BMTPC
PACS
PERFORMANCE APPRAISAL CERTIFICATION

Name and Address of Certificate Holder:
M/s Aap Ka Awas LLP
C-204, LGF, Greater Kailash-I
New Delhi-110048
Mobile: 9811118803, 9810037701
Email: contact@aapkaawas.com

Performance Appraisal Certificate No.
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Integrated Hybrid Solution – ONE (IHS – ONE)

User should check the validity of the Certificate by contacting Member Secretary, BMBA at BMTPC or the Holder of this Certificate.

Building Materials & Technology Promotion Council
Ministry of Housing & Urban Affairs
Government of India
Core 5A, First Floor, India Habitat Centre,
Lodhi Road, New Delhi – 110 003

Tel: +91-11-2463 6705, 2463 8097; Fax: +91-11-2464 2849
E-mail: info@bmtpc.org Web Site: http://www.bmtpc.org

PERFORMANCE APPRAISAL CERTIFICATE

FOR

Integrated Hybrid Solution - ONE (IHS - ONE)

ISSUED TO

M/s. Aap Ka Awas LLP

STATUS OF PAC NO: 1048-S/2020

S. No	Issue No.	Date of Issue	Date of renewal	Amendment		Valid up to (Date)	Remarks	Signature of authorized signatory
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1	2	3	4	5	6	7	8	9
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PAC No. 1048-S/2020 **Issue No. 01** **Date of Issue: 13/01/2020**

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PART 1 CERTIFICATION

1.1 Certificate Holder: M/s Aap Ka Awas LLP

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1.2 Description of System

1.2.1 Name of the System – Integrated Hybrid Solution - ONE

1.2.2 Brief Description –

IHS-ONE is an Intermediate Building System (IBS) having three main components: walls, floor/roof and stairs. All 3 components are integrated to construct a building and hence named as "Integrated Hybrid Solution – ONE". It has the integration of the following:

Walls : Hydraform Prefabricated Mortarless Interlocking P-12 Technology. The interlocking blocks are manufactured with a block making machine offsite or onsite in an open shed. The blocks can be of cement-flyash-block or cement-soil block.

Floors/Roof : Mechanized Precast R.C. Plank & Joist system : The RC planks as well as joists are partially precast either offsite or on site. After placement as floor/roof elements, the haunches are filled with in-situ concrete. A layer of ferrocement course is laid with wire mesh reinforcement. The assembly provides monolithic behavior and diaphragm action to transfer horizontal loads to supporting members.

Ferrocement Elements : Mechanized precast/prefab Ferrocement staircase, kitchen shelves, kitchen platforms, sunshades, lintel bands, water tanks, fines.

The Integrated Hybrid Solution – ONE uses the technologies, which can be bridged to erect a structure by using precast floor/roof system bridged with interlocking mortarless block wall system in a load bearing system upto G+3 structures. 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.

The system has been designed for all loads including earthquake.

1.3 Types of precast elements (For Walling)

THE INTERLOCKING BLOCK

There are two major objectives of any dry-stack interlocking block system. The first objective is to be self-aligning. Features requiring for self-aligning interlocking blocks include:-

- Fitting into each other without adjustment (e.g. cutting, shaving or shining)
- Features, so that, if wrongly placed they will not fit and therefore, require either reversing or replacement for rectification.
- Modular coordination requirements.
- Tight tolerances.
- Simple shapes so as to simplify the management of production, construction & maintenance.

1.3.1 An Interlocking Compressed cement/ flyash / gypsum / sand or soil /Flyash / cement Block made on the Hydraform machines is referred to as a block **(Fig 1)**

1.3.2 Interlocking: - The locking of a male face of one block with the female face of another or the locking of the bed of one block with the ridge of the one below it is called Interlock **(Fig.2)**.

1.3.3 Bed: - The recessed under surface of the block is called the Bed **(Fig.3)**.

1.3.4 Ridge: - The raised top surface of the block is called the Ridge. **(Fig. 3)**

1.3.5 Course: - One (horizontal) layer of Hydraform blocks is called a course **(Fig.4)**.

- Height of a course = 115 mm

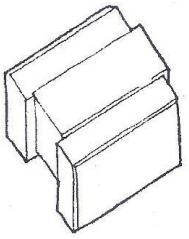


Figure - 1

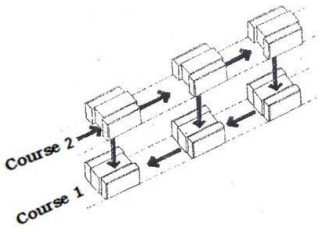


Figure - 2

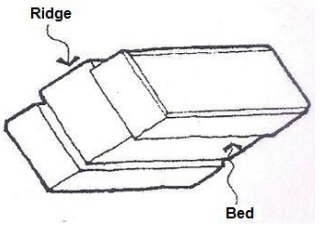


Figure – 3

Figure – 4

1.3.6 SIZE & DIMENSIONS OF BLOCKS

The blocks are mainly of following size and dimension to suit standard application**.** However, size can be tailored for large quantity application requirements.

For external application:
for load bearing the block sizes are :

HF190 : 240mm (l) x190mm(w) x 115mm (h)
HF 220 : 240 mm (l) x 220 mm (w) x 115 mm (h)
HF 150 : 240mm (l) x 150 mm (w) x 115mm (h)

For partition walls:

HF 100:240mm(l)x100mm(w)x115mm(h) or 220mm(h)

Special blocks:

For conduits and embedding of reinforcement bars

1.4 Types of precast elements (For floor / roof)

Floor / Roof is a precast system named as Precast RC Planks & Joists System. The precast planks are partially precasted and when placed over wall / joists/beams, serve as form work for cast-in-place concrete. The haunches are filled in situ along with the negative reinforcement of 6 mm dia in haunches.

This system consists of precast R.C. planks 60 mm thick supported over partially precast RC joists of 150 mm width and 150 to 200 mm depth with stirrup projecting out on the top. To provide for Tee-beam effect with the joist, the plank is made partly 30 mm thick. A 100 mm wide tapered concrete fillet is provided for strengthening the haunch portion during handling and erection.

1.4.1 Precast Planks :

The RC Planks typically have 3 Nos. 6mm dia bars as main reinforcement and 3mm dia mild steel wire @ 150mm c/c or 6 mm dia bars up to 200mm c/c as transverse reinforcement. The in-situ concrete at every joint with 2 no. 6mm dia as negative reinforcement form the flange of the tee beam along with the joists and provide monolithic effect.

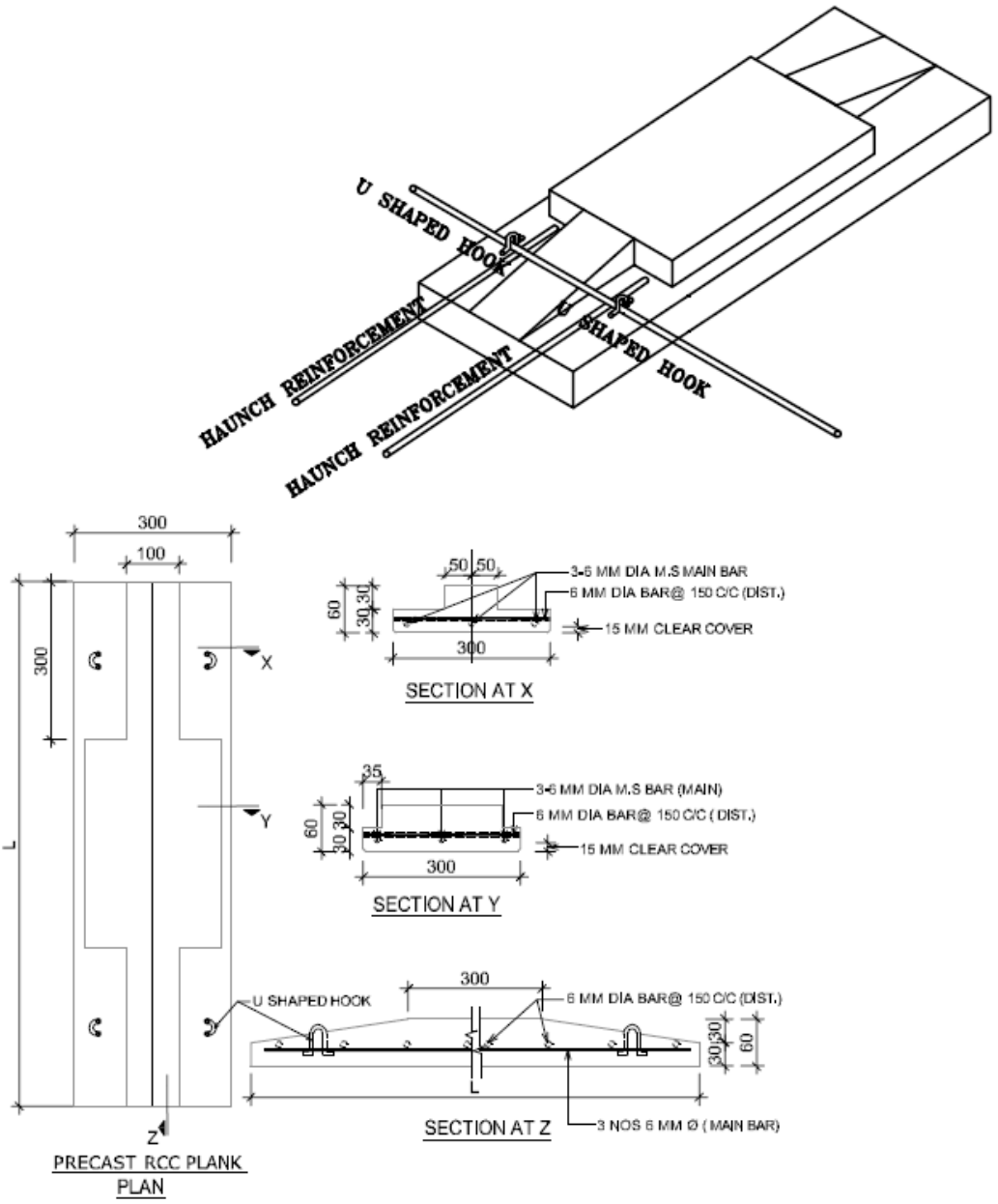


Fig. 5 Plan, Section & view of R.C. Plank

1.4.2 Partially Precast RCC Joist

It is a rectangular shaped joist 150 mm wide and the precast portion is generally 150 mm deep. The portion above is casted while laying in-situ concrete over planks. The stirrups remain projected out of the precast joist. Thus the total depth of joist becomes 210 mm. The joist is designed as composite Tee-beam with 60 mm thick flange comprising of 30 mm precast and 30 mm in-situ concrete. This section of the joist can be adopted upto span of 4 m. For smaller spans, the depth of precast joist can be reduced. For longer spans the depth of joist can be increased. However, the self-weight of joist shall increase and lifting would require simple chain-pully block.

