

**The Technology**

This is a construction method using structural load bearing panels replacing conventional building materials; Bricks, timber partitioning or block work. Though newly introduced to the local industry, this technology has been used globally for over 35 years. The panels could be used in conjunction with structural column beam construction for larger/taller buildings. This could also be used as independent load bearing elements for quicker construction; for floor slabs, load bearing exterior or interior walls, partitioning and roofs, canopies and cantilevers etc.

**Panel Specifications**

The shop-fabricated panels consist of a modified expanded polystyrene insulation core surrounded by a three dimensional welded wire frame. A layer of shot Crete is sprayed or trowel applied over this welded frame after erection on site. The finished panel could have a thickness of minimum 4"-5" or more depending on the thickness of the inner foam and the field applied plaster.

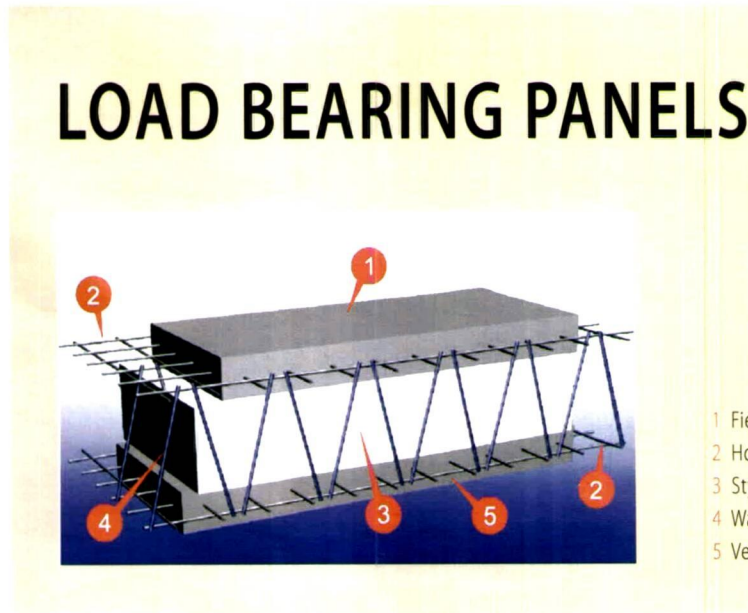
**Steel Structure**

The vertical truss chords (Gauge 14) are spaced at 2" centres on either side of the inner foam. This assembly, on each face is held together with horizontal wires (Gauge 12/14) welded to the truss chords at 2" inch centres.

This mesh projects approximately 3/8" beyond each foam face to permit the wire embedment within the Portland cement application.

The structural strength and rigidity is provided by a vertical connector (Warren truss Gauge 14) diagonally welded between the two frames on either side. The resultant structure provides rigidity and shear.

All wire trusses are made of high tensile galvanized steel and conform to regulatory standards.



- 1 Field Applied Plaster
- 2 Horizontal Truss Chords
- 3 Styrofoam Fill
- 4 Warren Truss
- 5 Vertical truss Chords

**Infill**

Type 1 expanded polystyrene foam core (Thickness generally 2.5") with a minimum density of 0.9 pounds per cubic feet

**Portland Cement Application**

This is a mixture of Portland cement and aggregate. The plaster must have a minimum 28 days compressive strength as required by design based on testing.

2 coats of Portland cement are gun applied or sprayed on both sides of the panel. The finished wall resembles a conventional masonry wall. A thickness of 1.5" or 2" is possible depending on the use.

**Versatility As A Construction Method**

**Architectural Flexibility**

"The product did not really restrain us in what we wanted to do in terms of design. We just designed as usual and replaced all wall elements with this product. In terms of inserting conduits for electrical and plumbing services, we just had to make a cut out in the panel, insert our conduits and then plaster over with the cement spray gun." Says an Architect who had used this product.. The panels come in 8' x 4' sizes and could be cut and joined to

desired dimensions, curves and domes.

**Fixing methods**

- Panels are connected to slab and foundations with steel hold down connector channels and foundation bolts, along the width of the panels and fastened at the edges. Resistance to uplift /overturn is provided by installation of a wire loop hold down device.
- Wall panels are connected vertically, by a strip of welded wire mesh or truss placed along the centre of the joint on both sides of the panel. The strip mesh is clipped to the vertical panel wire reinforcement. Corner and intersecting walls are also connected to the mesh truss in a similar manner. Sheet metal sneer receivers or powder actuated anchor bolts are used to reinforce wall panel tops.
- The cut edges of openings are strengthened by truss reinforcement placed along the opening and connected to panel reinforcement.

