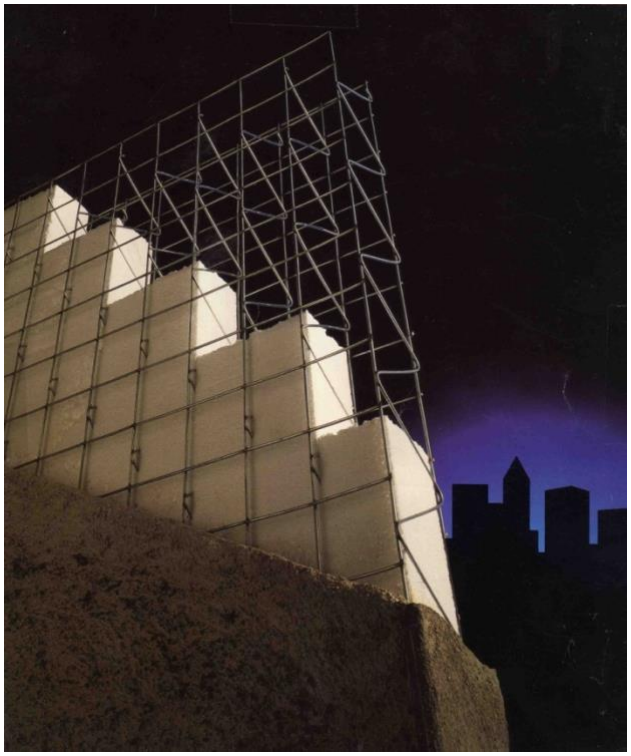
Smart Panel
WALLING SYSTEMS

Training and Assembly Manual



Design and Installation Manual 2023/24

Smart Panel Walling System

Smart Panel Walling Systems Pty Ltd.

The system and performance specification detailed in this guide are based on laboratory tested conditions. Actual site conditions should be checked, and advice obtained from an appropriate consultant. Any variations or substitution of materials or assembly requirements, or any compromise in assembly or in quality of the system components may result in failure under critical conditions.

It is the responsibility of the architectural designer and engineering parties to ensure that the details in the Smart Panel Walling System Design and Installation Manual are appropriate for the intended application. The recommendations of this manual are formulated along the lines of good building practice but are not intended to be an exhaustive statement of all relevant data. Smart Panel Walling Systems Pty Ltd accepts no responsibility for, or in connection with the quality of the recommendations or their other suitability for any purpose when installed.

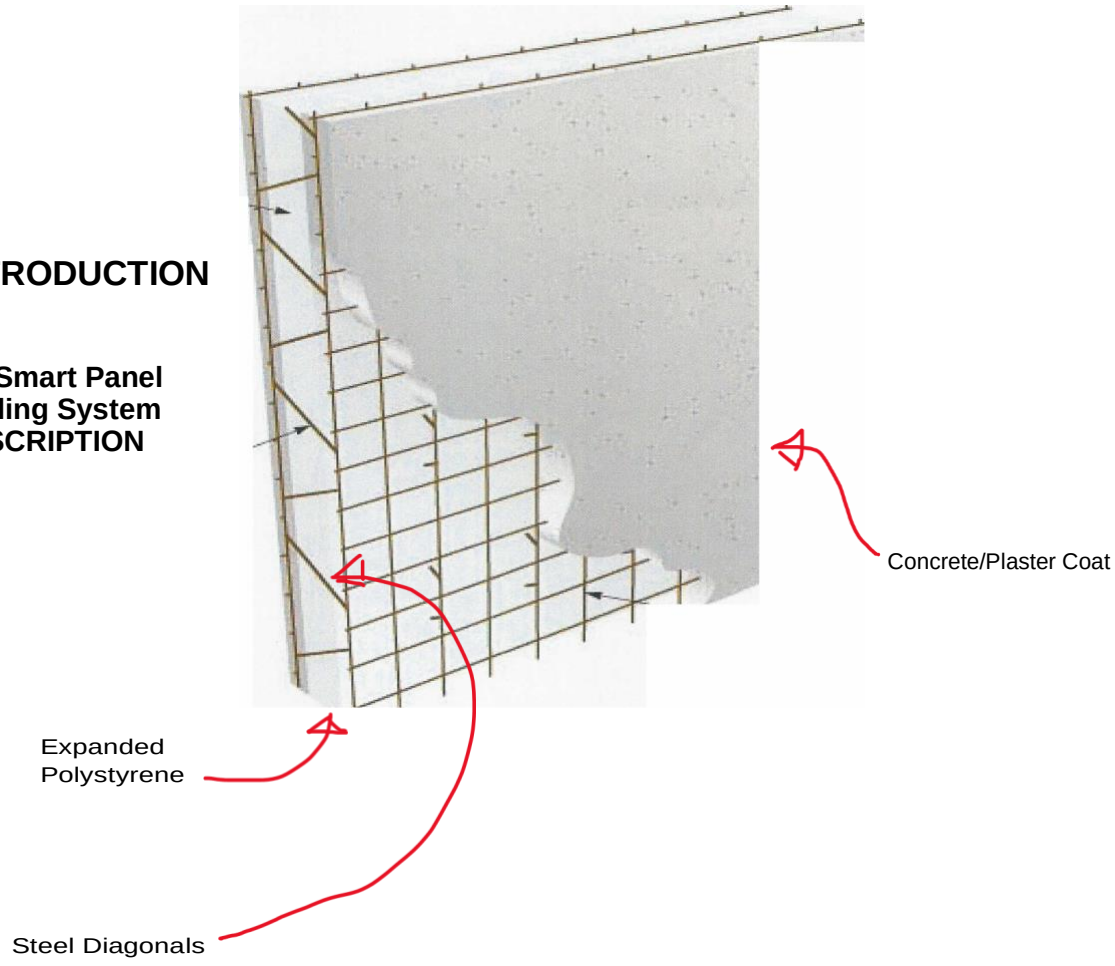
Smart Panel Walling Systems Pty Ltd is continuously developing its products. These on-going developments may result in changes to products specifications, range, and performance characteristics from time to time. The specifications, range, and performance characteristics on which the Smart Panel Walling System Pty Ltd are based are those current in December 2024.

The design of the Smart Panel Walling System requires the services of professional consultants. This design guide has been prepared as a source of information to provide the general guidance to the professional consultants, and in no way replaces the services of the professional consultants on the project. No liability can therefore be expected by Smart Panel Walling Systems Pty Ltd or other parties in use.

Smart Panel Systems Walling Pty Ltd products and systems undergo constant research and development to integrate new technology and performance experience. As additional knowledge, technologies and methods become available, Smart Panel Systems Walling Pty Ltd will endeavor to make these readily available via our website: www.smartpws.com

1. INTRODUCTION

1.1 Smart Panel Walling System DESCRIPTION



Smart Panel Walling is an extremely strong structural product which consists of super-insulated core of rigid expanded polystyrene sandwiched between two engineered sheets of 2.8mm – 3.2mm steel welded wire fabric mesh. To complete the panel process 3.2mm – 4.0mm steel truss wire is pierced completely through the polystyrene core at off set angles for superior strength, then welded to each of the outer layer sheets of eleven-gauge steel welded wire fabric mesh. These three elements are joined by state-of-the-art manufacturing equipment producing a three-dimensional lightweight panel that due to its characteristics, makes it one of the strongest building materials available. The product is then field

coated with concrete for structural integrity.

The Smart Panel Walling System is an innovative, yet tried and tested system, which is currently used in over 20 countries around the world. The system is revolutionizing the way in which buildings are being built. It enables builders to build structures stronger, faster, and More Cost Effective without skilled labor. The system is extremely versatile and flexible and has a multitude of applications.

1.2. BACKGROUND

In the early 1960's the idea of using a three-dimensional panel with insulation material sandwiched between two layers of welded wire fabric was developed in the United States. While the idea was sound, technology did not exist to economically and efficiently mass produce the panels, utilizing the most economical insulating and reinforcing components. Attempts have been made over the years to design a process to automate the manufacture of a welded wire sandwich panel. The idea arose to use the polystyrene sheet in module size. The spacer wires are diagonally pierced through the polystyrene EPS core and welded to the two mesh layers. The spacer wires hold the core firmly in the designed position.