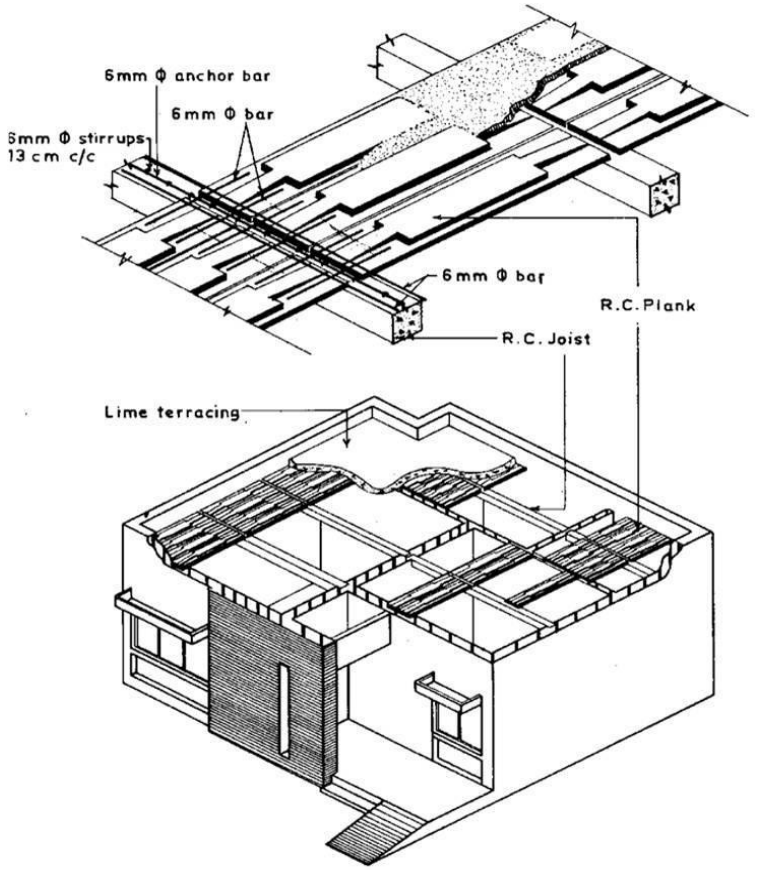


Fig.6

1.4.3 Precast Ferrocment / Ferrocrete elements

Ferrocement is a special form of reinforced concrete. It is a composite material consisting of cement sand mortar (matrix) reinforced with layers of small diameter wire meshes. It differs from conventional reinforced concrete primarily by the manner in which the reinforcement is arranged within the brittle matrix. Since its behavior is quite different from that of conventional reinforced concrete in performance, strength and potential applications, it is classed as a separate material. Usually steel bars are also used in addition to wire mesh, to form a steel skeleton, which helps in retaining the required shape of the ferrocement components once the cement mortar hardens. The wire mesh reinforcement is uniformly distributed across the thickness of the element.

Ferrocement Shelves

Conventionally, cooking platforms are provided in 50 mm thick cast-in-situ RCC slabs. Precast ferrocement cooking shelves are used which are easier to cast, easier to handle and light weight besides being economical. The cooking platform has 25mm

thickness having one layer of welded mesh 25x75mm of 2 mm dia and two layers of chicken mesh 24 gauge, embedded in cement mortar.

Ferrocement Staircase Steps

Stair case is an essential part of any building as it provides access to different floors in the structure. Conventionally, staircases are constructed in Reinforced Cement Concrete, having a waist slab, treads and risers, hand rails etc.

Precast ferrocement steps (tread & riser unit) are 25 mm thick, supported on walls / beams and provide aesthetic look like a folded slab.

Ferrocement Water Tanks

There are a number of options available to store water viz. brick masonry tanks, RCC water tanks, PVC tanks etc.

Ferrocement tanks of 1200 litres & 1600 litres have been provided which have a dia of about 1.5m. For these tanks, the base and the cylindrical container are casted separately. The wall thickness is 25mm. Two layers of chicken mesh along with GI wire in helical shape are provided in the walls.

1.5 Machines for Precasting / Prefab

1.5.1 Machine for Interlocking blocks production :

A block making machine is a portable Machine, shown in Fig.(6)

The Machine has the following parts :-

- Hopper
- Hopper support
- Valve control
- Top arm cylinder lever (Top ram)
- Bottom cylinder lever (Bottom ram)
- Chamber
- Wear plates 4 per set
- Top ram
- Bottom ram
- Top arm
- Rear pin and bearings
- Main cylinder (80 mm)

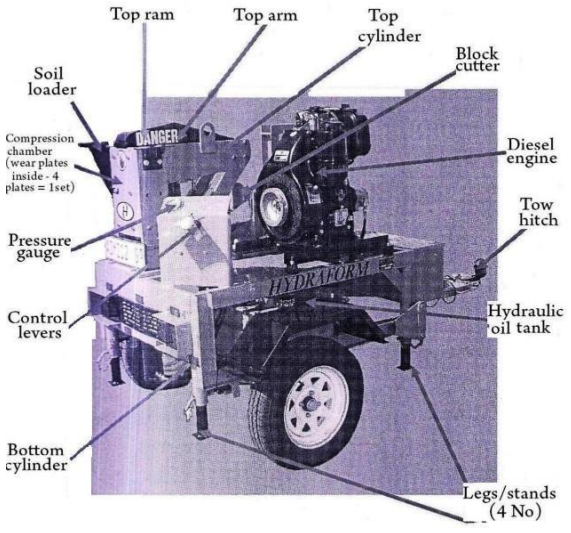


Fig.7

- Frame (fixed or mobile)
- Pin
- Top ram extension
- Top arm cylinder

Machines of different models and block production capacity

Machines of different models and block production capacity are available manufactured by Hydraform India Pvt. Ltd.

HYDRAFORM BLOCK MAKING MACHINES & MIXER

Models	M7E Stationary	M7E Mobile	M7D Mobile	M7EXM-E mobile	M7EXM-D Mobile	M7S2E-Stationary	M7 Twin-Mobile	Pan Mixer
Power Source	3 phase Elec. Motor	3 phase Elec. Motor	Diesel engine	3 phase Elec. Motor	Diesel engine	3 phase Elec. Motor	3 phase Elec. Motor	3 phase Elec. Motor
Dimensions(Indicative)	+- 1m X 1m X 1m	+- 1m X 1m X 1m	+- 1.7m X 1.7m X 1.7m	+-2.95 m X 1.7m X 1.7m	+-2.95 m X 1.7m X 1.7m			5 ft. Dia
Weight	+-700 kg	+-800 kg	+- 1150 kg	+- 1500 kg	+- 1500 kg	+-950 kg	+-950 kg	+-1400 Kg
Hydraulic Power Pack of cylinders	1	1	1	1	1	2	2	Machenical Gear Box
Compression chambers	1	1	1	1	1	2	2	Blender mix
Loading Assemblies	1	1	1	1	1	2	2	N/A
Hydraulically Powered Pan mixer	N/A	N/A	N/A	140 Ltr.	140 Ltr.	N/A	N/A	+ - 400 ltrs
Tow Hitch Trolley & Road tyres	N/A	N/A	ü	ü	ü	N/A	N/A	N/A
Block Production /hour	Upto 200	Upto 200	Upto 200	Upto 200	Upto 200	Upto 400	Upto 400	Upto 400
Space required in Sq. Mtr.	1500- 2000	1500-2000	1500-2000	1500-2000	1500-2000	2500-3000	2500-3000	
Man Power/per machine	* 6-8	6-8	4-5	7-8	7-8	+-10	+-10	3-4

* Excluding Mixing/sieving

Machines Production Rate :-

Production of blocks depends upon the requirement. Production is started well in advance, so that by the time the foundation is completed, the blocks for superstructure are ready and cured for 28 days. Machines are available for different production rates per day. Machines can run for two shifts also, if required. However, the process is batch based and not continuous. Of course, the wet mix should be consumed, before initial setting of cement mixed.

1.5.2 Machines for Precast R.C. Planks

For Precasting of planks the main Machine **(Fig.8)** is a vibrating table. The Mould is not stationery, but is moved and placed over the vibrating table, with a wheel moved on a light U-Channel

rail. One Machine can cast 180 planks in a day with 8 hours shift. The planks can be precasted at site in a covered shed. The precasting is done on "Stretcher pallets", which are stacked within the covered shed for 24 hours and then demoulded and shifted to curing yard. **(Fig.9)** shows the Mould **(Fig.10)** shows the pallets stacked with freshly casted planks.

All machines and equipments are portable and local fabricated.

The planks can also be casted with self compacting concrete, wherein the vibrating table is not required. Only a plain smooth leveled table is required.

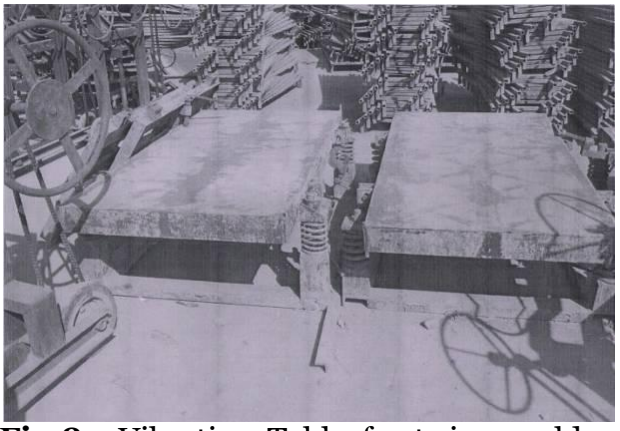


Fig.8 – Vibrating Table for twin mould

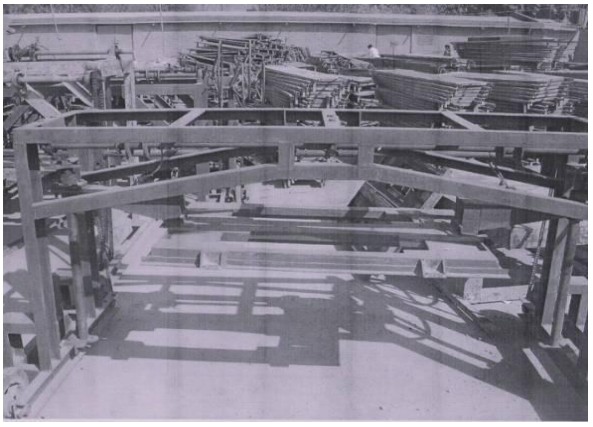


Fig.9 – The Machine with mould

Fig.10 – Casted planks on pellets stacked for initial strength

1.5.3 Machines for Partially precast joists

The Joists are precasted as partially precast in an egg-laying Machine **(Fig.11).** Joists can also be casted on a levelled platform, with MS Channels detachable moulds **(Fig.12)**.

All machines and equipments are portable and local fabricated.

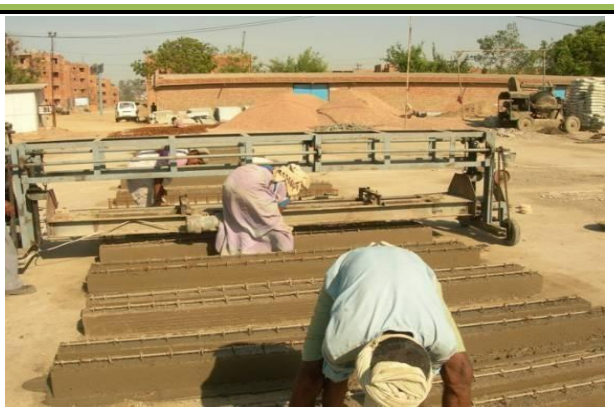


Fig.11 – Precasting of joists with egg laying machine

Fig. 12 – Precasting of joists with MS Channel molds

1.5.4 Machines for Ferrocement elements

The ferrocement elements such as treads and riser units, steps, shelves, partitions, water tanks, bed blocks, sunshades, fins etc. are precasted on a leveled platform or on vibrating tables.

