

Pocket Book on

Emerging Construction Systems



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**Building Materials & Technology
Promotion Council**

Ministry of Housing & Urban Affairs
Government of India
New Delhi





Conventional Construction Systems

The prevalent construction systems in vogue around the globe are:

Load bearing Structure

The system comprises of load bearing walls which are constructed using bricks/stone/block masonry and floor/roof slabs are of RCC/stone/composite or truss. It is cast in-place system commonly known as load bearing system as load of structure is transferred from slab to foundation and then to ground through load bearing walls.

RCC Framed Structure

In this cast in-situ system, the skeleton of a structure is of RCC column and beam with RCC slab. The infill walls can be of bricks/blocks/stone /panels. The load of the structure from slab is transferred through beam and column to the foundation.

Steel framed Structure

Commonly known as pre-engineered building system where RCC beams and columns are replaced by hot rolled/built-up steel sections and being used for industrial applications.



Emerging Construction Systems

The conventional construction systems are primarily cast in-situ slow paced construction systems and can not meet the present requirement of housing shortage. Therefore, it is prudent to adopt new construction systems which ensure quick delivery of quality houses without compromising functional and structural requirements. These innovative systems are resource efficient, climate responsive, energy efficient, disaster resilient leading to sustainable development.

These systems are broadly classified as (a) precast concrete construction-2D & 3D, (b) hot and cold form steel construction, (c) formwork systems, (d) prefabricated sandwich panel construction, (e) Stay in Place formwork systems, etc. It is time that construction fraternity in India take a paradigm shift from conventional cast-in-situ construction to these fast track emerging systems which are being explained in this pocket book.

The technical details about these systems can be obtained from www.bmtpc.org and ghrc-india.gov.in.



Precast Concrete Construction Systems-Precast Components Assembled at Site



SRPL Building System (Waffle-Crete)

- ❖ Waffle-Crete Building system of M/s Shaival Reality Pvt. Ltd., Ahmedabad, consists of large structural ribbed panels (cast-at-site) of reinforced precast concrete, bolted together and the joints between the panels are caulked to form the walls, floor and pitched or flat roofs of buildings.
- ❖ The surface of each panel consists of 51 mm thick slab or skin, stiffened with the ribs around the perimeter and across the panel, giving an overall panel thickness of 152 mm or 203 mm.
- ❖ The floors are constructed using precast reinforced concrete floor panels supported on precast concrete beams.
- ❖ The window & door frames are incorporated into the wall panels during casting or fitted after erection into openings that are formed in the panels during casting.



Walltec Hollowcore Concrete Wall Panels

- ❖ Walltec Hollowcore Concrete Wall Panels of M/s B N Precast Pvt. Ltd., Gandhinagar, are extruded non-load bearing concrete hollowcore wall panels.
- ❖ These panels are factory produced using light weight concrete made of river sand, crushed stone aggregate, light weight aggregate and Ordinary Portland cement.
- ❖ The concrete panels are extruded and cut while still wet to the requisite length. Walls have cylindrical hollow cores which helps to reduce weight, facilitate mechanical, electrical and plumbing services through hollow cores and provide better sound and thermal insulative properties.
- ❖ The sides of all panels are tongued and grooved to facilitate jointing.



Precast Large Concrete Panel System

- ❖ Precast Large Construction Panel (PLCP) system of M/s Larsen & Toubro Ltd., Mumbai, is a structural system comprising of various precast elements such as walls, beams, slabs, columns, staircase, landing and other customized elements.
- ❖ There are two types of precast concrete elements, namely precast reinforced concrete elements and precast pre-stressed concrete elements, produced either in a precast yard/factory or site.
- ❖ The precast elements are installed on site and supported by temporary jacks. Shims are used to carefully align the elements and grouted after the final adjustments.
- ❖ A typical construction involves design, strategic yard planning, lifting, handling, transportation and assembly of precast elements.



Industrialized 3-S system using RCC precast with or without shear walls, columns, beams, Cellular Light Weight Concrete Slabs/Semi-Precast Solid Slab

- ❖ The industrialized total open prefab construction technology of M/s B.G.Shirke Pvt. Ltd., Pune, is based on factory mass manufactured structural prefab components conforming to norms of IS standards and BIS Certification mark.
- ❖ In this Patented system, precast dense concrete hollow column shell of appropriate size are used in combination with precast dense concrete rectangular T Shape/L shape beams and lightweight reinforced cellular concrete slabs for floors and roofs/semi-precast solid slab with or without shear wall. The hollow columns are grouted with appropriate grade of in-situ concrete.
- ❖ All the connections and jointing of various structural elements are accomplished through in situ concreting along with secured embedded reinforcement of appropriate size, length and configuration to ensure monolithic continuous resilient ductile behavior.