1.3. THE CONSTRUCTION SYSTEM

In the Smart Panel Walling System, the EPS insulation core fulfils several important functions. Firstly, it serves as formwork for the concrete layers, secondly it also acts as a displacement body in the sandwich construction method of the Smart Panel Walling System, minimizing concrete requirements. The EPS core also contributes its share to the excellent thermal insulation properties of the Smart Panel Walling System.

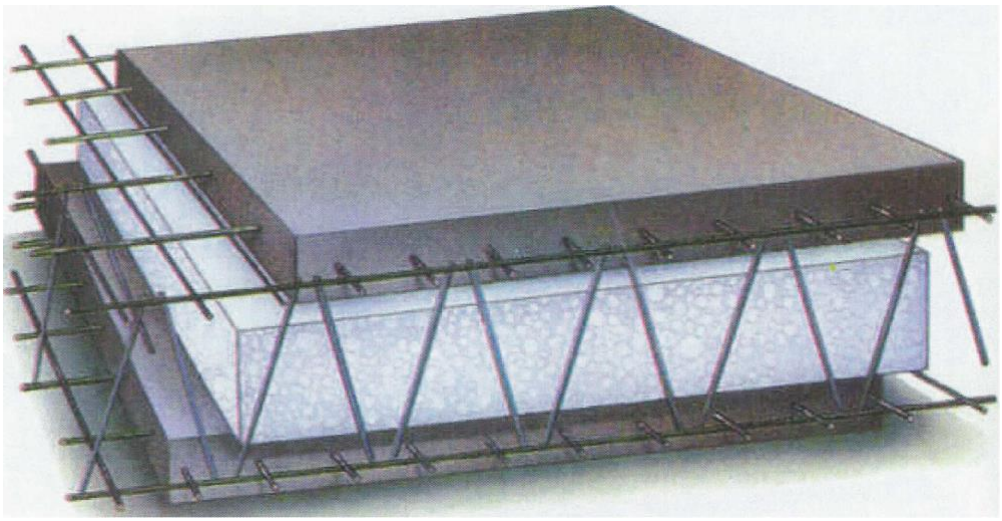
The Smart Panel Walling System is primarily conceived to be used as a total construction system, combining the strength of steel, the insulation of EPS and the durability of special concrete. It is designed to be used as load-bearing and non-load bearing walls, floors, and roofs structure for various construction buildings. Smart Panel Walling can also be included in other construction systems as a component, i.e. steel frame or reinforced concrete construction such as curtain walls, partition walls and as core in precast elements.

1.4. DESCRIPTION OF COMPONENTS

The wire fabric mesh is composed of horizontal and vertical reinforcing bars with typical diameter of 3mm with 50x50mm openings. The horizontal and vertical bars are welded in every crossing location by automatic plant operation. The size and distances between wire mesh can vary for some special structure requirements.

The two parallel wire meshes are kept in their relative positions with diagonal bars welded in them every 120 - 200 mm (100 per square meter), with diameter 3.2 – 4.0 mm and slope 30 to 60 degrees, thus, creating a three-dimensional double wire mesh system.

In the space between the wire-meshes a built-in expanded polystyrene - EPS is placed parallel to these meshes during the manufacturing process. This insulating material is produced with controlled thickness, typically 50mm, but it can vary from 40 to 200 mm. The EPS being perforated by the diagonal trusses is safely kept parallel to the wire meshes in a controlled distance from them.



The Smart Panels Walling System are produced on a fully automatic welding line, which assembles the 3 components: welded mesh, truss spacer wires and expanded polystyrene - EPS. The insulation core is expanded polystyrene (EPS), a high-density product (approx. 18- 20 kg/m3). The Smart Panels Walling System panel receives its out of plane strength and rigidity by truss action where the concrete layers are the chord members, and the diagonal crosswires are the web members. This configuration provides an incredible structural strength and ductility and adequate shear transfer for composite behaviour.

Different configurations of Smart Panels Walling System panels are manufactured. Various thicknesses of EPS (40 - 100 mm) and different wire gages are also available. The number of diagonal wires per square metre can be determined based on the shear strength required (may range from 50 - 200 per m2). The diagonal wire diameters range from 2.8mm - 4.0mm. The typical standard Smart Panels Walling System panels are made of 80mm thick EPS, with 2.8mm welded mesh fabric on each side and with 100 truss wires per m2. The typical width of Smart Panels Walling System elements is 1200 mm, their lengths are variable and can be produced up to 6000 mm.

Concrete is applied on both side of the panels by method of spraying - shotcreting. The Concrete mix is specially designed for the above system to meet several important requirements, such as workability, strength, pumpability, water/cement ratio, rebound factor, waterproofing etc. Typically, the Concrete mix is 32 mpa, up to 7mm aggregate, up to 450kg cement per m3 of concrete, slump between 80-100mm and with several additives, such as silica fumes (Micropoz), retarder etc. The thickness of concrete layer for Smart Panels Walling System walls is typically 40mm inside and 40mm outside of the building. These thicknesses can be increased if required.

1.5. BENEFITS AND ADVANTAGES

The Smart Panels Walling System provides a fast, economical, and easy construction system which offers the builder a premier finished concrete wall or building that withstands a lot more stress than regular building methods. The system allows Architects and Designers much greater design flexibility to effectively use the same material in both load bearing and non-load bearing applications, straight, curved, and angled walls for single and multi-story buildings.

- Construction time is substantially reduced. The lightweight panel is easily handled, transported and installed at the job site. Exterior and interior walls can go up in hours.
- Earlier completion and earlier occupancy mean a lower total capital investment and quicker return on investment.
- Flexibility of design with the length and width of panels able to be cut to any size.
- Heavy equipment on job site is virtually eliminated. Handling and installation require fewer pieces of equipment.
- Fewer specialized sub-trades are required. The need for framing, masonry and dry wall trades are virtually eliminated,
- Simplified utility installation with easy routing of electrical conduits and plumbing pipes saves time.
- A continuous reinforced, insulated wall with extraordinary strength to weight ratios achieves greater structural integrity.
- Excellent thermal and sound barrier achieved with the modified double concrete shell and polystyrene core.
- Environmentally friendly system as the polystyrene core does not contain chlorofluorocarbons (CFC's) and the system does not deplete valuable forestry products.
- Long term maintenance costs are virtually eliminated.
- Other properties include.
    - Superior Fire Resistance
    - Termite and rodent resistant
    - No dry rot, no mustiness, no mould
    - Energy efficient
    - High wind resistant
    - Earthquake resistant
    - High durablility
    - Internationally proven

1.6. TYPICAL APPLICATIONS

The Smart Panels Walling System can be used in construction projects of virtually every type and its application is almost limitless. Most structures will benefit from the light weight, flexible, strength, sound, and thermal qualities of the system.

- Domestic dwellings
- Commercial office buildings

- Factories
- Warehouses
- Low-cost housing projects
- Agricultural buildings
- Retail outlets
- Hotels and resorts
- Swimming pools
- Fencing
- Retaining Walls
- Sound barrier walls
- Transportable structures
- Government building projects
- Fire/privacy/partition walls

2. PREPARATION OF Smart Panels Walling System

2.1. LAYOUT AND CUTTING SCHEDULE

From the architectural plans and engineering drawings and details, a panel layout elevation and cutting schedule should be created before starting the Smart Panels Walling System installation. This is very simple drawing showing the sizes, numbers and position of the panels that need to be cut before assembling. These drawings should also show arrangement for the panels around openings, corners, etc.

Based on the above information, the panels are cut to the sizes specified in the cutting plan. As the panels are made up of square mesh, once the initial measurement is made, it is simple to make a true cut by eyeing along the wires of the mesh. The panels can be cut using a grinder with carborundum cut off disk, or a skill saw with a metal cutting blade.

2.2. ASSEMBLY

Once the panels have been cut to the correct sizes, the walls are ready for assembling and installation. Assembling of the panels can be made on site (e.g. using concrete slab area) or off-site (in controlled environment). The shop drawings are used to determine the layout of the panels.