1.5.5 Other tools / plants / equipments

- Hoisting equipments for light weight upto 1 tonne capacity only.
- A hydra/trolley for transporting the precast planks/ joists / ferrrocement elements from casting /curing yard to place of erection.
- Cement concrete Mixer with weigh batcher.
- Shearing Chisel
- Heavy hammer
- Welding machine
- Shear cutting Machine : for cutting of bars
- Single phase welding transformer for spot and line welding
- Weld mesh & chicken mesh cutters

- Mortar mixer with spinal blades or paddles inspite the stationery drum or pan mixer (A rotating drum mixer with fins fixed to the sides is not recommended)
- Hand trowel
- Plate trowel
- Hand vibrating trowel
- A chain pully block with hoisting poles / or a small capacity crane (say max. 1tonne)

1.6 Use of System

Interlocking blocks as :

load bearing walls
non-load bearing
partition infill wall in multi-storey building

RC Plank & Joists System as :

Floor / roof slabs in all class of buildings
In load bearing structures
In RCC Framed structures
In steel structures
In RCC – Steel composite structures

Ferrocement elements :

Sunshades
Shelves
Fins
Water tanks
Flooring tiles
Terracing tiles
Drains
Drain covers

1.7 Assessment

Scope of assessment include suitability of walling, roofing and other building elements to the specified requirements for building constructions as : load bearing system, non load bearing system. The structural and water tightness design for each specific structure is the responsibility of the building designer.

1.8 Basis of Assessment

Performance evaluation assessment and quality checks have been done by various agencies including, TPQC through JNNURM, Shri Ram Institute & Test House engaged by DSIIDC, the technical project team of DSIIDC, Govt. of Delhi for various housing projects / sites at Bawana, Narela, Bhorgarh, Baprola, Tikri, Poothkhurd.

- Test Reports for Workers Housing project executed at Vapi and Anjar, Gujarat.
- IS : Codes 13990 & 13994 for the floor / roof system
- CBRI Building Research Note BRN-4.
- Maintenance checks & schedules for machines.
- Quality assurance system for manufacturing / production, erection, placement etc., provided by the PAC Holder.

The PAC holder has transformed the technology from manual to mechanization for better quality production and faster construction. The System also brings in the conservation of materials, form work, water, thus, conserving the natural resources and use of waste (such as fly ash).

The IHS-ONE is a hybrid system of construction using traditional materials but with precast / prefab technology. IS Codes for materials, specifications and tests are already available.

PART 2 CERTIFICATE HOLDER'S TECHNICAL SPECIFICATIONS

2.0 General

The PAC holder shall manufacture the precast items / prefabrication for walls, floor / roof and other precast elements in accordance with the requirements and specifications at site or off site in an covered shed and in control environment.

2.1 Specifications of raw materials

2.1.1 Interlocking blocks

The main raw materials for production of interlocking blocks are Cement + Flyash + Sand for Flyash Blocks or cement + soil for soil blocks, which are available cheaply and in abundance. The ingredients are compressed and compacted in the block making machine.

The Mix design and proportions of the ingredients depends upon the nature of fly ash and the strength of block required.

Fly ash grade II AS PER is 3812-1981 is used for Blocks.

Sample mix design for achieving respective class strength.

	Cement	Gypsum	Lime	Sand	Fly-Ash
Class 75	6%	3%	3%	25%	63%
Class 100	7%	3%	4%	30%	56%
Class 125	8%	3%	4%	35%	50%

2.1.2 RC Planks & Joists

The materials used are cement, aggregates, water, reinforcement, admixtures.

2.1.3 Ferrocement elements

The materials used for ferrocement are cement, sand, wire mesh and steel bars.

2.1.4 Quality of Materials :

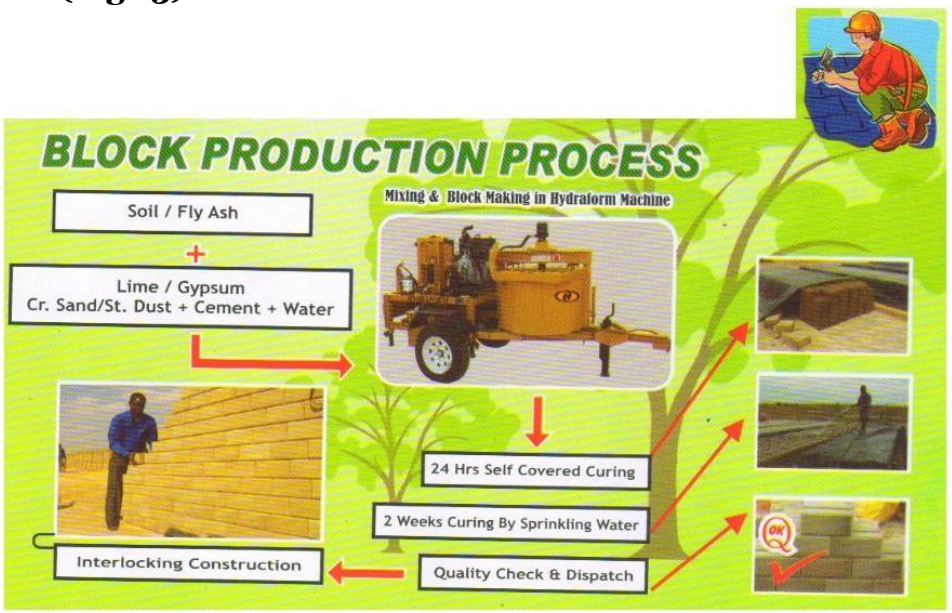
All the raw materials used shall be as per relevant IS Codes.

2.2 Manufacturing / production process

2.2.1 Interlocking block

- Blocks are produced in a special Block Making Machine of different production capacity.
- Ingredients (sand, flyash and gypsum) or soil, flyash are mixed dry in pan mixer for one minute. Then cement is added. When homogenous mixing is achieved, water is mixed.
- The moisture in the mix is checked with drop test.
- The sequence of operation of machine is :
  - Lower the main ram
  - Open the pre-compression ram
  - Fill the compression chamber with raw material mixture in the hopper.
  - Close the pre-compression ram.
  - Raise the main ram to compress the block
  - Open the pre-compression ram
  - Raise the main ram fully to eject the blocks.
  - Remove and stack the blocks
  - Curing done for 14 days.

Flow Chart For Production of Blocks :-
The Flow chart for production of Interlocking blocks is given in **(Fig.13)**



(Fig.13) Flow Chart

2.2.2 RC Planks & Joists

The reinforcement cage comprising of 3 Nos., 6mm dia main reinforcement and distribution bars 6mm @ 200mm spacing is prepared. 3 Nos. of cover blocks are also binded. The cage is placed on the pallet over the Vibrating table. Two planks are casted together on one table. The twin moulds are tightened with the table. Min. M-25 strength of concrete is poured in a measured quantity. Vibration is done with a timer. No smooth finish is required on top of planks. Rather it is roughened with a steel broom.

After the casting, the mould is lifted and the plank along with pallet is lifted and placed for curing. After 48 hours the plank is demoulded from the pallet and shifted to curing yard. The process takes about 3 minutes, when self compacting concrete is used no vibration is required.

The precast joists are casted on a leveled platform using MS Channel as form work. The reinforcement cage with triangular stirrups having one bar on top and 2 or 3 bars in bottom is placed. Concrete is poured and compacted with a 25mm needle vibrator. The lower part of joists is casted up to top of the MS Channels. The edges are finished. The mould are removed after 4 hours of initial setting and reused. The joists are cured with gunny bags or under polythene cover. After 14 days they are shifted to stacking yard.

2.2.3 Ferrocement elements

The reinforcement cage is prepared for ferrocement items such as sunshades, platform, shelves, steps, tread riser units, covers etc., using min. two layers of chicken mesh, one layer of WWF/mesh and edge bars/middle bars for handling stresses. The cage is placed on leveled platform with steel angle moulds. A thin layer of 5mm thick cement sand mortar (1:1.5 or 1:2) is mortared. Chicken mesh is placed. Next layer mortar is laid, WWF is inserted and top layer of mortar is laid and finished. The thickness of ferrocement elements vary from 10mm to 50mm.

2.3 Construction process / methodology

2.3.1 Wall

2.3.1.1 Preparation of blocks: - Before use in stacking of blocks for walling, the blocks require preparatory work.

Cleaning: - By using a piece of hacksaw blade, remove any stubborn mortar/soil lumps from top and bottom surfaces of recesses, ridges of flanges of blocks, so that laying of successive layer of blocks are laid in the 'true' line and level (**Fig.14**). Before using, the top and bed surfaces of the block must be cleaned using a brush.

Cutting and Shaving: - You can cut your block with a block cutter or a blaster chisel and hammer. Use "used" hacksaw blades or chisel and hammer to shave blocks (**Fig.15).**

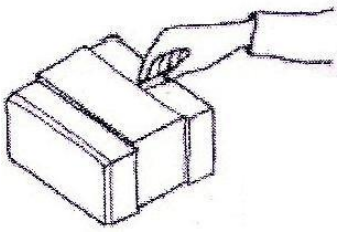
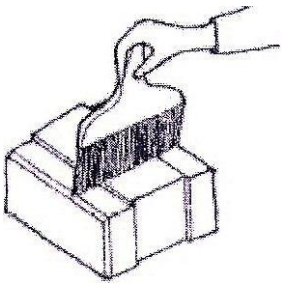


Fig.14



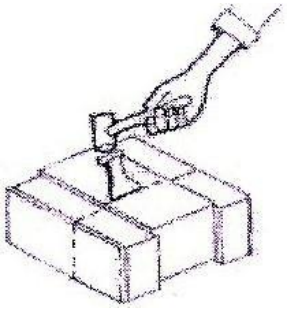


Fig. 15

2.3.1.2 Laying the First Superstructure Course: - It is most important that the first course is perfectly level since superstructure courses are without mortar. Find the highest corner of the plinth beam/ DPC. Start laying the first course on a 10/12 mm bed of 1:4 /1:6 mortar at this point with a spirit level or water level for checks. Do not build on top of this first course for at least 12 hours because the weight of the blocks will squash the

un-cured mortar and may spoil base level, resulting into undulations in block laying.

Corners: - All corners are started with a half block. The male face or 'tongue' may be cut off, but this is not essentials. The ridges on the blocks are shaved to allow the incoming blocks to sit level. The tongues of the blocks may be shaved, but this is not essential **(Fig.16)**.

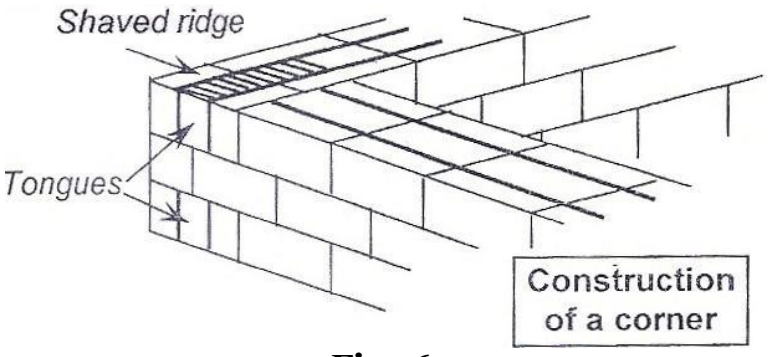


Fig.16

Gauge rods and Line blocks: - The ideal method of ensuring that walls are straight and level is to set up gauge rods at each corner of the building. A gauge rod should have two steel stays to anchor it are set on the gauge rods to hold the building line (**Fig.17**).