Robomatic Hollowcore Concrete Wall Panels

- ❖ Robomatic wall panels of M/s Robomatic Precon Pvt. Ltd., Hyderabad are extruded non-load bearing concrete hollowcore wall panels manufactured in fully automated machines. These wall panels are factory produced using light weight concrete made of manufactured sand, crushed stone aggregate and Ordinary Portland cement.
- ❖ Hollowcores are incorporated in the walls to reduce dead weight, facilitate mechanical, electrical and plumbing services through hollows, increase sound and thermal insulation properties. The sides of all panels are tongued and grooved to facilitate jointing.
- ❖ These wall panels can be used as non-load bearing walls/partition walls and compound/ boundary walls in residential/ commercial/ industrial/ institutional buildings.



K-Wall Panels

- ❖ K-Wall panels of M/s Pioneer Precast Solutions Pvt. Ltd., Chennai are factory produced non-load bearing hollow core wall panels using light weight concrete made of ordinary Portland cement, fly ash, perlite, foam, fevicol DDL, fiber-glass mesh, river sand and water.
- ❖ Panels have cylindrical hollow cores with 7 no. of 60 mm dia voids in the 100mm thickness, 8 no. of 50 mm dia. voids for the 80 mm thickness and 9 no. of 39mm dia voids for the 65mm thick panels.
- ❖ Hollow cores in K-wall panels help reduce weight, facilitate mechanical, electrical and plumbing services enhance sound and thermal insulation properties. The panels are joined using tongue and groove system.



Urbanaac Precast Construction Technology

- ❖ Precast construction Technology from M/s Urbanaac Infrastructures Pvt. Ltd., Ahmedabad is essentially a offsite precast concrete construction system under controlled environment using a reusable mould or “form”. The components produced are then transported to the construction site and later lifted & assembled to produce structure.
- ❖ Precast Construction Technology consists of various precast elements such as walls, beams, slabs, columns, staircase, landing and other customized elements that are standardized and designed for stability, durability and structural integrity of the building.
- ❖ This technology is suitable for construction of high rise buildings resisting seismic and wind induced lateral loads along with gravity loads. The building framing is planned in such a way that maximum number of repetitions of moulds is obtained.



Integrated Hybrid Solution - One (IHS-One)

- ❖ IHS-ONE of M/s Aap Ka Awas LLP, New Delhi is an Intermediate Building System (IBS) having three main components namely, interlocking walling system, precast floor & roof system and ferrocement building elements i.e. stairs, shelves, etc. All three components are integrated to construct a building and hence named as “Integrated Hybrid Solution – ONE”.
- ❖ This system uses Hydraform prefabricated mortarless interlocking blocks, precast RC Planks & Joists system to build load bearing structures upto G+3 storeys.
- ❖ Both roof/floor and walling system can also be bridged with RC framed structure as well as steel structure in multistoried structure providing a complete solution for a building structure.

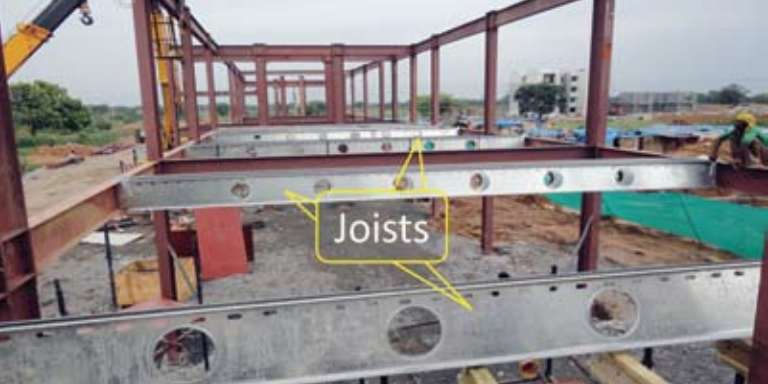


Light Gauge Steel Structural System & Pre-Engineered Steel Structural System



Factory Made Fast Track Modular Building System - INSTACON

- ❖ Factory Made Fast Track Modular Building System - INSTACON of M/s Synergy Thrislington, Mohali, is hot rolled steel frame structure with different walling components, manufactured and fabricated in a controlled factory environment.
- ❖ The steel-modules pre-fitted with flooring, ceiling tiles, electrical and plumbing fittings are transported to the site for installation.
- ❖ Once all the components are assembled and erected at site, shortcreting is done on the factory made 3-D Expanded Polystyrene (EPS) panel walls making it a monolithic structure.
- ❖ The floors consist of composite steel floor deck slab.



Speed Floor System

- ❖ The Speedfloor (patented) System of M/s Jindal Steel & Power Ltd., Gurgaon, is a suspended concrete floor-system using a hot rolled steel joist as an integral part of the final concrete and steel composite floor.
- ❖ It is a hybrid concrete/steel tee-beam in one direction and an integrated continuous one-way slab in other direction.
- ❖ The joists of different depths are manufactured from pre-galvanized high tensile steel. These joists are roll formed, punched, pressed and slotted in a fully computerized machine.
- ❖ The joist depth and the concrete thickness are varied depending on the span, imposed loads and other functional considerations and custom manufactured.