If off-site option is chosen, the panels are laid out on the floor in front of the wall support frame, splice mesh is used to join the top side. C Ring guns are used to join the mesh. The wall is then lifted upright and secured in this position to the vertical wall support frame. This makes it possible to access both sides of the wall and relieves stress on the back by not requiring as much bending over. Depending on the size of the pre-tied assembled panels, the delivery system must take into consideration a lightweight truck and/or trailer design. This delivery system enables the total product to be transported to site efficiently.

If on site option is chosen, the panels could be partly pre-assembled (say 2-3 panels with openings) and lifted and placed into the position of installation. The advantage of this option is that no heavy delivery is required and easier for manipulating on site. It also speeds up the process by rectifying any possible error made in shop-drawings or during the cutting process.

3. INSTALLATION PROCEDURE OF THE SMART PANEL WALLING SYSTEM

The lightweight nature of the Smart Panels Walling System panels is a considerable advantage for the installation of Smart Panels Walling System, as the panels can be moved and erected either by hand or by mechanical means. A standard panel with the dimensions of 1200mm x 2700mm has a weight of approximately 20kg, therefore can be easily handled by one person. There is no need for expensive cranage or heavy trucks for delivering and lifting of the panels, which results in a significant cost saving during the installation. This is of particularly advantage working in areas with difficult access to the site.

3.1. Smart Panels Walling System TOOLS AND ACCESSORIES

The Smart Panels Walling System requires the following tools and machinery.

Shotcrete concrete pump

Concreting of the Smart Panels Walling System panels is a combination of shotcreting and plastering finishing work, therefore the concrete pump should be chosen as an adjustable pressure pump with controlled spraying solution. The capacity of the pump doesn't need to exceed a 4 - 5m3/hr, because it is very likely that the ordered quantity would be around 2 - 3 m3 of concrete at a time. The compressor for pumping should be around 4-6 bars (or 80-120 pound/sq. inch). It is also important to use smaller nozzles and hose to simply manipulate around the building. There are also some other elements which need to be taken into account when buying a shotcrete pump, such as: simple operating pump system, having sufficient capacity, being able to convey concrete and aggregate of at least 7-10mm, in case of blockage have a quick recovery system, easy cleaning, easy assembling and easy movement around the building, auto reverse and cooling system, low maintenance and simple mechanical and services backup.

Pneumatic Hog Ring Gun

This is a pneumatic gun with a C-rings (or Hog Rings) used for clamping various types of splice mesh between panels. Using a Hog Ring gun is a very quick and friendly way to connect and brace Smart Panels Walling **System** panels together.

Fastening C-Rings (Hog Rings) look like the letter C when they come out of the carton. When applied they close evenly and tightly around the wire making a secure closure that tends to size itself to the application. They are galvanised steel 24x12mm in diameter.

For operating pneumatic gun, a standard small compressor can be used including hoses to reach area of work.

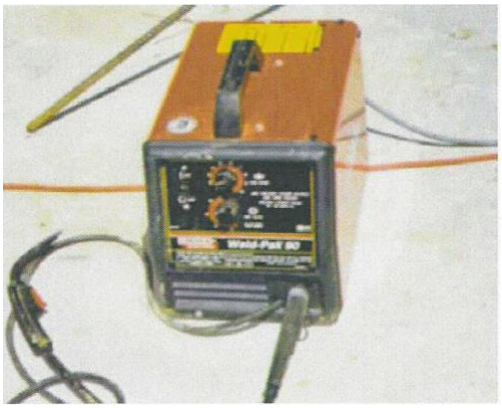
Cutting blade machine or bolt cutter

Electrical grinder with diamond cutting blade can be used for cutting Smart Panels Walling System panels. This is mostly for longer cut, such as full panels. In addition, for smaller cuts, hand bolt cutter, smaller size can be used for cutting mesh on and Smart Panels Walling System panels. These tools can also be used for cutting panels already installed for creating various openings (doors, windows, etc.).

In addition to the above tools for cutting and assembling the Smart Panels Walling System panels, basic hand tolls should also be used such as, standard saw, levels, string line, tie wires, bracing rails, screeds etc.

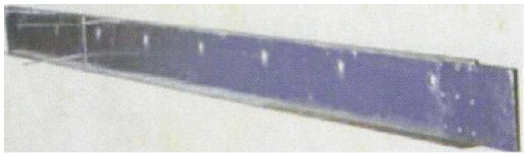
Welding machine

Welding electrical machine is used for spot welding metal brackets to the Smart Panels Walling System mesh for fixing metal top plate, metal frames for doors and windows and other various welding during assembling of Smart Panels Walling System panels. This is very simple work and does not require any special skill or additional training. Spot welding is very fast and helps keeping various supporting bracket in place.



Metal top plate frame

Galvanized (or black) 1.6mm metal U- shape frame is used for temporary top plate for accurate concreting of top of the Smart Panels Walling System wall. Typically, they are 150mm wide with one leg of 40mm and the other of 15mm. They have holes for reinforcing bars 18mm diameter positioned at 600 *clc* staggered, so that can be used for external and internal walls for floor starter bars.



Base U Bracket

Galvanized base U bracket is used for marking position of Smart Panels Walling System panels. They are made of 1mm steel. Length is 92 + 23 mm, for fixing Smart Panels Walling System panels (mesh to mesh) and for metal bracing. The bigger leg is 80mm and two smaller legs are 40mm each. The bracket is 60mm wide but may vary depending on the width of EPS. They are fixed into the concrete slab by dynabolts or any other concrete fixing.

Bracket for Top plate

Galvanized double T bracket is used for welding to Smart Panels Walling System mesh and fixing for metal top plate. It can also be used for fixing metal frame for doors with flat concrete finish. Bracket is 180mm high and 143mm wide. Distance between two legs is 92mm for placing the Smart Panels Walling System panels mesh to mesh. The size of the bracket may vary depending on the width of EPS.

Metal window frames

Metal windows and external doors frames are temporary formed for concreting area around windows. They are made of either galvanized or black steel 1.6mm thick with 25mm reveal for weather tight step. Typically, the width is 150mm with step 90mm from inside and 60 mm outside. Bottom sill is slopped out to allow any water to run out from the building. Once the walls are sprayed and metal frames removed, the concrete is formed with required steps and slopes, and it is easy for windows to be fixed.

Metal bracing

Three wall panels must be braced before concrete is applied. The bracing system is combination of metal bracing and timber. Metal bracings are L shape shelf brackets 60 x 60 mm with holes for easy fixing to the other elements. Brackets are fixed to the base U bracket at the bottom, to the top plate at the top of the wall and with a few spacings in their length. Timber bracing is usually used for angle bracing of the vertical walls.

Reinforcing Smart Panels Walling System mesh

All panels are connected using splice mesh, which is straight (for connection between two panels) or bended (for external and internal corner connection). This creates a continuous reinforcing mesh across the entire structure. Smart Panels Walling System mesh is only 2mm diameter and has openings of 50x50mm. The following customised types of splice mesh provide connection options for all Smart Panels Walling System requirements:

Type A Standard mesh 1200x300mm (used for straight panel connection and for Type D)
Type B Standard mesh 1200x450mm (used for forming Types C and Type E)
Type C "U" Shaped Mesh, (170x130x170) x1200mm (used for windows and panel edges)
Type D "L" Shaped Mesh (150+150) x1200mm (used for Internal Corners)
Type E "L" Shaped Mesh (200+300) x1200mm (used for External Corners)

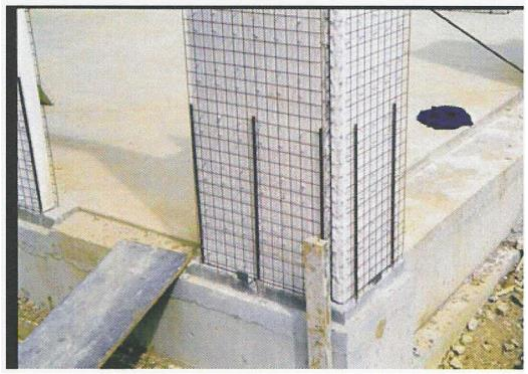
The mesh is fixed to the Smart Panels Walling System panels using pneumatic Hog Ring gun and C-rings accessories.

3.2. FOUNDATION AND SLAB DETAILS

The Smart Panels Walling System panels are approximately 30% lighter than many other standard concrete structures, therefore the saving in designing foundations is significant. Typically, foundation detail is similar to standard AS3600/As3700 for timber frame structure.