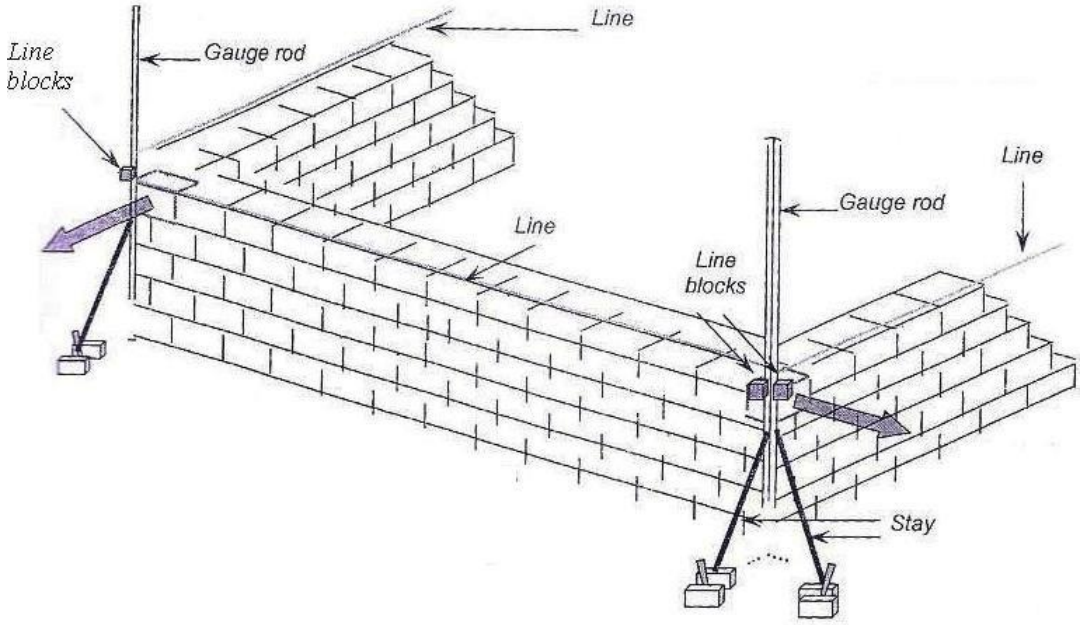


Fig.17

Half block direction: - Note that the corner half blocks 'rotate', facing as shown in the sketch. **(Fig.18)**

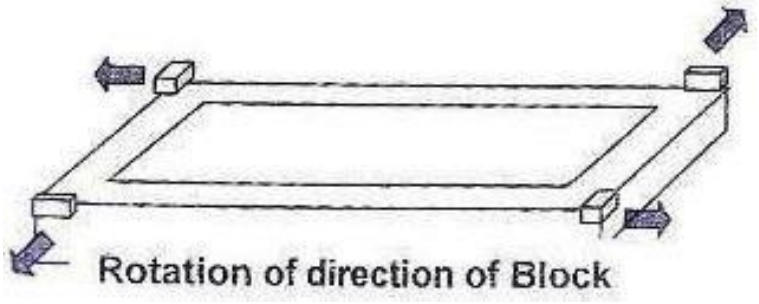


Fig.18

Reversing alternate block courses: - Each course of blocks is laid in the opposite direction from the course below. This compensates for differences between the upper and lower sections of the wear plates, during block production.

2.3.1.3 **Laying a wall: -** Begin at two corners and work towards the centre of the wall, ensuring that the blocks are being laid in the same direction so that the male and female interlocks will marry when the last block is laid. When only four or five blocks remain to complete a course, measure the gap and select blocks which will fill the gap precisely.

Seating the blocks: - It is vitally important that every block is seated with a rubber mallet. It is essential to have best rubber headed mallets preferably with steel or fibre handles. Wooden handles do not last.

Checking levels: - Block layers should use spirit levels not less than 1,000 mm long, but 1,200 mm levels are preferable. They are also long enough to check the vertical alignment of walls.

Keying in internal walls: - Every internal wall must be 'keyed' into an outside wall. Alternate courses are 'tooth bonded' into the outside wall. A half block is always used at the end of the internal wall. The ridges are shaved off as illustrated in the sketch alongside that of a 'One-Block Pier'.

EQ Bands :- Earthquake resistant bands and vertical reinforcement are provided as per design requirements.

2.3.1.4 **(Fig.19 to 22)** shows the blocks laying process for walls.

Fig.19 Block production in a shed

Fig.20 Corner vertical reinforcement

Fig.21 a,b,c,d walls under construction

Fig.22 a,b,c,d walls under construction

2.3.2 **RC Planks & Joists**

First the joists are lifted and carried to the site location. They are placed Mannually or by light crane over the walls with bed blocks beams and leveled. The spacing depends upon the room dimensions.

The RC planks are also lifted manually or by light crane. Planks are placed on wall to joist, joist to joist or beam to joist with a bearing of 40mm. 6mm dia negative reinforcement is provided in the haunched. Concrete is poured and compacted with hand plate vibrator. A coat of cement wash mixed with water proofing compound is laid, the next day of pour. A layer of 12mm thick ferrocement plaster with 150 x 150mm wire mesh of 2 mm dia reinforcement and water proofing compound is laid over the slab within 72 hours of haunch filling, when the in-situ concrete is 2 cm. This completes the slab system. The joists are supported at mid span till the insitu concrete gains bond strength.

2.3.3 **(Fig.23 to 36)** shows the construction of floor slab with planks & joists systems.

Under Construction Pictures

Fig.23 Stack of reinforcement cage for different size of planks

Fig.24 Placing twin plank reinforcement

Fig.25 Placing mould over reinforcement cage

Fig.26 Pouring of concrete in mould

Fig.27 Ready casted twin planks over pellets

Fig.28 Lifting casted plank with pellet

Fig.29 Casted planks on pellets stacked for initial strength

Fig.30 RC joists being precasted

Fig.31 Precasted joists under covered shed

Fig.32 Lifting of planks mechanically

Fig.33 Planks & Joists being placed on walls

Fig.34 reinforcement in haunches

Fig.35 Filled up haunches with in-situ concrete (curing being done)

Fig.36 The sunk slabs and vertical reinforcement projecting out

2.3.4 Ferrocement Elements

The ferrocement elements are placed in position embedded in walls/beams like any precast RCC element using mortar for gap fill. **(Fig.37 to 40)** shows ferrocement elements.

Fig.37 Precasting ferrocement shelves

Fig.38 Mesh placed on mould (staircase steps)

Fig.39 Laying mortarand finishing stairs step

Fig.40 Precast steps placed in first flight

2.3.5 Services

Electrical conduits in floor/roof can be concealed, through RC Joist, nearly at mid level (near neutral axis) and through the in-situ joints of two panels.

2.3.6 Finishing

The interlocking block external walls can be kept exposed with silicon water resistant paint or any other external paint, as done on the plastered surface. For the ceiling direct POP/Gypsum putty can be done. Ferrocement elements can be finished like any RCC element.

2.4 Performance requirements and product specifications

2.4.1 For Hydraform Interlocking Blocks Walling

S.No.	Performance characteristics	Requirement with tolerances	Test Method/Reference
	Block Height	± 2mm	
	Block Width	± 2mm	
	Block Length	± 10mm	
	Block compressive strength	30 to 125 (kg/cm²)	IS : 3495-1
	Water absorption	≤25%	IS : 3495-2
	Drawing shrinkage	≥ 0.15%	IS : 4139
	Weathering	Loss of weight ≥ 5%	IS : 1725
	Wall Plumb	± 3mm	

2.4.2 For R. C. Planks & Joists System

S.No.	Performance characteristics	Requirement with tolerances		Test method/reference
For Planks	Length Width Thickness Bow (deviation from intended line or plane) Twist (distance of any corner from the plane containing other three corners) Sequences Flatness Deflection	± 5mm ± 3mm ± 2mm ± 2mm = 1m Þ 3mm Þ2mm < 40 l²/D	Dimensional Conformity Deflection recovery test	As per IS Code 13990 & 13994
Joists	Length Width Depth Assembly Load Test	±4mm ±2mm ±2mm <40l²/D	Dimensional conformity Deflection recovery test	

* l is in meter and D in mm

2.4.3 For Ferrocement / Ferrocrete elements :

Characteristics	Specifications & Tolerances
Wire diameter	0.5 to 1.5mm
Size of mesh openings	6 to 25mm
Number of mesh layers	Upto 5 layers per cm. thickness
Volume fraction of reinforcement	Upto 8 percent in both directions
Specific surface of reinforcement	Upto 4 sqcm. Per cubic cm in both directions
Intermediate skeletal steel	
Diameter	3 to 10mm
Grid size	50 to 150mm
Typical mortar compositions	
Cement to sand ratio	1 to 2.5 by weight, 1 to 1.5 to 4 by volume
Water to cement ratio	0.4 to 0.6 by weight
Grading of fine aggregate	Passing 2.36mm with fineness modulus of

	2.4 to 2.5
Composite properties	
Thickness	6 to 50mm
Steel cover	1.5 to 5.0mm
Ultimate tensile strength	Upto 34.5MPa
Allowable tensile stress	Upto 10.3MPa
Modulus of rupture	Upto 55 MPa
Compressive stress	27.6 to 68.9 MPa

2.5 Maintenance of Machines

2.5.1 Hydraform Machines

2.5.1.1 Maintenance Checks

- Machine must be cleaned overall.
- If production is stopped make sure bottom ram is down and cleaned of all wear plates then the top ram is close.
- After stopping the engine/motor release the pressure in the hydraulic hoses by moving the hydraulic levers in the respective directions.
- In case of diesel engine, Clean Air filter daily and change whenever required or as recommended in the engine maintenance manual
- Check & amp; tighten as necessary electric connections
- Clean the Mixer to remove any raw material sticking in the Mixer.
- Check and top up or change the hydraulic oil in the machine and gear oil in the mixer gear box whenever required.
  - Do not give pressure for more than 10 seconds.
  - The above checks are done on a regular basis to ensure safe Operation of the machine.

2.5.1.2 Maintenance Schedule

Daily : Check hydraulic oil level in tank. Check for external leaks, Clean Air Filter, Nut Bolts Worn hoses, machine, mixer etc. for Avoiding raw material mix and cement Settings.

Every 6 Months : Change return – line filter element or Whenever gauge needle level in red area.

Yearly : Change suction strainer (inside the tank). Change return – line filter element. Remove tank lid and clean tank.

2.5.1.3 Wearplates

There are six wear plates in the machine, which give the shape of the block. These are of special material to achieve wear resistance. However, depending on the working conditions and the soil/raw material abrasion wear plates must be changed when required. When block thickness becomes 118 mm or block

does not sit in the groove, the wear plates should be changed supplied by the PAC holder.