Light Gauge Steel Framed Structure (LGSFS)

- ❖ Light Gauge Steel of M/s JB Fabinfra Pvt. Ltd., New Delhi, is cold form steel which has an advantage over hot rolled steel as it is lighter in weight and thin sections of any form can be manufactured.
- ❖ Normally, LGSFS is factory made galvanized light gauge steel components assembled as panels at site and suitable for 3 to 4 storey structures.
- ❖ The infill walls can be of any material ranging from precast boards, blocks, EPS panels or an external layer of insulation material and outer leaf of Cement Particle Board or dry mix shotcrete.
- ❖ The floor/roof can be RCC/Steel truss/Steel deck on joists as per the requirement.



Light Gauge Steel Framed Structure with Infill Concrete Panels (LGSFS-ICP)

- ❖ LGSFS-ICP Technology of M/s Society for Development of Composites, Bengaluru is a patented technology using factory made Light Gauge Steel Framed Structure (LGSFS). The infill wall comprises of factory made precast panels filled with light weight concrete at site.
- ❖ The LGS frame is a “C” cross-section with built in notch, dimpling, slots, service holes etc. produced by computerized roll forming machine.
- ❖ The frames are assembled using metal screws at site to form wall on a prebuilt concrete floor. The provisions for doors, windows, ventilators and other cut-outs as required are incorporated in the frame. The roof structure is conventional RCC slab.



Prefabricated Fibre Reinforced Sandwich Panels

- ❖ The Prefabricated Fibre Reinforced Sandwich Panels known as Aerocon Panels are patented panels of M/s HIL Ltd., Hyderabad. These are sandwich panels, made of two fibre reinforced cement facing sheets, on either sides of a lightweight concrete core.
- ❖ These panels have a unique tongue and groove jointing system that facilitates rapid construction and are fully cured at the factory itself. These panels are manufactured by using Flexo Board (FOB)/ Fibre Cement Board (NT).
- ❖ The panels can be used for variety of applications such as for partitions, cladding, mezzanine floors, boundary walls, etc.



Continuous Sandwich (PUF) Panels with Steel Structure

- ❖ Continuous sandwich panels of M/s Jindal Mectec Pvt. Ltd., Gurgaon, are single piece, prefabricated, modular, factory made units which consist of an insulating layer of rigid polyurethane foam between two layers of metal sheets.
- ❖ The panels comprise of PUF bonded between two sheets of Pre-coated GI sheets of 0.5 mm thick to produce straight-to-finish panels. Insulation core provides effective insulation and strong bonding for better structural stability to facilitate higher loading and wider spans. These panels are available for both wall and roof.
- ❖ The system can incorporate all types of architectural features like coving, boxes, cantilevers, projections, infill walls, mezzanine floors etc. This system can also incorporate all types of services viz. electrical, mechanical and plumbing etc.



V-Infill Wall (Light Weight EPS Wall)

- ❖ V-Infill Wall of M/s Visaka Industries Ltd., Secunderabad, is factory made 8/10mm fibre cement boards (V-board) on either side of GI studs and erected to produce straight to finish walls which are filled with light weight concrete made of EPS beads, cement, sand and additive.
- ❖ The system is integrated with conventional column and beam for pre-engineered buildings. The walls are used as partition walls for external and internal applications.
- ❖ The GI studs are “C” cross-section with built in notch, slots, service holes etc. fixed with floor and ceiling channels using anchor fasteners at spacing of 300mm c/c. Provisions for doors, windows, ventilators and other cutouts and electrical and plumbing pipes/conduits are provided in the service holes of studs before concreting is done.



Kon_Crete Reinforced Autoclaved Aerated Concrete Panels

- ❖ The Reinforced AAC wall & floor/roof panels by M/s UAL Industries Ltd., Howrah are innovative Autoclaved Aerated Concrete (AAC) products, having properties such as light weight, high thermal resistance, better acoustics & energy efficiency.
- ❖ AAC is a steam cured cementitious material manufactured from a mix of flyash, cement and other additives giving the material a unique cellular lightweight internal structure.
- ❖ The panels can be used for external & internal walls, floor & roof applications in any type of buildings.



Factory Assembled Insulated Sandwich Panels using Mineral Wool

- ❖ The panels by M/s Metecno (India) Pvt. Ltd., Chennai are factory assembled insulated sandwich panels consisting of an insulating layer 'sandwiched' between two layers of metal sheets suitable for non-load bearing walling and roofing applications.
- ❖ The panels are manufactured using mineral wool bonded between pre-coated steel sheets to produce profiled finish panels. The insulation core provides insulation and sturdy bonding for better structural stability and facilitates better load bearing capacity and wider spans for panels.
- ❖ Panels are available in thickness from 50 mm to 120 mm, with standard width of 1000 mm and length as per application.