Once the foundations are completed and before ground floor slab is poured, the rebate detail with re-starter bars must be created. Rebate detail is shown in construction detail attached to this Manual. Typically, rebate is 120x30mm and allows for Smart Panels Walling System panel to be seated inside of the rebate (special attention for french door and garage door which depend on metal frames used for forming the opening). Rebate is important to be installed in case of any moisture appear from the ground level under the panel. Reinforcing starter bars, typically HD12 are placed inside of the slab rebate in the line of outside gap of Smart Panels Walling System panels. They are cast in with concrete slab as per construction detail. Re-starter bars are projected 800mm into the Smart Panels Walling System panel walls placed between mesh and polystyrene.

The first step before starting installation of Smart Panels Walling System panels is to install base U brackets (see section: Smart Panels Walling System tools and accessories) under perimeter of the building where panels are to be installed. They should be placed about 250mm from each corner and then no more than 1500mm apart. Under windows base U brackets should be placed exactly under jamb of the window, so that it can be used for fixing of vertical metal bracings. **I**f window is wider than 1500mm, another base U bracket should be placed in the middle of window. Under doors (e.g. French door) base U brackets should be placed about 250mm outside of the jamb line of the door, so that door opening is fully accessible. Again, if door opening is bigger than 1500mm, another base U bracket should be placed in the middle.



Once the U brackets are in place, the Smart Panels Walling System panels are installed inside of base U bracket, on top of the floor slab or foundation. The foundation and slab details are like that required when constructing a block wall or pre-cast panels. Starter re-bars of 12mm diameter, spaced at 600mm centre must be installed for at least one side of the wall to attach the walls to the foundation or to the floor.

These bars may either be cast into the footings or drilled and epoxied in as the walls are erected, depending on accuracy of set-out. The starter re-bars are placed inside of the panels between the reinforcing mesh and polystyrene connected with tie wires to the mesh. Depending on the structural engineering design, in some locations, re-bars will be required to be installed on both sides of the panels.

3.3. INSTALLATION OF Smart Panels Walling System

Erection of the wall panels always starts in a corner. This is necessary to give the construction enough rigidity from the beginning, because then it is possible to arrange the wall panels vertically and to permanently fix them to the starters. Fixing two wall panels or corner panels is carried out by connecting the welded wire fabric on both sides of the walls using corner or top mesh. Once the first two panels are placed on-line (forming a corner), the adjacent panels are clamped together with splice mesh. After the first two panels are firmly attached, the panel tops can be brought into line using appropriate temporary bracing. The type of bracing required will depend on several factors, i.e. panel height, wind conditions etc. All bracing should be located on the same side of the wall (usually inside) opposite the side which will receive concrete spray first.

Strips of welded wire fabric are used as splice mesh to reinforce panel joints. These strips are easily attached to the panels using the pneumatic fastening gun. At corners right-angle wire mesh is added inside and outside (called the corner mesh) and tied to the panel mesh. U-shaped mesh is used for wrapping around free (exposed) edges of the panels, or for all edges around openings such as windows and doors.

3.4. CONNECTIONS

After erecting the walls, all joints between panels are connected using splice mesh. This is to create a continuous reinforcing mesh. For this purpose, the following areas must be covered by the splice mesh:

Type A - Straight panel joints, straight splice mesh, w=300mm

Type C - U-shaped bent splice mesh for jambs, sills, lintels, door reveals, end of panels, w=470mm

Type D - L-shaped bent splice mesh for internal corners, w=150+150=300mm

Type E - L-shaped bent splice mesh for external corners butted, w=200+300=500mm

In situations where columns are necessary at corners as part of the structural design, this is achieved by the addition of horizontal U-bars enclosing the vertical steel. This may be done for additional robustness or where small sections are carrying significant point loads. Similar detail can apply to horizontal section beam, lintel etc.

Additional reinforcing is typically added inside and tied to the mesh. Reinforcing used to increase the strength of panels (typically in floors) should be high strength steel - HD.

3.5. LINTELS

Forming the lintels above openings is a very simple structure and does not require any special type of construction. Capacity of reinforcing mesh attached to the Smart Panels Walling System panels usually is sufficient to take most of the loads above the lintels. Additional reinforcing placed at the bottom of the lintel (sometimes on the top) depends on loading, size of the opening and depth of the lintel. Engineering design and calculation will show additional reinforcement for each type of lintel for the project. As a simple preliminary rule, the following could be the orientation, but it must be checked with engineering calculation:

a) openings less than 1 meter - no additional reinforcing

b) openings 1 - 4 meters - usually 2 re-bars at the bottom part of lintel
c) openings 4 meter or more - usually 2 bars at the bottom and 2 at the top.

The above preliminary rule depends on depth of the lintel and loading, so it must be checked with engineering drawings and specification. Beams (metal, concrete, or timber), which are designed to support the upper structure of the building are attached to the Smart Panels Walling System walls by one of the various methods which are shown the typical construction details attached.

3.6. TOP PLATE FIXING

Once the panels have been erected, a metal top plate needs to be installed. Top plate is 150mm wide, U shape with one leg of 40mm and the other 15mm. Top plate is welded to the top plate brackets which need to be welded to both side of the Smart Panels Walling System mesh. Top plate brackets are double T shape, 143mm wide with 2 legs of 180mmpositioned 31 mm from outside edge and 20mm from inside edge of the top plate bracket. Welding of top plate and top plate brackets is a simple spot-welding operation and can be done by every qualified builder.

The spot-welding points create a solid base for metal top plate to be fixed, either by spot welding or by using tech-screws. Before spot welding, all brackets must be checked to be straight and leveled. Distance between top plate and top of the panel is usually 40mm to allow for concrete cover over the steel mesh. Once the concrete under metal top plate is placed, the plate is removed and permanent timber 150x45 top plate needs to be attached. Timber top plate is attached to the concrete by providing HD12 bars attached inside the mesh.

The correct height of the wall and their straight position must be accurately measured using and accurate laser instrument. Any adjustment must be done before concrete is applied to this area.

3.7. BRACING OF Smart Panel Walling System Panels

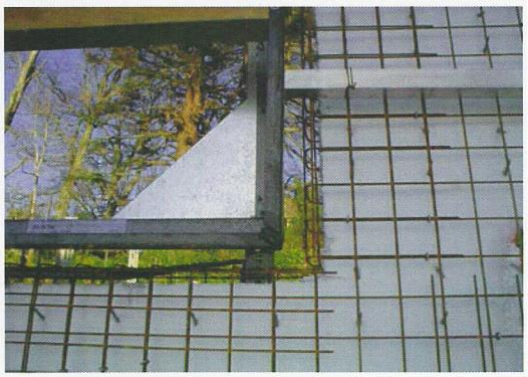
There are a several methods for making sure that plumb of Smart Panels Walling System panels and their exact position is firmly attached with no movement during concrete spraying application. Vertical L metal angles with holes are a good and strong bracing system which can be easily attached to the bottom U bracket using tech-screws. These angles are usually 60x60mm and are very strong and do not flex, which is important to keep walls plumb. Metal braces should be placed 25mm out of the line of the mesh to allow for concrete to be placed between, creating appropriate cover of the mesh. It is practical to use electrical conduit, or any other type of packer fixed between the mesh and metal brace angle.

In addition to metal bracing, diagonal bracing must be used, particularly for high walls. This is either timber fixed to the metal bracing or even better again same metal angle braces, which will have significantly less movement once they are fixed. Timber diagonals are fixed to the floor either by direct fixing or by fixing to the other timber fixed to the floor. **T**o protect floor for damage, or if the building has some restrictions in fixing timber directly to the floor (say underfloor heating), the horizontal timber plate can be glued to the floor and remove after all work is competed.

Bracing of the Smart Panels Walling System walls is one of the most important parts of the installation work to keep wall straight and plumb. This means that special attention must be taken when bracing work is constructed. It is always better to over-brace the structure, then not have enough bracing.

3.8. SCREED LINES FOR CONCRETING

Once the top plate, bracing and windows are installed there is almost enough reference points for concrete spraying. In addition, in areas where the wall is too long, between windows and braces, additional screed lines must be placed using aluminium box section 25x25mm for inside and 30x30mm for outside walls. These metal box sections are attached to the mesh by tie-wires and adjusted with other reference points for concrete spraying.