**Integrating Services**

Electrical conduits, switch boxes, outlet boxes are installed in to the panels prior to application of the Portland cement in accordance with local conditions. Outlet boxes are placed in a manner that minimizes the

cutting of wire mesh reinforcements. When two or more wires in the same direction has to be cut, they are replaced with wire of same gauge attached with sufficient overlap to allow for continuity. Plumbing and waste lines are limited to extending at right angles through the wall panels in a way that minimizes cutting of wire mesh.

**Cost and Time Comparisons**

An 8' x 4' panel weighs 18.5 kg., 40% light weight compared to conventional masonry work. This results in a lighter dead load from the structure and the possibility of an economized foundation design.

Unskilled labor is locally obtained and specifically trained to work with these panels. Panel construction does not involve traditional skills of masonry, carpentry etc. In modular construction, prototype housing and repetitive design, panel technology is used to hasten the speed of construction

The Architect states, "Since we were building in the east coast after the Tsunami, There was not enough skilled labor in the region, People were under shock. We were predicting that we would run out of traditional

building materials as the reconstruction took place and this being a prefabricated material, could just be brought into the area and installed in a very short time frame."

**Load bearing capacity**

Panels act as a monolithic structure. The load is transferred every two inches through the mesh reinforcement horizontally and vertically. Axial load for a panel height of 8 ft is 3100 Pounds/lf and transverse load for panel height of 8 ft is 89 pounds/sqft. These panels resist wind loads up to 260 km/hr and meet the design requirements of seismic zone 4.

**Fire resistance**

The finished panel with a plaster thickness of 1.5" has a fire rating of 1.5 hours, while a thickness of 2" has a fire rating of 2 hours. The fire ratings are valid for fire exposure from either side. Fire ratings are derived from the wire mesh gauge in combination from cement thickness. The polystyrene core does not burn.

**Insulation Properties**

The polystyrene infill in the panel acts as a thermal insulator and reduces heat transfer in to the building and vice versa. The product claims to save 30% on electricity consumption and 40%

on equipment cost in power managing of the building. The shell configuration of the Polystyrene foam acts as a sound barrier.

**Accreditations/ Consents**

- The IBT – WWPS describes this technology as complying to 1997 Uniform Building Code & International building codes.
- Environment Protection Agency's (EPA) Energy Star
- U.S department of Energy's PATH program

**Few Projects Completed and Under Construction Using Panel Technology In Sri Lanka**

- 220 houses of a project to build 250 houses in Batticaloa, for the Tsunami displaced were completed using this technology.
- 15 houses in koggala, Habaraduwa was also done using panel construction technology at an accelerated speed.
- In a pilot project for mass housing, 2 storey housing complexes were completed without the use of Columns & Beams.
- 6 luxury Bungalows are to be constructed in Katuwana for the Department of Archaeology. Foundations have been laid and walls are being erected. The whole project is to be completed within the 50% of the initially proposed construction duration.

**Concluding Remarks**

As much as this technology compliments the construction industry of Sri Lanka, there are areas where it does not show much competitiveness compared to conventional methods. The cost saving is a case in point. As the panels are lighter in weight the depth of the foundation and the involvement of columns and beams will be less. Yet this will apply only for short span structures and not complex designs. As soon as open spaces and spans wider than 15 feet are included in the design the involvement of columns and beams would be inevitable. Here, the cost saving in the design will be marginal compared to a conventional construction method. Yet high risers are possible, if the design incorporates load bearing walls with minimum involvement of columns and beams.

Since this technology needs specific skills and specific equipment, a mundane change a layman would do inside the house will not be an easy task. Yet the time consuming constructions could be made much easier and less complicated with the technology as it's just a matter of compiling a few panels together with

minimal time. Panel technology is vastly popular in the Tsunami housing reconstruction in East coast and Down South. This technology consumes comparatively lesser amount of material to conventional methods, thus the welcome cost savings in projects of this nature.

This technology may become more popular in the future as more labour is trained to use it, depending on the demand. There is also speculation of setting up a manufacturing plant in Sri Lanka, which of course may lead to this technology becoming more viable in terms of cost.

**by Zeena Marikkar**

Comments and input given by Archt. Kusumsiri Bandara, Architect Sumangala Jayatillaka and Architectural Graduate Ransirini Kumara is greatly appreciated.