Factory Assembled Insulated Sandwich Panels using PUF

- ❖ The panels by M/s Metecno (India) Pvt. Ltd., Chennai are factory assembled insulated sandwich panels consisting of an insulating layer 'sandwiched' between two layers of metal sheets suitable for non-load bearing walling and roofing applications.
- ❖ The panels are manufactured using rigid Polyurethane Foam (PUF) bonded between pre-coated steel sheets to produce profiled finish panels.
- ❖ The insulation core provides insulation and sturdy bonding for better structural stability and facilitates better load bearing capacity and wider spans for panels.
- ❖ Panels are available in thickness from 30 mm to 120 mm, with standard width of 1000 mm and length as per customer requirement.

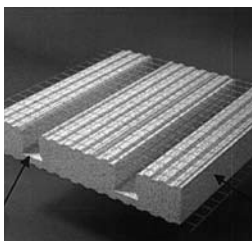
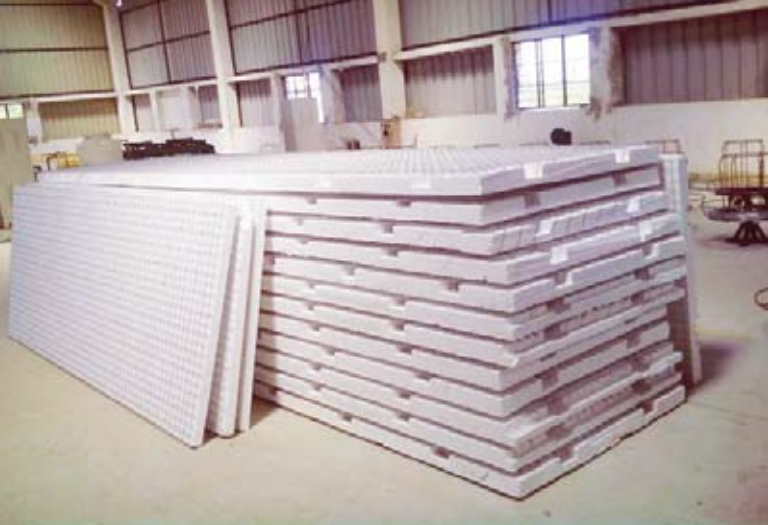


Prefabricated Sandwich Panel Systems



Advanced Building System – EMMEDUE

- ❖ EMMEDUE Advanced Building System (patented) of M/s EMMEDUE S.P.A., Italy is based on factory made panels consisting of self-extinguishing expanded polystyrene core (generally corrugated) sandwiched between two welded wire fabric mesh made of high strength galvanized wire. A galvanized steel truss wire is pierced completely through the core at an off-set angle for superior strength and welded to each of outer layer welded wire fabric mesh.
- ❖ The panels are finished at site using shotcrete of mix of cement and coarse aggregate of required thickness on both sides.
- ❖ The panels are used for load bearing walls and floors and suitable upto 3 to 4 storey buildings.



QuickBuild 3D Panels

- ❖ QuikBuild panel system (Patented) of M/s Beardsell Ltd., Chennai, consists of a welded wire space frame integrated with expanded polystyrene insulation core.
- ❖ The wall panel is placed in position and a wythe of concrete of required thickness is applied to both sides. The wall panel receives its strength and rigidity from the diagonal cross wires welded to the welded-wire fabric on each side.
- ❖ The shell of the structure is built manually by erecting the panels directly onto the slab with protruding reinforcement rods and then finished by plastering with cement using the traditional method or by shotcreting to create a monolithic structure.



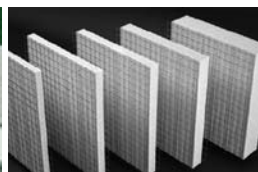
Reinforced EPS Core Panel System

- ❖ Reinforced Expanded Polystyrene Core Panel System is a factory produced sandwich panel system for the construction of low rise buildings up to G+3 and as filler walls in high rise RCC and steel frame buildings. These panels are being produced by M/s Jindal Steel & Power Ltd., Gurgaon.
- ❖ A core of undulated polystyrene is covered with interconnected zinc coated welded wire mesh on both sided reinforcement and shotcrete.
- ❖ The panels are finished on site by spraying concrete to realise the different structural elements i.e. Vertical Structural Walls, Horizontal Structural elements (slabs, floors) and non structural cladding elements.