2.5.1.4 Suction Filter :-

- Every 600 hours the suction filter must be removed and cleaned. To do this, first remove reservoir lid, then reach into the tank and loosen filter. Wash filter with cleaning fluid (paraffin or equivalent), blow dry and replace filter, close lid ensuring gasket is intact.
- Visually check Temperature gauge for abnormally high temperature and stop the machine if temperature exceeds 50°C

2.5.2 Other Machines and equipments

The vibrating tables require regular cleaning, oiling greasing. The pellets require removal of dents, the lifting machines also require regular check & oiling.

2.6 Maintenance of Buildings –Structures

(a) The walling system do not require any special maintenance. The colourless silicon based water repellent / water proof cement paint/textured paints can be done on external face of wall without cement plaster. There is no deterioration in the blocks with time. The external paint shall require to be done as per climatic conditions after 3 to 7 years.

(b) The precast floor / Roof system is in RCC and has long life and do not require any specific maintenance. If there is any leakage/seepage of water, due to any reasons need to be checked/repaired/controlled, to avoid corrosion of steel reinforcement.

(c) Ferrocement elements can be repaired easily with thick cement mortar paste, whenever any cracks or damage occur.

(d) If Interlocking blocks are not available and any block in a wall gets damaged, it can be dismantled with fine chisel and replaced with a flyash brick / concrete fill and pointed to match the aesthetics.

(e) There is no associated health hazard or otherwise.

2.7 Applicable Standards :

- ACI 549 (1999), "Guide for design, construction and repair of ferrocement", ACI 549 ACI 549. IR-93.
- ACI 549 R (1993), "Guide for the Design, Construction & Repair of Ferrocement (Reapproved 2009)", American Concrete Institute.
- ASTM A820-11, "Standard Specification for Steel Fibers for Fiber-Reinforced Concrete", ASTM International.
- IS 383 : 1970 Specification for coarse and fine aggregates from natural sources for concret (second revision)
- IS 1542 : 1992 Specification for sand for plaster (second revision)
- IS 2116 : 1980 Specification for sand for masonry mortars (first revision)
- IS 2386 : Methods of test for aggregates for concrete
- IS 1489 : Specification for Portland pozzolana cement :
- IS 3466 : 1988 Specification for masonry cement (second revision)
- IS 8112 : 1989 Specification for 43 grade ordinary Portland cement (first revision)
- (Part 2) : 2003 For use as admixture in cement mortar and concrete (second revision)
- IS 456 : 2000 Code of practice for plain and reinforced concrete (fourth revision)
- IS 4926 : 2003 Code of practice for ready mixed concrete (third revision)
- IS 516 : 1959 Methods of test for strength of concrete
- IS 1199 : 1959 Methods of sampling and analysis of concrete
- (Part I) : 1982 Mild steel and medium tensile steel bars (third revision)
- IS 1786 : 1985 Specification for high strength deformed steel bars and wires for concrete reinforcement (third revision)
- IS 6523 : 1983 Specification for precast reinforced concrete door and window frames (first revision)
- IS 12440 : 1988 Specification for precast concrete stone masonry blocks
- IS 13990 : 1994 Specification for precast reinforced concrete planks and joists for flooring and roofing
- IS 875 (Part I) : 1987 Code of practice for design loads (other than earthquake) for buildings and structures Part I Dead loads – Unit weights of building materials and stored materials (second revision)

- IS 8888 (Part I) : 1993 Guide for requirements of low income housing : Part I Urban area (first revision)
- IS 13920 : 1993 Code of practice for ductile detailing reinforced concrete structures subjected to seismic forces
- IS 4326 : 1993 Code of practice for earthquake resistant design and construction of buildings (second revision)
- IS Codes for Ferrocement under preparation (CED-2 A2-25)
- IS:3812(Part1) : 2003 Flyash
- IS:2542-2(1981) Gypsum
- IS :4948-2002 - Galvanised wire mesh
- IS :4948 -2002 – Galvanised chicken mesh
- IS : 9103 – 1999 - Admixture
- IS : 1725-1982 – test for compressive strength
- IS : 3495 (Part II) : Test for water absorption
- IS : 4139-1989 – Drying shrinkage
- IS : 1725 – 1982 – Weathering
- IS : 12894 – 2002 – Compressive test

2.8 National Building Code of India
Relevant Applicable Clauses

2.8.1 Part 4 :Fire & life safety

- Clause 3.3.1 and 3.3.2 (types of construction)
- Table 2 : Masonry walls solid required to resist fire
- Table 12 : Modified w.r.t. CBRI Research Noted (4) 1982 and 1987. (fire rating for RC Planks & Joists is 1 hours & 40 minutes)

2.8.2 Part 6, Structural Design Section 4 (Masonry) Clause 6.2 : Minimum thickness of walls from consideration other than structural

- Clause 6.4 : Joists to control deformation & cracking Clause 7 : Special consideration in Earthquake Zones
- Part 6 : Structural Design : Section 7B (System building and composite construction) good practices and accepted standards

2.8.3 Part 7 : Construction Practices and Safety : good practices and accepted standards

2.8.4 Part II : Sustainability

2.9 Design Parameters

- Loads as per IS-875 (Part 1 & 2):1987
- Ductile detailing as per IS:13920 : 1993
- EQ Resistant design and provision as per IS:4326:1993

- Code of practice for Brick work : IS:2212:1991
- Design & installation of joints : IS:3414:1968
- Design for structural use of unreinforced masonry : IS:1905:1987
- Design of Precast Planks & Joists : IS:13994:1994
- Design of Ferrocement Structures/elements : ACI:549 R (1993)
- RC Planks is designed as simple supported element with partial fixity
- Joists is designed as single supported beam with partial fixity as a Tee-beam

2.10 Energy Efficiency, Eco friendly and Green Building Materials & Technology

- The technology uses: flyash an Industrial By product.
- The technology consumes less cement and steel and therefore conserve embodied energy.
- The technology saves on fuel and transportation energy as all productions, precasting done at site.
- The technology reduces the consumption of fine and coarse aggregates.
- No shuttering is involved, thus saves forest.
- No ceiling plaster required.
- Because of precast elements for walls & floors/roof, the quality is controlled, requiring less maintenance.
- Good practices are adopted to achieve the objectives of Economy, energy efficiency, eco friendly, green materials, reuse and resource conservation.
- The life cycle cost is also less.

2.11 Training :

No special training to workers or technicians are required. The technology for production of wall & roof elements and erection is simple. Normal training for operation of machines maintenance, practices of masonry and RCC works for practice are required with normal safety measures. The PAC holder shall arrange training of workers, as required in this regard.

2.12 Guarantee / Warrantee provided by PAC Holder :-

After Sales Service facilities during guarantee / warrant period shall be provided for mechanical equipment by the Machine Manufacturer.

2.13 Manual / Instruction

No set of manuals are required for structural works. However the manuals of required machines are for precast elements and interlocking blocks shall be provided.

PART 3 BASIS OF ASSESSMENT AND BRIEF DESCRIPTION OF ASSESSMENT PROCEDURE

3.1 Basis of Assessment

3.1.1 The technical basis for assessment is as per the standards listed in Part V.

(i) Assessment of quality assurance procedures provided the PACS holder.

(ii) Tests done at the site and in Labs by DSIIDC.

(iii) Tests conducted by Shri Ram Research Institute for Industrial Research.

(iv) Tests conducted by CPWD central Lab.

(v) Tests conducted by Civil Engineering Research Cell, Dimapur, Nagaland (through PWD).

(vi) Tests conducted by SABS (South Africa Bureau of Standards).

(vii) Tests conducted by Test House (SABS affiliated company) Pretoria, South Africa).

(viii) Tests conducted by University of WITWATERSRAND, Johanesuburg.

(ix) Tests conducted by Unique Engineering Services, Gandhidham, Kutchh (for Welspun Group projects).

The Block making Hydraform machine inspected at their work site at :

- Multi Level Residential Projects by Jay Pee Associates at Greater Noida, UP
- Institute Building, Peiryar Centre at Jasola Vihar, Delhi
- Ticket Windows and Office complex outside Qutab Minar, Delhi
- CPWD Dhaula Kaun Flyover project office, Nr.ARSD College,Dhaula Kaun , Delhi

The sample tests reports by the PACs holder.

The IS Codes applicable for the Technology.

3.2 Site Manufacturing Process :

The block making and precast roofing and other elements are manufactured/casted at site job, no centralized manufacturing industry is required. The site production, and erection is based on Good Engineering practices as per I.S. Codes.

3.3 Major projects where Technology used :-

Sl. No.	Name of the Client	Nature of work	Date of construction
1	Delhi State Industrial & Infrastructure Development Copr. Ltd. (DSIIDC)	3164 Housing with cost effective technologies (Industrial Workers housing at Bawana) (SFS Scheme)	2003-06
2	Delhi State Industrial & Infrastructure Development Copr. Ltd. (DSIIDC)	1184 houses (Type-III) with cost effective technologies at Bawana Industrial Complex (Pocket-B, Extn.)	2007-08
3	Delhi State Industrial & Infrastructure Development Copr. Ltd. (DSIIDC)	Housing for Urban poor at Narela, Delhi (BSUP / JNNURM)	2007-09
4	Delhi State Industrial & Infrastructure Development Copr. Ltd. (DSIIDC)	Housing for Urban poor at Bhorgarh Delhi (BSUP / JNNURM)	2008-10
5	Delhi State Industrial & Infrastructure Development Copr. Ltd. (DSIIDC)	5552 EWS houses with cost effective technologies (Composite work) at Baprola, Delhi	2008-11
6	The G.M. (Planning & Architecture), Greater Noida Industrial Development Authority	EWS Housing at Omicron, Greater Noida	2013-15
7	M/s. Inno Infra Private Limited,	Innocity Geo Smart City, Oragadam, Chennai	2009-13
8	M/s Welspun Projects Ltd., Welspun City	Bachelor/Family/Workers Accommodations for WSL at Anjar	2013-16
9	M/s Welspun Projects Ltd., Welspun City	Bachelor/Family/Workers Accommodations for WSL at Vapi	2013-16

The buildings are already occupied. Few photographs of sites provided by the PAC's holder have been taken into record. No adverse remarks / comments have been received from clients/users and Executing Agency, which could create adverse effect.

3.4 Inspection :

RC Planks & joists and ferrocement elements, site inspections have been made by BMTPC officials and TAC Members for Housing projects executed by DSIIDC at Bawana, Baprola, Poothkhurd etc.