3.9. METAL FRAMES AND BRACKETS

The best result to create various openings and to fix top plates can be achieved by using various metal frames and brackets. They are made of either galvanised or black steel 1.6mm thick, so that there is enough rigidity but not too heavy for installation. There are number of frames as follows:

Code 001 Corner flat bracket - optional used for corners of the walls where two sides meet at 90 degrees.

Code 002 - Base U Bracket 122+23mm to suit 80mm EPS core- this is used for placing Smart Panels Walling System panels inside of U bracket and for fixing of metal bracing to the outside leg.

Code 004 - Bracket for top plate 143mm - this is welded to both side of panel mesh and it is used for fixing and leveling of metal top plate on the top of the wall.

Code 005 - External 150 top plate 150mm This is temporary top plate used for leveling of the concrete on the top of the wall.

Code 006 - As above with additional holes on both side for reinforcing steel.

Code 008 - Window and door reveal - used for forming rebate to 3 sides of the openings lintel and 2 sides of jambs.

Code 009 - Window sill reveal - used for forming rebate to sill side with sloping detail.

Note: the size of the bracket may vary depending on the thickness of the EPS.

3.10. OPENINGS

Openings for doors and windows can be cut out either before or after panels have been erected. For bigger openings it is advisable to cut panels before installation and install them around opening. For smaller openings it might be easier to cut panel after installation. Once the opening is formed U-shaped mesh is used to reinforce window and door openings. This U-mesh is fixed to the panel's mesh using hog rings staples. U-mesh must be placed approximately 20mm from the edge of the panel to allow required distance between U-mesh and polystyrene.

On the other side U-mesh should be placed at least 30mm from the edge of the window frame to allow enough concrete cover over reinforced mesh. This distance depends on exposure environment classification. This means that panels around openings must be cut bigger then opening size at least 60mm on lintel and jamb sides and 90mm on sill side. Generally, extra reinforcing bars will be required to both sides of lintels above openings in accordance with the specific structural engineering design.

Before concrete spraying, the openings are to be formed as per architectural plans. Metal frames are used for windows as a temporary form before concreting starts. They are made of steel 1.6mm thick with 25mm reveal for weather tight step. Typically, the width is 150mm with step 90mm from inside and 60 mm outside. Bottom sill is slopped out to allow any water to run out from the reveal. Once the walls are sprayed these metal frames are to be removed. After removing frames, the concrete around reveal is formed with required steps and slopes for easy installation of aluminum of timber windows and doors.

Metal frames are fixed to the panels using metal bracing which are placed in the line with openings and base U brackets. They are fixed using tech crews (metal to metal) fixings. Special attention must be taken for plumbing and straightening of the frames before concrete starts.

For openings which are to be with straight edge (e.g. garage door, internal doors etc.), metal top plate fixed on bracket - similar to top plate, can be used to form edge. In this case U-mesh must be installed 20mm from edge of the panel. In addition, a concrete cover of 30mm must be left, so that total distance from the edge of the panel to finish concrete is at least 40mm depending on exposure environment

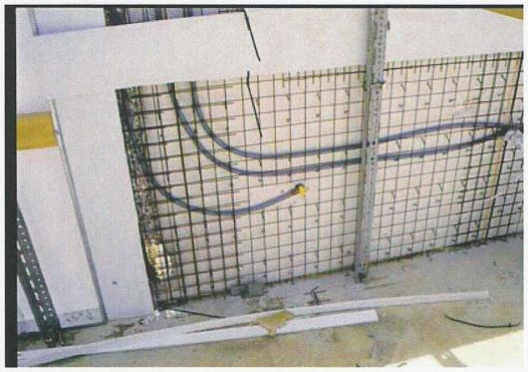
classification. As an alternative a timber stud 150x50mm can be used to form the edge of the Smart Panels Walling System panel before concreting.

3.11. ADDITIONAL COLOUMNS AND BEAMS

Very often engineering design requires for additional columns and beams to be placed within the walls. In this case, additional reinforcing needs to be placed inside of the panels. Often, removal of the EPS from the panel may be necessary to strengthen a certain area by filling it solid with concrete. Areas of support pockets for steel beams or similar are also created in the same fashion. Additional re-bar is than easily placed in these cavities.

EPS removal can be achieved quickly by a variety of means. The recommended method involves the use of a propane torch to melt the polystyrene. A heat gun may also be substituted for some applications. When engineering calculation requires, columns and beams can be created with additional re-bars in the corners of the buildings (leaving a gap between two corner walls) and in the connection between walls and floor panels. Beams within floors, or at floor edges are normally formed by stopping and starting panels either side of the beam. Continuity is achieved by the addition of re-bars transverse to the beam and/or splice mesh. Beams can be formed as up stand (within a wall above) or down stand as required.

3.12. INSTALLATION OF SERVICES



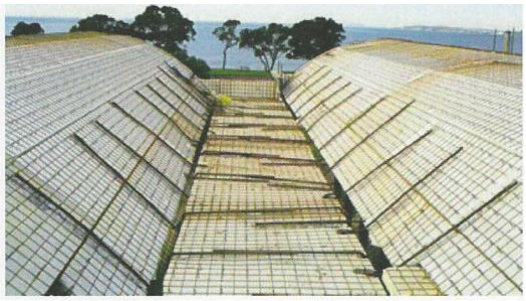
Most of the services (electrical conduit, water pipes, drain, gas etc.) can be easily accommodated between mesh and EPS within Smart Panels Walling System panels. This gap is 20mm wide, but it can be extended by removing EPS in this area. The cover mesh provides a very convenient place to tie pipe and boxes in place. Larger service waste pipes will require the EPS to be cut away to form a cavity. Provisions for wall outlets are fixed on the wall face by tying to the re-mesh before shotcreting application. It is recommended to pre-make provision for outlets by placing piece of EPS around this spot and cut concrete after for fixing of various outlets. PVC sheathed electrical cables must not come into contact with EPS and must, therefore, be contained within a conduit.

Generally, installation of services is a simple job, but it requires a good planning exercise.

3.12. INSTALLATION OF FLOORS AND ROOFS

There are several floor systems - concrete or timber that can be used in conjunction with Smart Panels Walling System walls panels. Each of them has some specific connection details which need to be incorporated into the Smart Panels Walling System panels. The decision is whether the floor structure will seat on top of the Smart Panels Walling System walls or be fixed into the Smart Panels Walling System walls. If the floor structure is to seat on top of the Smart Panels Walling System walls it is important that this seating detail has enough space and that re-bars are installed within the floor area (e.g. Interspan ribs etc.). If the floor structure is to be fixed on the side of the Smart Panels Walling System wall, it is necessary to create either seating pockets inside of the wall panels or fix steel or timber support to the walls for floor structure to be seated on it (e.g. timber floor structure, tray-deck, Unispan etc.).

Smart Panels Walling System panels as floor and roof structure can easily be incorporated into the Smart Panels Walling System. In this case the panels are prepared on the ground floor before installation. Often, additional items are to be installed: a) additional reinforcement (bars) at the bottom of the floor panel, b) Splice mesh at the bottom (on one side), c) Support stirrups - U-bars. After all preparation work is completed, the panels are lifted into place and attached to walls with binding wire. In addition, extra reinforcing bars may be required to support upper-level internal walls. After erection, splice mesh must be complete on both sides of all joints. Additional top reinforcing may also need to be added over internal support locations.



Adjustable shuttering supports (Acro Props) are the preferred method of propping the slab. These supports must be put up with girders that run at right angles to the slab. When choosing the distance between the support rows it is necessary to consider the buckling moment of the panels. Support must also be provided at all longitudinal splice locations. Similarly, Smart Panels Walling System panels can be used for roof structures incorporated with the Smart Panels Walling System walls. Because of the slope, special shuttering support and propping is prepared before installation of roof panels. Additional angled reinforcement needs to be installed on the ridge of the roof panels with additional splice mesh before shotcrete application.

4. CONCRETING OF KITOFRAME SYSTEM

Without any doubt, concreting is a key element in Smart Panels Walling System procedure. Concrete is a "one chance" material, and it is very important that specification, good preparation, and construction techniques recognize this. Good organization and planning are necessary to ensure economical construction that optimizes the use of plant, labour, and material.