Rapid Panels

- ❖ Rapid Panel is patented EPS Core Panel System of M/s Worldhaus Construction Pvt. Ltd., Bengaluru.
- ❖ It is a prefabricated assembly of high-Strength steel wire forming a panel with core of expanded polystyrene (EPS).
- ❖ The basic unit of the Rapid Panel is the zig-zag truss. Steel wire is bent into a zigzag shape to form a continuous chain of web members. This bent wire is then welded to continuous chord wires at every node to form the complete truss.
- ❖ During construction, Rapid Panels are installed as walls and/or slabs. Specified mixtures of mortar or concrete are applied to the surfaces of the panels to complete the structure.



Concrewall Panel System

- ❖ The Concrewall is patented system of M/s Schnell Home, Italy. It comprises of panels of expanded polystyrene (EPS) insulation and steel reinforcement which are applied with concrete, onsite.
- ❖ The Concrewall panel comprises of a layer of welded wire mesh on either side of EPS core welded together by steel orthogonal trusses which penetrates through EPS core. The panels are joined together in a desired configuration on site and sprayed onb both sides with shotcrete to form a sandwich type construction.
- ❖ The exterior of the panels may be finished with weather proof coating such as plaster while interior surfaces (walls) and ceilings can either be plastered or lined with conventional lining material.



Rising EPS (Beads) Cement Panels

- ❖ Rising EPS (Beads) Cement Panels are patented panels from M/s Rising Japan Infra Pvt.Ltd., New Delhi. These are lightweight composite wall, floor and roof sandwich panels made of thin fiber cement/calcium silicate board as outer and inner faces with a core of EPS granule balls, adhesive, cement, sand, fly ash and other bonding materials in mortar form.
- ❖ The core material in slurry state is pushed under pressure into preset molds. Once set, it shall be moved for curing and ready for use with RCC or steel framed structure.
- ❖ These panels are used as walling, flooring & roofing with Steel/RCC structural system.



PIR Dry Wall Pre-Fab Panel System

- ❖ PIR Dry Wall Pre-Fab Panel by M/s Covestro (India) Pvt. Ltd., Maharashtra, is a walling system where two fibre cement boards (FCB) of 10 mm thickness are filled with insulation material namely Poly Isocyanurate (PIR) and erected to produce straight to finish walls.
- ❖ These non-load bearing walls are integrated with conventional framed construction of column and beams for pre-engineered buildings.
- ❖ Insulation core provides effective insulation and strong bonding for better structural stability to facilitate higher loading and wider spans.



BauPanel System

- ❖ BauPanel System of M/s Bau Panel System India Pvt. Ltd., Pune, consists of panels of expanded polystyrene (EPS) and steel wire mesh which are applied with concrete at site. The system comprises of a layer of steel mesh on either side of EPS core welded together by steel trusses (orthogonal) which penetrate through EPS core.
- ❖ The panels are joined together in a configuration on site and sprayed on both sides with shotcrete to form a sandwich panel type construction for walling/roofing.
- ❖ The exterior of the panels are finished with weather proof coating or lined with conventional lining material while interior surfaces (walls) and ceilings shall be finished with water/ solvent based coating or lined with conventional lining material.



Flyash EPS (Beads) Cement Sandwich Panels

- ❖ EPS Cement Sandwich Panels by M/s Bhargav Infrastructure Pvt. Ltd., Surat, are lightweight solid core sandwich panels made of 5mm non-asbestos fiber cement boards on both sides of panels as facing sheet and the core material of expanded polystyrene beads, admixture, cement, sand, fly ash and other bonding materials in mortar form.
- ❖ The core material in slurry state is pushed under pressure into preset moulds. Once set, it is moved for curing and ready for use with RCC or steel framed structure. These panels are installed without any structural support up to 5m. The prefinished panels do not require plastering and water curing and are joined with tongue & groove jointing system.



Nano Living System Technology

- ❖ Nano Living System Technology of M/s Nano Living System Pvt. Ltd. (India), New Delhi, comprises of an inner and outer skin of magnesium oxide (MgO) board, with an injected core of closed cell, polyurethane foam, free of Chlorofluorocarbon (CFC) blowing agent. Cold formed metal studs are incorporated within the foam and between the magnesium oxide board skins at nominal 600mm c/c.
- ❖ The panels are manufactured in 150mm thickness having 80 mm cold formed steel studs, 10mm magnesium oxide board on each side and 50mm thermal packer between the internal stud and exterior magnesium oxide board with core insulation of 130mm closed cell and polyurethane foam.
- ❖ The Nano Living System Technology is suitable for use as load bearing walls in residential buildings up to G+3 storey.



Monolithic Concrete Construction



Formwork for Monolithic Concrete Construction

- ❖ The conventional mode of construction is cast-in-place RCC framed structure with infill masonry walls using formwork for beam, column & slabs separately, whereas in this system of M/s Sintex Industries Ltd., Gandhinagar, all walls, floors/slabs, stairs together with door & window openings are cast in-situ monolithically using specifically custom designed modular formwork made up of aluminium/plastics/steel/composite, for the entire modular unit.
- ❖ The appropriate grade of concrete and reinforcement is used as per design and the entire casting of a modular unit is done in a single pour.
- ❖ Being modular predesigned formwork system, it acts as an assembly line production and enables rapid construction of multiple/mass scale units of repetitive type.