For Hydraform Interlocking block walls visits have been made by TAC Members to - Multi Level Residential Projects by Jay Pee Associates at Greater Noida, UP, Institute Building, Peiryar Centre at Jasola Vihar, Delhi, Ticket Windows and Office complex outside Qutab Minar, Delhi, CPWD Dhaula Kaun Flyover project office, Nr. ARSD College, Dhaula Kaun , Delhi

3.5 Typical Details :

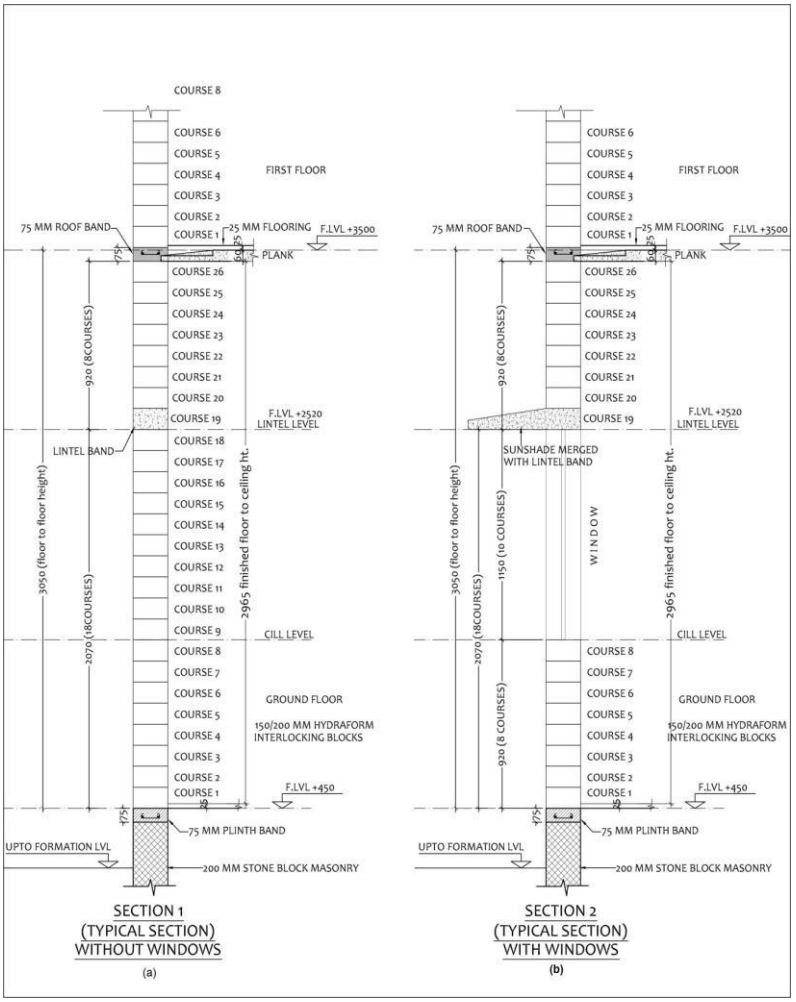


Fig. 41

EXTRA EQ PROVISION AT L & T-JUNCTION AT SILL LEVEL

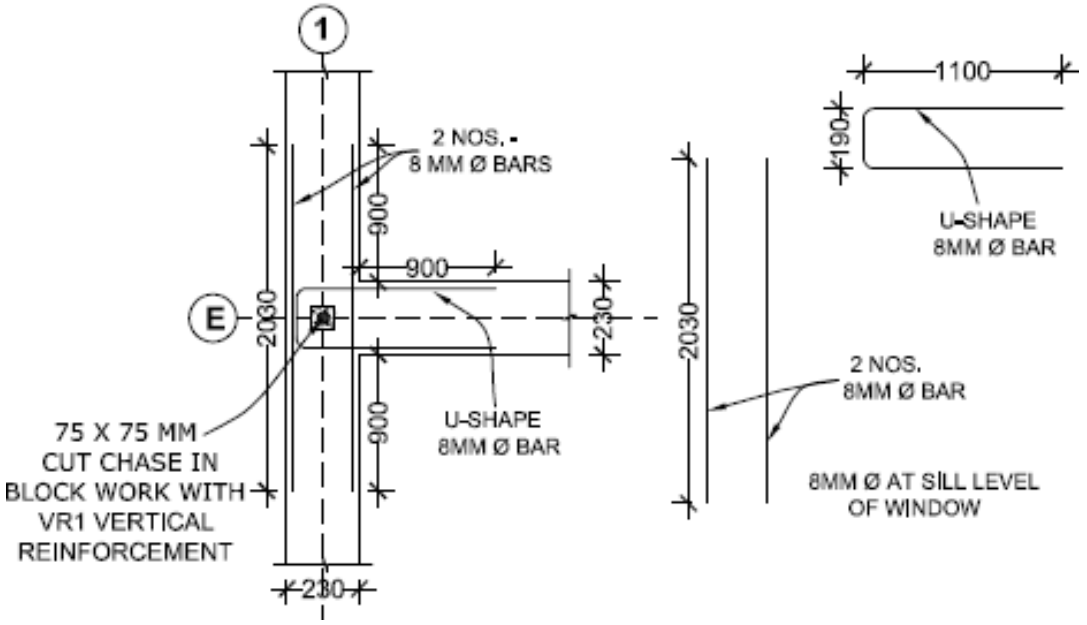


Fig. 42

TYPICAL EQ REINFORCEMENT AT T-JUNCTION AT SILL LEVEL

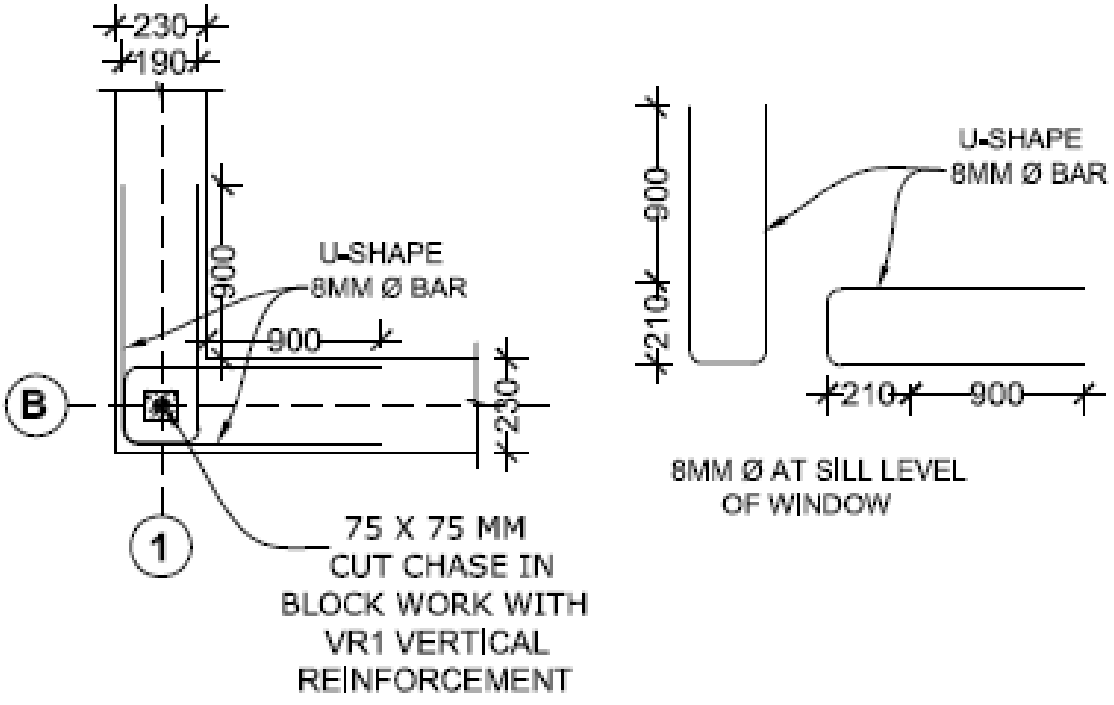
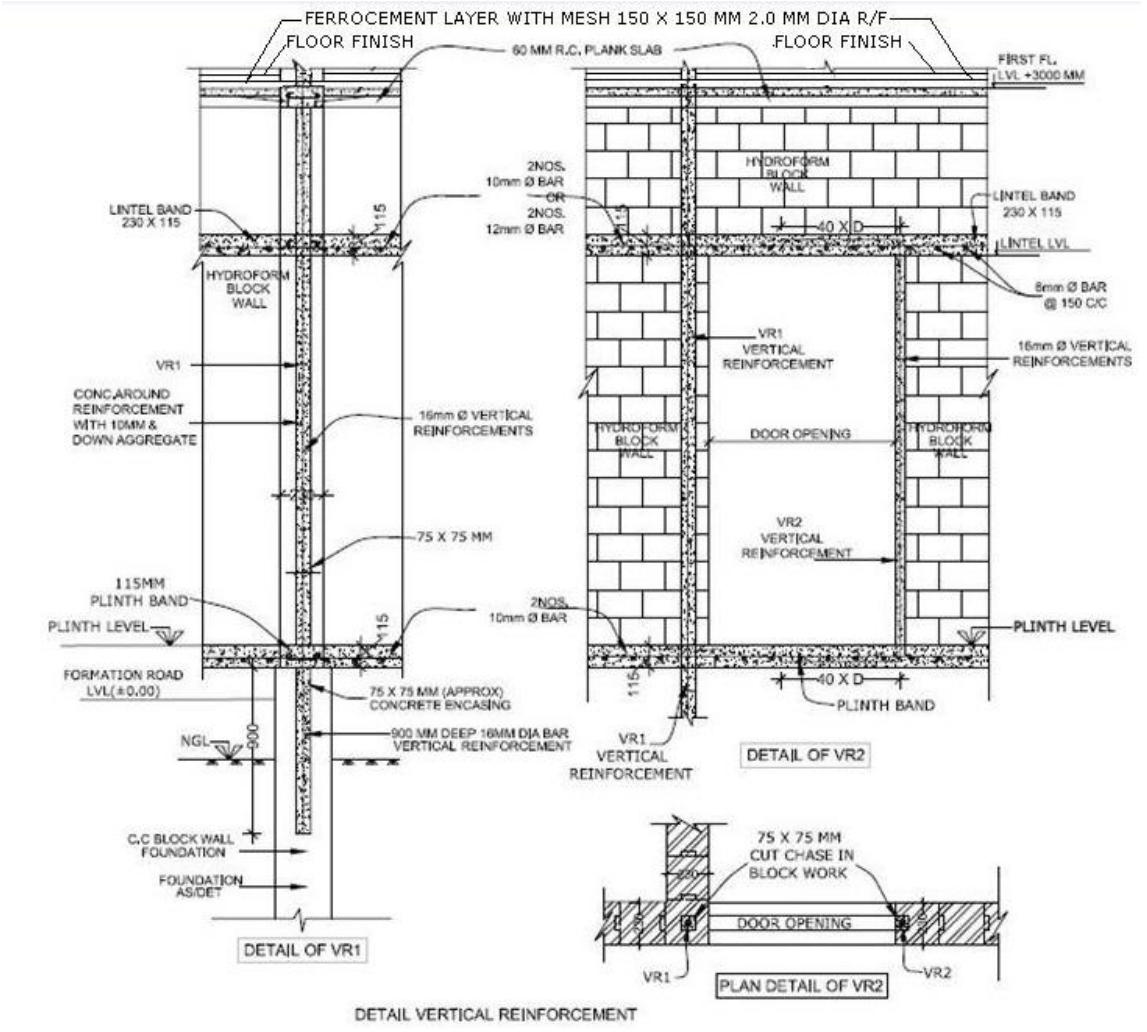
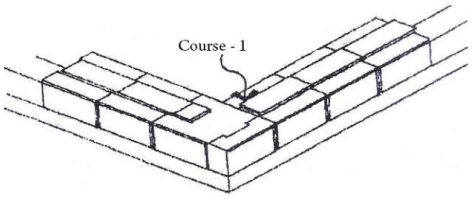


