restrictions.

In residential circumstances, perimeter walls are to be load bearing and interior partitions non-bearing. With that in mind, this truss system allows for clear spans of 40 feet – and even greater with modifications to engineering.

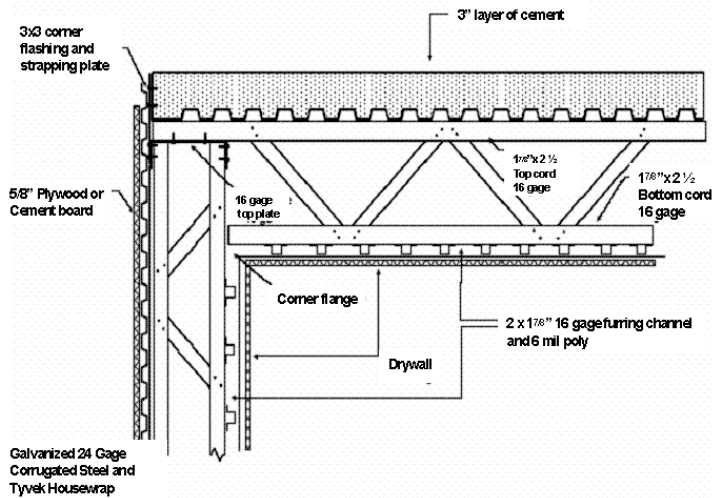
**Note:** Also, the use of Simpson Strong-tie connectors is a significant factor on the achievement of hurricane ratings with Category 5 being the **Enviro Building Systems** standard.

## Appendix C



Simpson Strong-tie Connectors are anchors designed to connect rafters or joists to wall plates or studs. The H2.5 tie is formed from No. 18 gage galvanized steel. The steel meets ASTM A 653 FS with minimum yield strength of 28,000 psi (193mpa) and a minimum tensile strength of 38,000 psi (262mpa).

The H2.5 is a twisted strap tie used to attach a rafter or stud member to the side of a top plate or bottom sole plate. The lower end is fastened to the wall plate and is long enough to locate the screws into each of the two top plates.



This drawing depicts an **Enviro Building Systems** web joist as it connects to an exterior bearing wall. The floor joist is secured to the 16 gauge top plate of the wall section. Finally, a strapping plate is installed between the wall and the concrete pad. Similarly, there is a 16 gauge bottom plate and strapping plate to connect the wall section to the foundation. This combination of plates and straps is repeated for every story of the building.

Above the floor joist is the form which holds the poured concrete. To reinforce the concrete floor, we recommend the use of a  $\frac{3}{4}$ " nylon fibre mesh or a 9 gauge 6 x 6 galvanized steel mesh. Between floors, we typically use a 3" layer of concrete that is supported by high strength floor joists. This produces a floor that has been engineered for a structural strength ranging from 50 to 300psf depending on the application and requirements. Treatment for the exterior walls can include stucco, plaster, brick and stone veneers, paint, and siding or galvanized coloured steel.