Modular Tunnel form

- ❖ Tunnel formwork of M/s Outinord Formworks Pvt. Ltd, Pune, is a mechanized system for cellular structures. It is based on two half shells which are placed together to form a room or cell. Several cells make an apartment. With tunnel forms, walls and slab are cast together.
- ❖ The formwork is set up for the day's pour in the morning. The reinforcement and services are positioned and concrete is poured in the afternoon. Once reinforcement is placed, concrete for walls and slabs shall be poured in one single operation. The formwork is stripped the early morning and positioned for the subsequent phase.
- ❖ Here the walls and slabs are cast in a form of a tunnel leaving two sides open whereas in monolithic concrete construction all the four walls are cast in a single pour.



Stay in Place Formwork System



Glass Fibre Reinforced Gypsum (GFRG) Panel System

- ❖ GFRG is an integrated composite building system using factory made prefab load bearing cage panels and monolithic cast in-situ RC infilled for walling and floor/roof slabs, suitable for single storey to ten storey building.
- ❖ It is made of calcined gypsum plaster, reinforced with glass fibres and panels manufactured to a thickness of 124mm under carefully controlled conditions to a length of 12m and height of 3m, containing cavities.
- ❖ The cavities are filled with reinforced concrete or any other filler material as per design requirements.
- ❖ The panel are being produced at M/s FACT – RCF Building Products Ltd.(FRBL), Kochi and being promoted by IIT Madras.



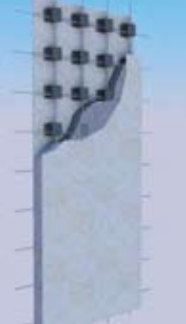
Sismo Building Technology

- ❖ Sismo Building Technology M/s M. K. S. Infosolutions Pvt.Ltd., Gurgaon is an insulating shuttering kit for whole building unit based on a three-dimensional lattice made of galvanized steel wire and EPS panels. The lattice is filled with materials of different nature to serve as formwork.
- ❖ The basic structure of the Sismo building module is steel wire lattice. At the exterior sides of the lattice, infill panels (EPS) are inserted, which transform the lattice into a closed structure that can be filled with concrete.
- ❖ The steel wire also acts as armature and anchoring for the finished material and it holds reinforcement bars in place during concrete filling.
- ❖ The various components of the system are 3D lattice, infill panels, structural filler and finishing.



Insulating Concrete Forms (ICF)

- ❖ These are formwork systems which are left in the structure after concreting and act as insulation.
- ❖ Insulating concrete Forms (ICF) System is a patented system of M/S Reliable Insupacks (P) Ltd., Greater Noida and comprises of a panel of two walls of Expandable Polystyrene (EPS) separated by a nominal distance of 150mm by hard plastic ties. These are assembled on site to hold reinforced concrete.
- ❖ The forms are open ended hollow polystyrene blocks which are fit tightly together through tongue-and-groove to form a shuttering system when joined together. Concrete is poured into the hollow space to form a continuous wall. When cured, this wall supports the structural loads from floors/roofs, and the shuttering provides thermal insulation. Reinforcing steel shall be provided as required from design.



Lost-in-Place Formwork System

– Plaswall Panel System

- ❖ Plaswall Panel System is a lost in place formwork (patented system of M/s FTS Buildtech Pvt. Ltd., Mumbai), where two fiber cement boards (FCB) of 6mm thickness each are bonded through HIMI (High Impact Molded Inserts) spacers.
- ❖ These panels are erected in situ to produce straight-to-finish panels. A monolithic structure is then created by filling the entire structure with suitable grade of concrete to produce panels for structural applications.
- ❖ Reinforcing steel shall be as required from design. Presently, the fibre cement board (FCB) are imported from Malaysia for use in the construction of structures.



Lost-in-Place Formwork system

– Plasmolite Wall Panels

- ❖ Plasmolite Panels are lost in place formwork system (patented system of M/s FTS Buildtech Pvt.Ltd., Mumbai), where two fibre cement boards (FCB) of 6 mm thickness are bonded together through High Impact Molded Inserts (HIMI) spacers. These panels are erected in situ to produce straight to finish panels which are filled with light weight foam concrete.
- ❖ The thus finished walls may be used as partition walls for external and internal applications and can be integrated with conventional RCC/Steel framed structure.
- ❖ Reinforcing steel shall be as required from design. Presently, the fibre cement board (FCB) are imported from Malaysia for use in the construction of structures.