Fig. 43



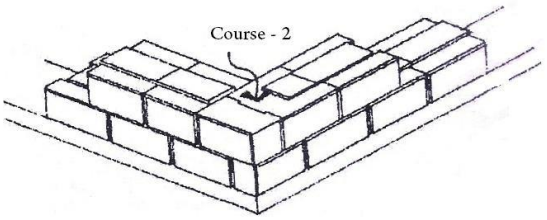
DETAIL VERTICAL REINFORCEMENT

Fig. 44



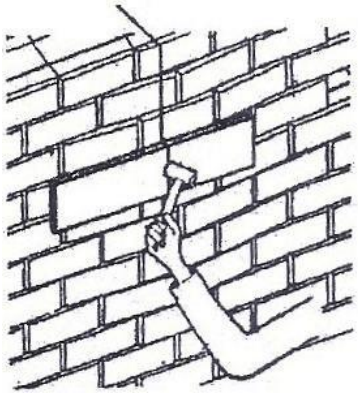
Laying Course

Fig. 45



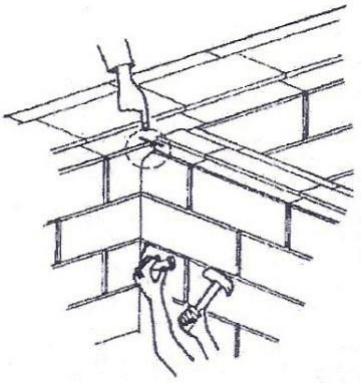
Laying Course

Fig. 45



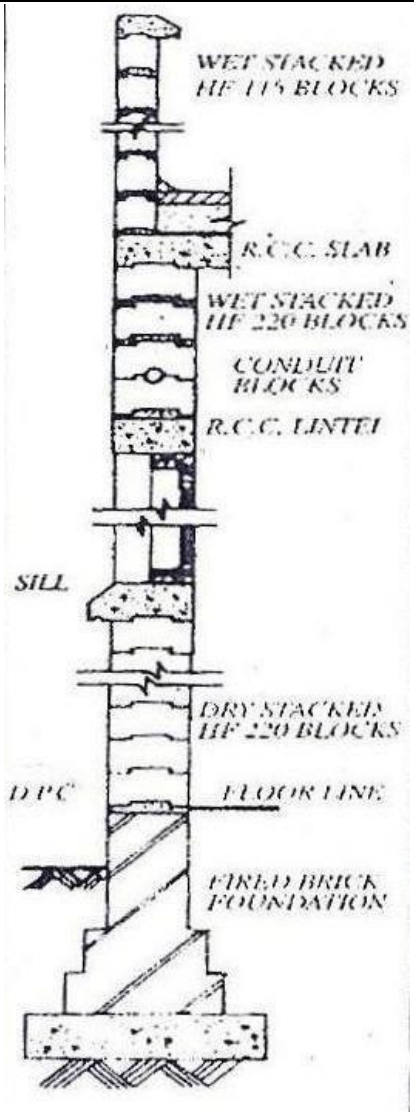
Alignment of blocks

Fig. 46



T-Junction

Fig. 47



Typical Section

Fig. 48

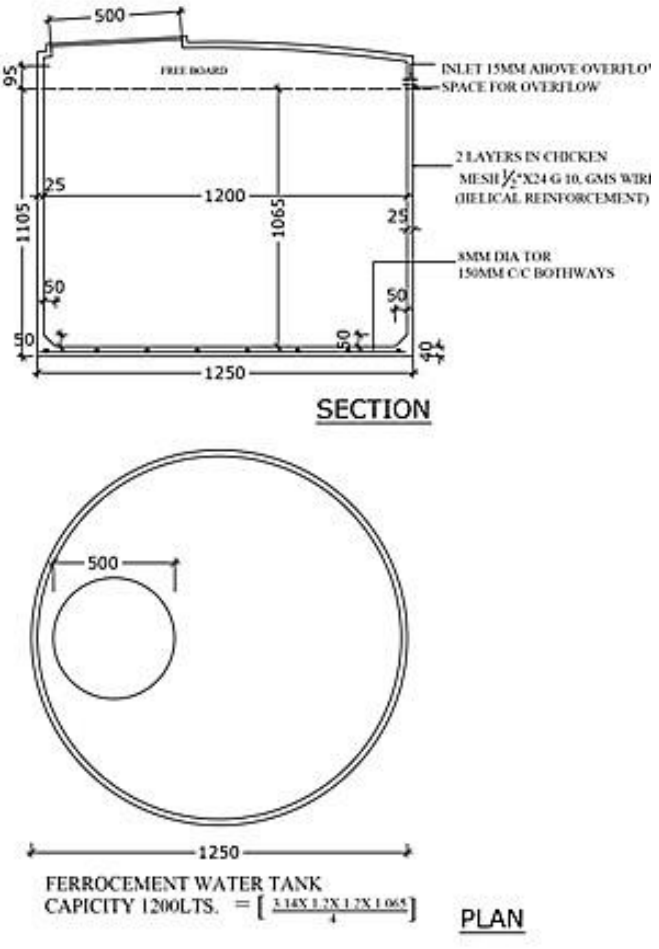


Fig. 49

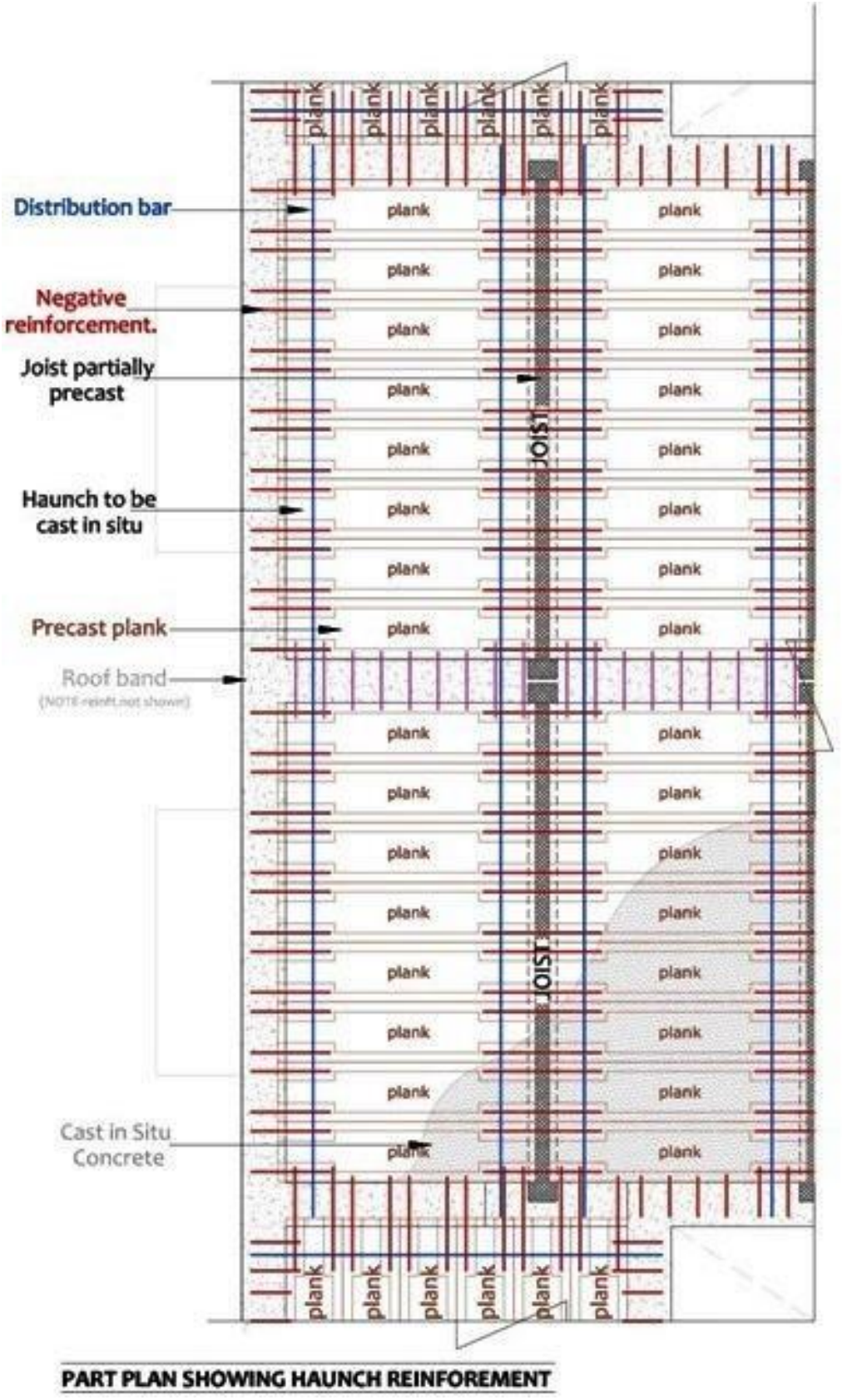


Fig. 50 Typical junction of plank & joist assembly

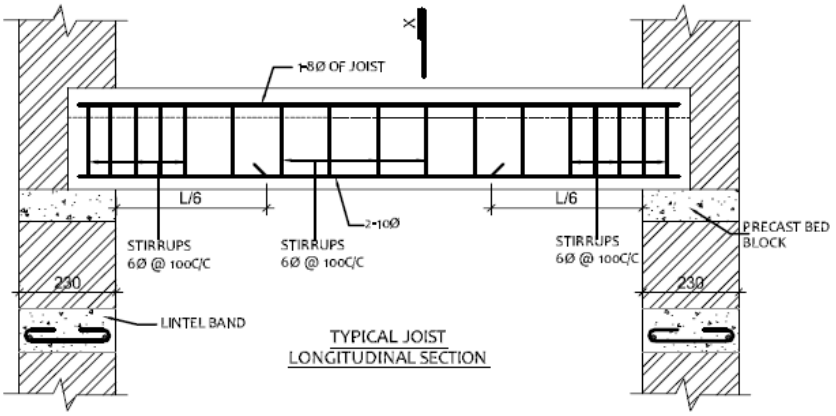


Fig. 51 Precast R.C. Joist

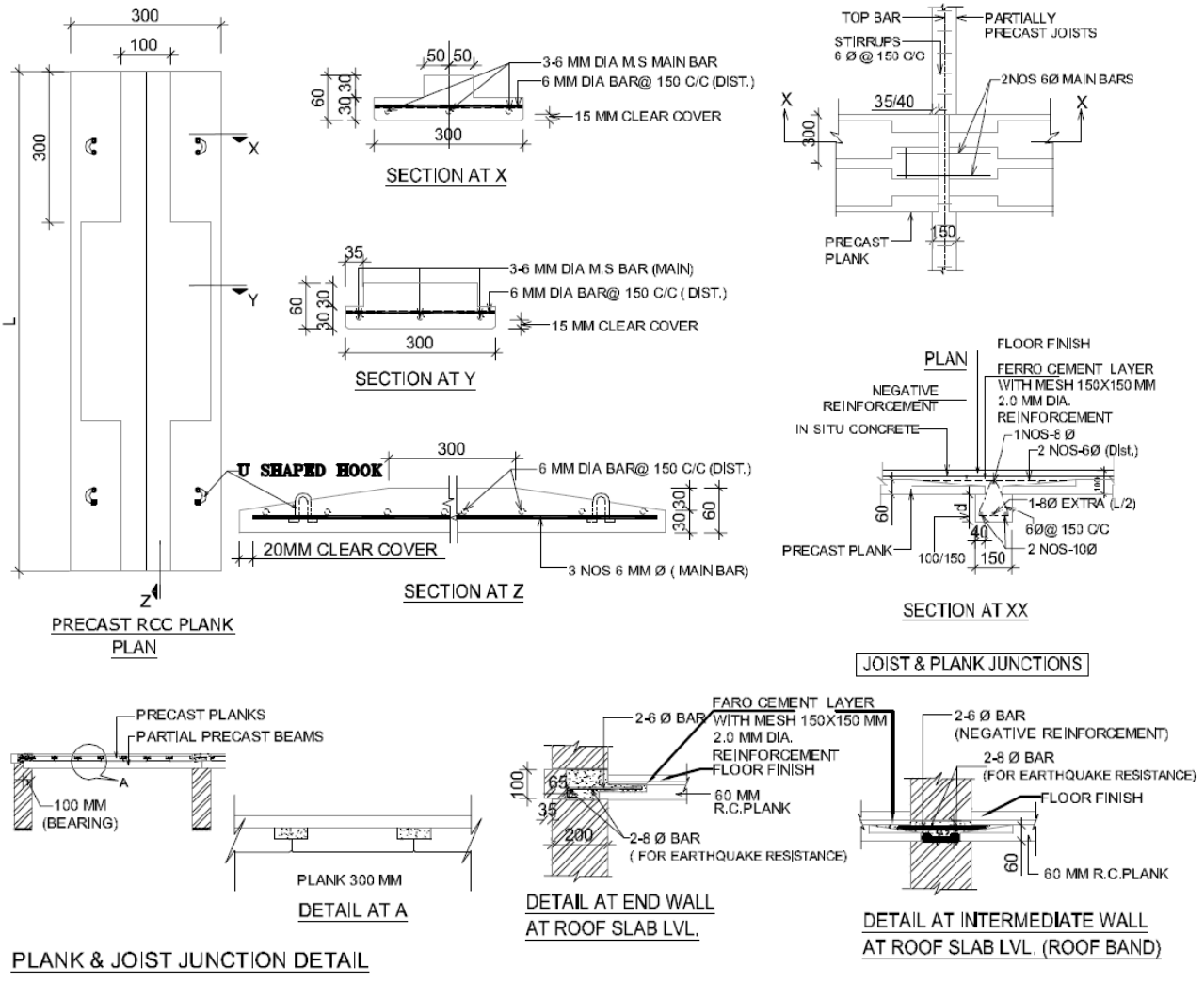


Fig. 52

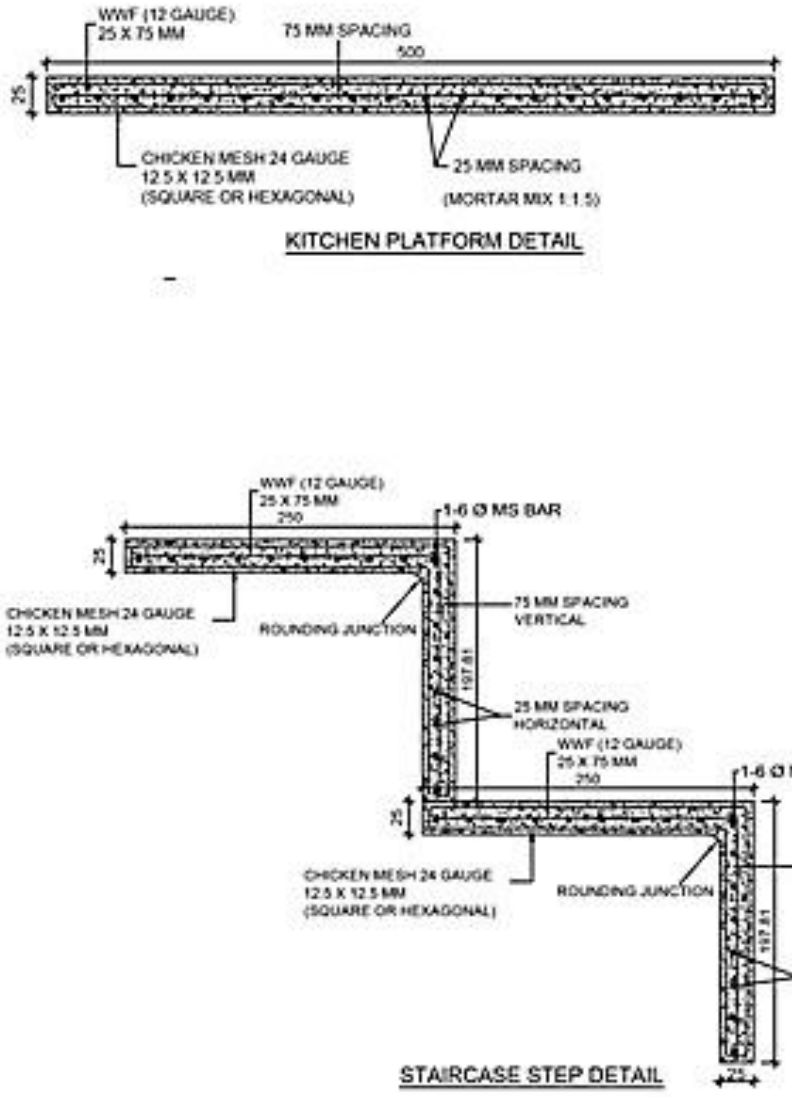


Fig. 53 Ferrocement shelf and steps

PART 4 STANDARD CONDITIONS

4.1 The certificate holder shall satisfy the following conditions:

4.2 The certificate holder shall continue to have the product reviewed by BMBA.

4.3 The product shall be continued to be manufactured according to and in compliance with the manufacturing specifications and quality assurance measures which applied at the time of issue or revalidation of this certificate. The Scheme of Quality Assurance separately approved shall be followed.

4.4 The quality of the product shall be maintained by the certificate holder.

4.5 The product user should install, use and maintain the product in accordance with the provisions in this Certificate.

4.6 This certificate does not cover uses of the product outside the scope of this appraisal.

4.7 The product is appraised against performance provisions contained in the standards listed in Part-V. Provisions of any subsequent revisions or provisions introduced after the date of the certificate do not apply.

4.8 Where reference is made in this Certificate to any Act of Parliament of India, Rules and Regulations made there under, statutes, specifications, codes of practice, standards etc. of the Bureau of Indian Standards or any other national standards body and the International Organization for Standardization (ISO), manufacturer's company standards, instruction/manual etc., it shall be construed as reference to such publications in the form in which they were in force on the date of grant of this Certificate (and indicated in Part V to this Certificate)

4.9 The certificate holder agrees to inform BMBA of their distributors / licensees whenever appointed by him and agrees to provide to BMBA a six monthly updated list thereof.

4.10 The certificate holder agrees to provide to BMBA feedback on the complaints received, the redressal provided, and the time taken to provide redressal on complaint to complaint basis as soon as redressal is provided. BMBA agrees to provide the certificate holder the user feedback received by it, if any.

4.11 If at any time during the validity period, PACH is unable to fulfill the conditions in his PAC, he should on his own initiative suspend using the PAC and notify Chairman, TAC the date from which he has suspended its use, the reason for suspension and the period by which he will be able to resume. He shall not resume without the prior permission of BMBA. He shall also inform, simultaneously, his agents, licensees, distributors, institutional, government, public sector buyers, other buyers and all those whom he has informed about his holding the PAC. He shall also inform all those who buy his product(s) during the period of suspension. He shall provide to BMBA at the earliest the list of who have been so informed by him.

4.12 In granting this Certificate, BMBA takes no position as to:

(a) The presence or absence of patent or similar rights relating to the product;

(b) The legal right of the Certificate holder to market, install or maintain the product;

(c) The nature of individual installations of the product, including methods of workmanship.