4.1. CONCRETE

Concrete is a composite material made from a mixture of three basic materials - cement, aggregate and water - and sometimes a chemical additives or admixtures. Cement is a fine powder which when mixed with water forms a paste that gradually hardens. Aggregate is a filler material, normally gravel, crushed rock and sand. Classes are - fine aggregate (sand, crushes rock fines), coarse aggregate (crushed rock, gravel), all-in aggregate (mixture of fine and coarse aggregate). Water normally specified/accepted as being suitable for drinking. Typical sample of hardened concrete will consist of 60 to 75 per cent aggregate (approximately 35% fine and 65% coarse aggregate), with 25 to 40 per cent cement paste.

Properties of concrete can be divided in main three areas:

a) **Workability** - to enable the fluid concrete to be transported, placed and compacted into its required shape. This is the property of fresh concrete that can range from extremely low workability (slump 0 - 25 mm), to a high workability (slump 100 - 150 mm).

b) **Strength** - to enable concrete to satisfactorily perform its desired structural function.

This is its compressive strength at an age of 28 days (80% of its ultimate - full strength). After 7 days the concrete reaches approximately 60% of its ultimate strength. The measurement for the strength is 1 Mpa = 1 N/mm2 = 0.1 kg/mm2. The main factors that affect the compressive strength are - the percentage of the void content, water/cement ratio, aggregate/cement ratio, fine/coarse aggregate ratio, curing etc. The typical range of concrete strength is as follows: 10 Mpa - for site concrete, 20 - 25 Mpa - for foundations pads, continuous strips, slabs etc, 30 - 35 Mpa for RC beams, RC columns, wall panels, precast units etc, over 40 Mpa - for special strength requirements.

c) **Durability** - to ensure that it serves its purpose for as long as possible with the minimum of deterioration. The durability of concrete generally increases as its void contents decreases.

4.2. CONCRETE SPECIFICATIONS

Preparation of the mixture is one of the very important factors for good concrete works.

Working with Smart Panels Walling System and shotcrete application of the concrete, mix design becomes a crucial element. Spray mixture for Smart Panels Walling System is slightly different that of other shotcrete applications, because this work requires a smaller quantity of the concrete at a time, but also requires a longer workability to achieve a good concrete/plaster finish surface. As a general guide for preparing a good mixture, several requirements need to be taken in account:

a) **Good workability** - with a higher slump (80 - 120 mm) a good workability can be achieved, but even more important is to extend the workability in order to have sufficient time for finishing work.
b) **Sufficient strength** - normally a 32 Mpa concrete is to be prepared. In some cases, strength can vary between 20 Mpa or 32 Mpa, if necessary.
c) **Easy pumpability** - because of the small mesh openings (only 50 mm x 50 mm) and because of the small spraying thickness of concrete (40 to 80 mm), pumpability is a very important factor. To achieve such a pumpability the aggregate must contain a minimum, but sufficient quantity of super-fines with a diameter of up to 0.2mm. The superfine ensure that the concrete can keep the water and that it can be pumped through the hose. The maximum size of coarse aggregate should not exceed a 6 - 7 mm in diameter.
d) **Cement contents** - The shotcrete's cement content should be between 350 kg/m3 and 450 kg/m3. This value ensures both - sufficient strength and the pumpability of concrete. Due to a larger portion of water, concrete with a bigger cement content is prone to shrink and, consequently, to form cracks. For this reason, it is to recommend trying to keep the cement content on the lower range.
e) **Water/cement ratio** - this ratio does not only influence workability, but also strength and rust protection of the reinforcement element. If the water content is too high, air voids form and influence the concrete quality. For the fabrication of reinforced concrete, a water/cement ratio of 0.5 to 0.6 is recommended.
f) **Rebound factor** - to avoid a bigger percentage of wastage, and better stickiness of concrete to the surface (particularly in underside floor and roof application), some chemical additives can be added to the concrete mixture.
g) **Waterproofing admixture** - it is not necessary, but may be required in some circumstances, to use some admixture products (or after application products) to add additional waterproofing treatment for the concrete. Some of additives are: Aquaron 2000, Xypex etc. Those applications are additional cost, which are not necessary, but some saving could be achieved in reducing the thickness of the concrete cover (if those additives can reduce the corrosion factor).

As a summary of the above, the following concrete mixture is recommended to use for making of 1 m3 of concrete - 32 Mpa:

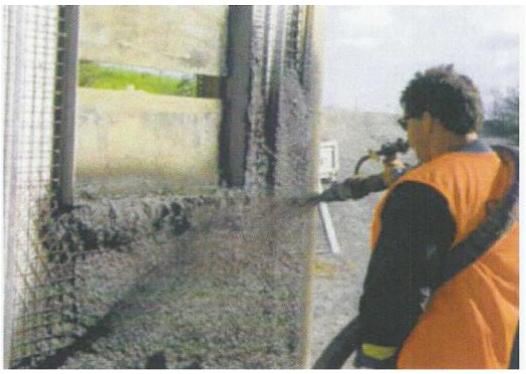
SPRAY MIXTURE (Walls and underside of ceiling):

Aggregate 0 – 7 mm	1550 – 1700 kg
a) 0 – 0.2mm super-fines – 35%	
b) 0.2 – 7mm - 65%	
Cement	350 – 450 kg
Water	200 – 250 kg

Slump	80 -120 mm
Additives	To achieve: - extended workability - added stickiness. - waterproofing

4.3. CONCRETE PUMP

Concreting of the Smart Panels Walling System is a combination of shot-creting and plaster finishing work. Taking this into account, concrete is to be applied in a smaller quantity, with controlled wastage and thickness, but also to be finished as a plaster application product. For this reason, concrete pump should be chosen as a controlled pressure pump with easy spraying solution.



The capacity of the pump doesn't need to exceed a 4 - 5 m3/hr, because is very likely that this quantity would be around 1.5 - 2 m3/hr. Compressor pressure should be around 4 - 6 bar, or 80 - 120 pound/sq.inch. To make a good choice when buying the concrete pump, the following items need to be checked and taken in account:

a) design of the pump to be simple, easy to dismantle and put together.

b) have more capacity than required, but with possibility to adjust air pressure.

c) be able to convey concrete & aggregate at least 7mm (preferable 10 mm)

d) Motor case to be separated and protected from concrete mixture.

e) Standard hoses and nozzle connections and easy to be replaced.

f) Roller auto reverse and cooling system to protect extruding tube.

g) In case of blockage have a quick system of repairing

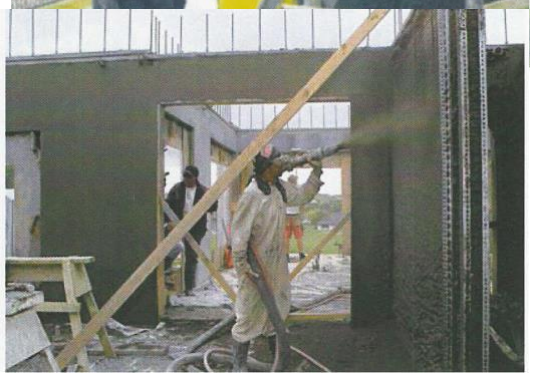
h) Easy cleaning

i) Easy assembling of system, easy movement around the project and to other places

j) Low maintenance and mechanical services (part and labour) backup.

4.4. SHOTCRETING PROCEDURE

Good installation of the walls, bracing, guidelines, and string lines together with specified connections, additional meshes and re-bars needs to be completed before starting shotcrete application. Screed lines must be placed in sufficient places to give a guide for required thickness of the concrete. For spraying the walls, it is recommended to use screed lines on the floor, ceiling, top plate, all openings, such as widows, doors etc. and in every corner of the wall. In addition to that, for longer walls screed line is to be positioned in every 2 - 3 m of the walls as a good guide for shotcrete thickness. Most of those guidelines can be used as a part of the bracing system for Smart Panels Walling System structure.