Structural Stay-in-Place Formwork System (Coffor)

- ❖ It is a structural stay in place formwork system to build load bearing monolithic concrete wall structures based on shear wall concept patented by M/s Coffor Construction Technology Pvt. Ltd., Vadodara.
- ❖ The formwork is composed of two filtering grids comprising of rib meshes which are made up of galvanized plain steel (GP) sheets with a herringbone mesh pattern (rib lath) reinforced by C profile GP sheet vertical stiffeners. These grids are further connected by articulated horizontal MS rebar loops in one direction and Cold Rolled Close Annealed (CRCA) plate/GP horizontal connectors in other direction.
- ❖ After the erection of formwork panels in alignment, corners, edges of door and window frames are closed with rebar positioning & concrete of required Grade is poured in the panels. The concreting may be done with a pump, bucket or with a shovel loader. The inside and outside walls are finished with cement plaster of suitable grade.



Monolithic Insulated Concrete System (MICS)

- ❖ Monolithic Insulated Concrete System (MICS) is a patented system of M/s Maiwir Ecotech Pvt. Ltd., Khammam. It is a formwork system for reinforced concrete made with a rigid thermal insulation that stays in place as a permanent interior and exterior substrate for walls, floors and roofs.
- ❖ This system consists of two layers of modules i.e. Expandable Polystyrene (EPS) separated by hard plastic ties. The modules are interlocking modular units that are dry stacked (without mortar) and filled with cast-in-situ concrete. The units lock together and create a form for the structural walls or floors of a building. When cured, the wall supports the structural loads from floors and roofs, and the shuttering provides thermal insulation. Reinforcing steel shall be as required from design.



Stay-In-Place PVC Wall Forms

- ❖ This is a prefinished wall formwork from M/s Novel Assembler Pvt. Ltd., Mumbai, comprising of rigid Poly-Vinyl Chloride (PVC) based polymer components that serve as a permanent stay-in-place durable finished form-work for concrete walls.
- ❖ The extruded components slide and interlock together to create continuous formwork with the two faces of the wall connected together by continuous web members forming hollow rectangular components. The web members are punched with oval-shaped cores to allow easy flow of the poured concrete between the components.
- ❖ The hollow wall components are erected and filled with concrete, in situ, to provide a monolithic concrete wall.



Permanent Wall Form (PVC)

- ❖ “Permanent Wall form” of M/s Kalzen Realty Pvt. Ltd., Hyderabad is an innovative permanent structural walling system consisting of rigid Poly-Vinyl Chloride (PVC) formwork that serve as a stay in place finished form-work for concrete walls.
- ❖ The extruded components slide and interlock together to create continuous formwork with the two faces of the wall connected together by continuous web members forming hollow rectangular components. The web members are punched with holes to allow easy flow of the poured concrete between the components.
- ❖ Wall components are erected and filled with concrete, in situ, to provide a monolithic concrete wall with enhanced curing capacity due to water entrapment.



Performance Appraisal Certification Scheme -

A Tool to Propagate Innovative and New
Building Materials & Technologies

Performance Appraisal Certificates Issued on Emerging Technologies/Systems

S. No.	Product	Name of Firm	PAC No.
1	Formwork for Monolithic Concrete Construction	Sintex Industries Ltd, Kalol Gujarat	1006-A/2011
2	Glass Fibre Reinforced Gypsum Panel System	Rashtriya Chemicals & Fertilizers Ltd. Mumbai	1008-S/2011
		FACT-RCF Building Products Ltd, Kochi	1009-S/2012
3	Factory Made Fast Track Modular Building System	Synergy Thrislington, Mohali	1011-S/2013
4	Advanced Building System Emmedue	BK Chemtech (I) Pvt Ltd, Italy/ Bangalore	1010-S/2014
5	Speedfloor System	Jindal Steel & Power Ltd., New Delhi	1013-S/2014
6	Light Gauge Framed Steel Structure	JB Fabinfra Pvt. Ltd., Gurgaon	1014-S/2014
7	Quick Build 3D Panels	Beardsell Ltd., Chennai	1019-S/2015
8	Modular Tunnelform	Outinord Formworks Pvt. Ltd., Pune	1018-S/2015

S. No.	Product	Name of Firm	PAC No.
9	Reinforced EPS Core Panel System	Jindal Steel & Power Ltd., Gurgaon	1020-S/2015
10	SRPL Building System (Waffle-Crete)	Shaival Reality Pvt. Ltd., Ahmedabad	1021-S/2015
11	Industrialized 3-S system using RCC precast with or without shear walls, columns, beams, Cellular Light Weight Concrete Slabs/Semi-Precast Solid Slab	B.G. Shirke Construction Technology Pvt. Ltd., Pune	-
12	Walltec Hollowcore Panel System	B N Precast Pvt. Ltd., Gandhinagar	1022-P/2015
13	Sismo Building Technology	M K S Infosolutions Pvt. Ltd., Manesar	1025-S/2016
14	Rapid panels	Worldhaus Construction Pvt. Ltd., Bangaluru	1026-S/2016
15	Precast Large Concrete panel System	Larsen & Toubro Ltd., Mumbai	1027-S/2016
16	LGFSFS-ICP Technology	Society for Development of Composites, Bangaluru	1028-S/2016
17	Insulating Concrete Forms	Reliable Insupacks (P) Ltd, Greater Noida	1029-S/2017
18	Prefabricated Fibre Reinforced Sandwich Panels	HIL Ltd., Hyderabad	1030-S/2017
19	Concrewall System	Schnell Home, Italy	1031-S/2017
20	Rising EPS (Beads) Cement Panels	Rising Japan Infra Pvt.Ltd., New Delhi	1032-S/2017

S. No.	Product	Name of Firm	PAC No.
21	Lost-in-Place Formwork system – Plasmolite Wall Panels (For Partition Walls)	M/s FTS Buildtech Pvt. Ltd., Mumbai	1033- S/2018
22	Lost-in-Place Formwork system – Plaswall Panel System (For Structural Applications)	M/s FTS Buildtech Pvt. Ltd., Mumbai	1034-S/2018
23	Structural Stay-in-Place Formwork System	M/s Coffor Construction Technology Pvt. Ltd., Vadodara	1035-S/ 2018
24	Monolithic Insulated Concrete System (MICS)	M/s Maiwir Ecotech Pvt. Ltd., Khammam	1036-S/2018
25	Continuous Sandwich (PUF) Panel with Steel Structure	M/s Kingspan Jindal Pvt. Ltd., Gurugram	1038-S/2018
26	PIR Dry Wall Prefab Panel System	M/s Covestro (India) Pvt. Ltd., Thane (West)	1039-S/2018
27	Robomatic Hollowcore Concrete Wall panels	M/s Robomatic Precon Pvt. Ltd., Hyderabad	1040-S/2018
28	Baupanel System	M/s Bau Panel System India Pvt. Ltd., Pune	1041-S/2018
29	Flyash EPS (Beads) Cement Sandwich Panels	M/s Bhargav Infrastructure Pvt. Ltd., Surat	1042-S/2018
30	K-Wall Panels	M/s Pioneer Precast Solutions Pvt. Ltd., Chennai	1043-S/2019
31	Stay-In-Place PVC Wall Forms	M/s Novel Assembler Pvt. Ltd., Mumbai	1044-S/2019

S. No.	Product	Name of Firm	PAC No.
32	V-Infill Wall (Light Weight EPS Wall)	M/s Visaka Industries Limited, Secunderabad	1045-S/2019
33	Precast Construction Technology	M/s Urbanaac Infrastructures Pvt.Ltd., Ahmedabad	1046-S/2019
34	Nano Living System Technology	M/s Nano Living System Pvt. Ltd., New Delhi	1047-S/2019
35	Integrated Hybrid Solution - One	M/s Aap Ka Awas LLP, New Delhi	1048-S/2020
36	Permanent Wall Forms	M/s Kalzen Realty Pvt. Ltd., Hyderabad	1050-S/2020
37	Kon_Crete Reinforced Autoclaved Aerated Concrete Panels	M/s UAL Industries Ltd., UAL-KON-CRETE, Howrah, West Bengal	1056-P/2021
38	Factory Assemble Insulated Sandwich Panels using Mineral Wool	M/s Metecno (India) Pvt. Ltd., Chennai	1057-P/2021
39	Factory Assembled Insulated Sandwich Panels using PUF	M/s Metecno (India) Pvt. Ltd., Chennai	1058-P/2021

ABOUT BMTPC

Setup in 1990, Building Materials & Technology Promotion Council (BMTPC) under the Ministry of Housing & Urban Affairs strives to bridge the gap between laboratory research and field level application in the area of building materials and construction technologies.

Vision

“BMTPC to be world class knowledge and demonstration hub for providing solutions to all with special focus on common man in the area of sustainable building materials, appropriate construction technologies & systems including disaster resistant construction.”

Mission

“To work towards a comprehensive and integrated approach for promotion and transfer of potential, cost-effective, environment-friendly, disaster resistant building materials and technologies including locally available materials from lab to land for sustainable development of housing.”



OBJECTIVES OF BMTPC

- ***Building Materials & Construction Technologies :***
To promote development, standardization, mechanization and large scale field application of proven innovative and emerging building materials and technologies in the construction sector.
- ***Disaster Mitigation & Management :***
Mainstreaming disaster risk reduction in housing, existing and developmental projects.
- ***Capacity Building and Skill Development :***
To work as a Training Resource Centre for capacity building and promotion of good construction practices to professionals, construction agencies, artisans and marketing of building technologies from lab to land.
- ***Project Management & Consultancy :***
To undertake project management and consultancy services encompassing DPR preparation, innovative design consultancy and vetting, appraisal, monitoring, quality assurance and third party inspection of housing projects under the various Central/State Schemes.





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