Covering the Smart Panels Walling System with concrete can be achieved by a variety of methods. Concrete can be applied mechanically by using the wet (mortar pump) or dry (gun) process of shotcreting. Concrete thickness varies, but usually it is twice the distance between the face of the polystyrene and the cover mesh. In many cases, thickness is 40 - 80 mm of concrete on each side of the panel. **To ensure corrosion resistance, the steel mesh must be covered by at least 25 - 40 mm in normal environments. In aggressive environments, the concrete cover thickness must be increased.**

Depending on the capacity of the concrete pump and compressor, recommendation is to use a small amount of concrete mixture at time (1 - 3 m3). If the wet - ready mix is used, it is recommended to order 2 to 3 concrete mixers per day with approximately 3 m3 each time - say 8.00 in the morning 3 m3 and 12.00 another 3m3. With this quantity an area of about 100 m2 can be sprayed and finished, which is an average area per day. This can be done with 5-6 people on site (3-4 plasterers and 1-2 concrete trades).

It is a good idea to start a shotcrete application on parallel walls first and then, removing the screed lines at the corner start with other parallel walls in the other way. With this scenario, it is likely to achieve a

very good finish of the external and internal corners of the walls. Various systems may be employed to apply concrete to the panel surface. Each system has its own unique method of screeding and finishing to achieve the desired surface. The type of system to be used is determined by the structure to be built. Concrete can be sprayed in two coats or in one coat. It is recommended to spray one coat only, because a better quality of concrete can be achieved - thicker concrete allows for longer drying and slow evaporation procedure. One coat system is also a much quicker and more economical system of shotcreting.

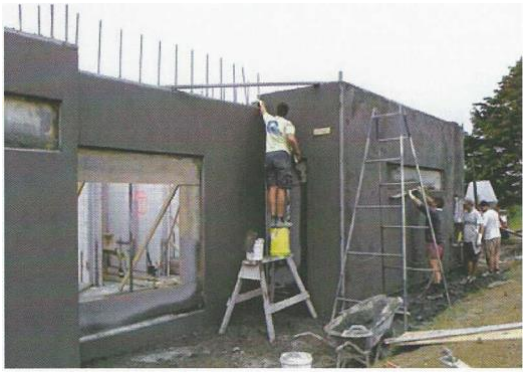
Concrete pump, accessories, hose, nozzle etc. must be cleaned and ready before concrete arrives and before shotcreting starts. Depending on the type of the structure, labour requirement can vary. To achieve an average of 100m2 of finished wall area per day, there should be at least 5-6 people (3-4 plasterers, 1 shotcrete-gunman and 1 pump control). It should be expected that this team are able to finish a 100 m2 of the wall (one side) including a sponge finish, ready for paint.

Shotcrete application should always start from the bottom part of the wall, building the base thickness and going horizontally in a left-right direction. The upper part is to be sprayed on top of the bottom part, the next arear above is to be built up in the same way. During the first run of one wall, the concrete should be applied at half the total thickness and then build up another half of the thickness with the second run over the same wall. This second run can be done within an hour of the first run. It is a good idea to leave the sprayed concrete for approximately 30 minutes and then start cutting and screeding as per required thickness. It is very important that concrete fill the whole area between the polystyrene and the reinforcing mesh (this is the most critical area to achieve a required strength). It is also important to fill all other gaps and voids during the application.

4.5. FINISHING PROCESS

When the shot-creting is completed in a certain area, and when the concrete material has stuck on the wall for approximately 30 minutes, the finishing, plastering work can start. Cutting and screeding can start, using aluminium bull-floats (or timber), long enough to reach area between screed guidelines, already prepared. After the initial screed the area should be immediately re-checked for level with a straight edge or template. High and low spots are corrected at once - high spots by cutting off the surface with a trowel, and minor low spots by screeding with mortar taken from fresh concrete.

After the concrete is spread, screeded and bullfloated, some amount of time must than elapse before any final finishing is started. During this period some bleeding will occur, the resulting bleed water will either evaporate or be removed, and the concrete will start setting. The timing for this waiting period is important. If it is too short bleed water will be reworked back into the wall, resulting in a weak and dusty surface. If it is too long the final finishing operations will then be difficult to accomplish satisfactorily. The length of time required will vary from one to two hours and depends on number of factors such as weather conditions, temperature, slump of concrete, mix design, admixture etc.



Final floating and troweling is a manual procedure of making the surface dense and hard. Both, metal, and timber floats can be used. Depending on the requirements, plain, fine texture or sponge hard plaster finish can be achieved. Also, a fine aggregate topping - skim coat can be applied later and then struck and trowelled. For outside wall surface a sponge finish is a common option. This is a finish floated coat with a wood float and lightly finished with a sponge, producing a light texture. There is also very common option of applying a texture coating (light or heavy), which can be pigmented with colour, to avoid additional paint application. For inside wall finish surface, there are a few options, such as sponge finish, smooth interior hardwall finish, or gypsum board fixed to the concrete wall, etc.

Any plaster paint system for any of the above finishes can be applied. It is recommended to use waterproofed paint with possibly elastometric properties, to be on the safe side in case of any cracks which appear. There are also available a mineral paint with breathable properties, which gives additional ventilation for concrete walls.

4.6. CURING

Curing process is a very important part of concrete application. Concrete gains strength gradually over a period by hydration between cement and water. Curing is the process of retaining water in the concrete and providing insulation from extremes of temperatures. The main causes of loss of water are sun, drying wind and frost. A curing period of 7 days from the time of placing is normally considered adequate. There are several methods of curing that can be used:

a) **Keeping the surface damp** - Sprinkling with water is a good method, but care must be taken to prevent the concrete from drying between applications of water. Wet covering, such as wet hessian sacking, wet sand or wet straw are extensively used for curing concrete. Such covering should be placed as soon as the concrete has hardened and must be held firmly against the concrete surface.

b) **Providing an impervious barrier** - a waterproof building paper and plastic sheet (polythene) or tarpaulin coverings can be used to assure continuing hydration of cement by preventing loss of moisture from the concrete.

c) **Curing compounds** - Liquid membrane curing compounds which harden to form a low permeability coating reduce the rate of evaporation of moisture from the concrete. They may be applied as soon as the concrete surface has been finished. Clear or translucent compounds may contain a dye which fades out after application. The colour ensures coverage of the exposed concrete surface. Curing components are applied by hand-operated or power-driven spray equipment, usually on wet concrete surface.

4.7. CRACKS IN THE Smart Panels Walling System SURFACE

Having many overseas experiences as well as our own experience in construction work, we are confident to guarantee that the Smart Panels Walling System will not crack. As the Smart Panels Walling System is reinforced concrete with very small mesh openings, the splice mesh between two panels and around all openings, makes the whole structure as a monolitique uniform system wall. Working as such it is logical to conclude that structural cracks caused by changes in stress, temperature or moisture contents should not appear.

But, other type of cracks, called "plastic shrinkage cracks" are still applicable and can be expected to happen during the application of the concrete. Those cracks are formed while the concrete is still in its "plastic" (not yet hardened) state and are a result of too rapid a loss of water (evaporation) from the surface of the wet concrete. Plastic shrinkage cracking is usually associated with hot weather, high concrete temperature, low humidity, and high dry winds. To eliminate plastic shrinkage, it requires all evaporation be prevented immediately after placing. There are a several important precautions to avoid or minimize the plastic shrinkage cracking:

a) **Reduce evaporation** - use of windbreaks to reduce the airflow over the concrete surface (hanging of hessian (or similar) cloth on the outside of the scaffolding).

b) **Erect sunshades** to reduce concrete surface temperature - use as a temporary cover.

c) **Lower the fresh concrete temperature** during the hot and windy weather, by using cool aggregates, cool mixing water, and try work early in the morning etc.

d) **Avoid overheating** fresh concrete during the cold weather.

e) **Protect the concrete** with temporary wet covering during period of appreciable delay between placing and finishing - see Finishing concrete work.

f) **Delay the time between bull floating and screeding** - see Finishing concrete work. It provides protection for the concrete surface during the critical period between placing and final finishing.

g) **Commence curing** as soon as possible after finishing.

h) **If plastic cracks** occur before the concrete has hardened, **revibrating and refloating** the surface can be effective.

5. TECHNICAL QUALITY OF Smart Panel Walling System

5.1. TECHNICAL DATA

- Length of **KitoFrame** Panel: up to 6000 mm
- Width of **KitoFrame** Panel: 1200 mm
- EPS Insulation Core: 40 / 60/ 80/ 100 mm Self Extinguishing
- Density: 18 - 20Kg CUM
- EPS Grade: SL or better
- Polystyrene: must meet A.S - 1366.3

- Welded Mesh: 50 X 50 mm
- Mesh wire Diameter: 2.8mm -3mm
- Mesh wire material: Low carbon steel wire
- Diagonal truss: 100 per Sq. Mtr. (9 diag truss wire/Sq Ft)
- Truss wire Diameter: 3mm -3.2mm, Galvanized.
- Properties of wire: Carbon content - less than 0.15%
  Yield strength: >5,500kg/cm2
- Wire mesh: Meet AS/NZS 4671 or AS 1304
- Spacing between cover Mesh and EPS Core: 20 mm
- Overall Thickness of Panel: 80/100 /120/140mm

5.2. DESIGN AND STRUCTURAL SPECIFICATIONS

CODES:

All Smart Panels Walling System and mesh fabrication shall be in strict accordance with the Smart Panels Walling System Pty Ltd Design and Installation Manual and fire characteristics shall meet the requirements of the Australian Standards AS 3600/ AS 3700 and AS 1170, to comply with Building Code of Australia (BCA 2006)

DESIGN:
All design shall be in accordance with that specified in the Smart Panels Walling System Pty Ltd literature. Concrete design shall be in accordance with AS 3600, AS 3700 for Masonry Structures and AS 2870 for Residential Slabs and footing Construction.

Timber and Steel design shall be in accordance with the Australian Institute of Steel Construction Specification for Design Fabrication and Erection of Structural Steel. Roof framing and interior partitions may be constructed using the conventional details set out in AS1684.2 or AS1684.4 for timber framing, or steel framing, AS/NZA 4600 or AS4100. Calculations for loads and loading conditions shall be based in accordance with Volume 2, Building Code of Australia (BCA) 2006.

B. Modified expanded polystyrene must be to AS 1366.3 and have test reports to support.

QUALIFICATIONS:

A. All materials used in fabrication and methods of fabrication shall comply with the requirements of the Smart Panels Walling System Pty Ltd Design and Installation Manual.

B. All field erection, including panel splice fabrication, shall comply with the instructions for installing of Smart Panels Walling System Pty Ltd.

PLANS:

The manufacturer's published installation instructions plus the plans and specifications shall be strictly adhered to and a copy of these instructions shall be always available on the job site installation.

STORAGE, CARE AND HANDLING OF Smart Panels Walling System:

Smart Panels Walling System panels are commonly delivered on flatbed trucks. Their lightweight nature means that they can be unloaded either by hand or forklift truck. Gloves are recommended to be worn when handling the panels.

Panels can be stored out of doors on well drained flat surfaces without protective covering. However, due to their lightweight nature, care must be taken to prevent damage from winds. Stacks of panels should be tied to adequate supports to prevent damage. Care must be taken not to store any objects on top of the **Smart Panels Walling System** that would break the welds, puncture the polystyrene, or warp the **Smart Panels Walling System**. Improper storage could result in subsequent alignment problems.

Long term storage of panels should be carried out in a covered, protected, dry environment, so that corrosion of the reinforcing does not occur, and the panels do not get damaged.

Panels can easily be set in place or staked using a one- or two-man crew. Crews should be cautioned when moving panels in windy weather.

MATERIAL:

The **Smart Panels Walling System** consists of a three-dimensional truss type welded wire frame, integrated with a modified expanded polystyrene insulation core. Each **Smart Panels Walling System** consists of the following:

A. Type 1 Expanded polystyrene foam core with a minimum density of 18 to 20 Kg CUM which is self extinguishing. Polystyrene must meet AS – 1366.3 and must be SL Grade or better. The better the polystyrene, the better the R-Value achieved. Thickness of panels can vary.

B. The reinforcement module (RIM) is manufactured with highly automated equipment. The welded – wire fabric has a standard size 50 x 50 mm mesh x 2.8 mm wire diameter must be in accordance with AS/NSZ 4671. Different configurations of RIM are manufactured depending on the end use.

SIZES:

A. The Smart Panels Walling System are produced in the standard width of 1200 mm, with lengths supplied as required up to 6000 mm. The Smart Panels Walling System weight is approximately 7 kg/m2 and may be site cut to size and shape. The standard thicknesses are 40, 60, 80, 100 mm (depending on R-value requirements)

B. Dimensional tolerance - the tolerances shall comply with values listed in the manufacturer's quality assurance procedures.

Note: Overall length ± 5 to 6 mm; Overall width ± 3 to 4 mm; Overall thickness ± 3 to 4 mm". Location of truss wires within units ± 5 to 6 mm.

5.3. THERMAL RATING

The Smart Panels Walling System Construction System has been designed with maximum environmental comfort in mind. R-values change with the different thickness and density of the polystyrene panel core, various thicknesses of the concrete applied to the interior and exterior, as well as the fluctuation of ambient temperatures. The Smart Panels Walling System Consruction System provides an efficient thermal barrier, comnbining the thermal properties of continuous polystyrene and a concrete thermal mass of up to 120mm, achieving an R-value of up to 1.4.

5.4. DURABILITY

Walls constructed of Smart Panels Walling System panels are designed to meet the durability requirements of AS 3600 and have a design service of at least 50 years.

5.5. SOUND

The STC (Sound Transfer Coefficient) attenuation of Smart Panels Walling System is excellent. The double shell configuration of the concrete with sandwiched polystyrene minimizes sound transmissions, achieving the STC rating of up to 61.

5.6. FIRE

Smart Panels Walling System Insulated Concrete Wall Structure have the following fire-resistance ratings (ratings are valid for fire exposure from either side). Fire-rating is derived from the wire mesh gauge in combination with cement thickness (see chart below).

The expanded polystyrene foam core has a minimum density of 18 to 20 Kg CUM and is self extinguishing.

Polystyrene must meet AS –1366.3 and must be SL Grade or better. Thickness of panels can vary.

- 80 mm polystyrene core with 40 mm concrete each side = 1.5 Hours App.
- 80 mm polystyrene core with 50 mm concrete each side = 2.0. Hours App.
- 80 mm polystyrene core with 80 mm concrete each side = 4.0 Hours App.

The fire rating increases with greater quantities of concrete applied to each side. The polystyrene core will not burn and does not contain ozone-damaging chlorofluorocarbons (CFC's) in the manufacturing process or products.

5.7. LOAD BEARING

The load-bearing weights that a typical Smart Panels Walling System wall will support is amazing and much greater that a typical wood or metal frame wall. Full load-bearing chart is avaiable.

5.8. DAMP AND WEATHERPROOFING

The expanded polystyrene (EPS) core is water resistant. EPS is an inert, organic material.
It provides no nutritive value to plants, animals, or microorganisms. The EPS will not rot and is highly resistant to mildew. Aging has no effect upon the performance of the EPS, and it is able to withstand the abuse of temperature cycling 180° assuring long term performance. Please refer to fire rating for flame spread information.

Smart Panels Walling System Insulated Concrete Wall Structure must be finished on the exterior face with the suitable waterproof external finishing system such as 13 mm cement render. Openings of windows, doors, and other penetrations and at junctions with adjoining construction, must be designed and detailed to prevent the penetration of moisture such that BCA 2006 Volume Performance Requirement P2.2.2 is met. BCA 2006 Volume 2 Part 3.3.4 Weatherproofing of Masonry provides detailing that meets BCA 2006 Performance Requirement P2.2.2 Weatherproofing. Alternative details may be acceptable and are the responsibility of the designer.
Note: The weatherproofing detail in AS3700 will give some guidance if used but the system manual must give full compliant detailing.

BCA 2006 Volume 2 provides details for the damp-proofing in Acceptable construction practice Clauses 3.3.4.4, 3.3.45 and 3.3.4.6 for Class 1 and Class10 building.

5.9. WIND LOAD CAPACITY

The Smart Panels Walling System has been designed to AS 3600. AS 3600 requires a total design from the ground design up incorporating AS 1170.1-Dead and Live Loads and Load Combinations. AS 1170.2 – wind Loads. (Or AS 4055 – Wind Loads for Housing) AS 1170.3 –Snow loads. AS 1170.4 – Earthquake Loads (where applicable).