4.13 BMTPC and the Board of Agreement of BMTPC (BMBA) take no position relating to the holder of the Performance Appraisal Certificate (PACH) and the users of the Performance Appraisal Certificate (PAC) respecting the patent rights / copy rights asserted relating to the product / system / design / method of installation etc. covered by this PAC. Considerations relating to patent / copy rights are beyond the scope of the Performance Appraisal Certification Scheme (PACS) under which this PAC has been issued. PACH and users of this PAC are expressly advised that determination of the Claim / validity of any such patent rights / copy rights and the risk of infringement of such rights are entirely the responsibility of PACH on the one hand and that of the users on the other.

4.14 It should be noted that any recommendations relating to the safe use of the product which are contained or referred to in this Certificate are the minimum standards required to be met with when the product is installed, used and maintained. They do not purport in any way to restate or cover all the requirements of related Acts such as the Factory Act, or of any other statutory or Common Law duties of care, or of any duty of care which exist at the date of this Certificate or in the future, nor is conformity with the provisions of this Certificate to be taken as satisfying the requirements of related Acts.

4.15 In granting this Certificate, BMTPC and BMBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the use of this product.

4.16 The certificate holder indemnifies BMBA, its officers and officials involved in this assessment against any consequences of actions taken in good faith including contents of this certificate. The responsibility fully rests with the certificate holder and user of the product.

4.17 The responsibility for conformity to conditions specified in this PAC lies with the manufacturer who is granted this PAC. The Board (BMBA) will only consider requests for modification or withdrawal of the PAC.

4.18 The PAC holder shall not use this certificate for legal defense in cases against him or for legal claims he may make from others.

Place: New Delhi
Date of issue: 13.1.2020

Chairman TAC & for and on behalf of
Member Secretary, BMBA

Chairman, TAC
& Member Secretary, BMBA
Building Materials and Technology Promotion Council
Ministry of Housing and Urban Affairs, Govt. of India
Core 5A, 1st Floor, India Habitat Centre
Lodhi Road, New Delhi-110003

PART 5 LIST OF STANDARDS AND CODES USED IN ASSESSMENT

Part 5.1 **Standards -** These Standards are referred for carrying out a particular test only and do not specify the requirement for the whole product as such

Part 5.1.1 ACI 549 (1999), "Guide for design, construction and repair of ferrocement", ACI 549 ACI 549. IR-93.

Part 5.1.2 ACI 549 R (1993), "Guide for the Design, Construction & Repair of Ferrocement (Reapproved 2009)", American Concrete Institute.

Part 5.1.3 ASTM A820-11, "Standard Specification for Steel Fibers for Fiber-Reinforced Concrete", ASTM International.

Part 5.1.4 IS 383 : 1970 Specification for coarse and fine aggregates from natural sources for concrete (second revision)

Part 5.1.5 IS 1542 : 1992 Specification for sand for plaster (second revision)

Part 5.1.6 IS 2116 : 1980 Specification for sand for masonry mortars (first revision)

Part 5.1.7 IS 2386 : Methods of test for aggregates for concrete

Part 5.1.8 IS 1489 : Specification for Portland pozzolana cement :

Part 5.1.9 IS 3466 : 1988 Specification for masonry cement (second revision)

Part 5.1.10 IS 8112 : 1989 Specification for 43 grade ordinary Portland cement (first revision)

Part 5.1.11 (Part 2) : 2003 For use as admixture in cement mortar and concrete (second revision)

Part 5.1.12 IS 456 : 2000 Code of practice for plain and reinforced concrete (fourth revision)

Part 5.1.13 IS 4926 : 2003 Code of practice for ready mixed concrete (third revision)

Part 5.1.14 IS 516 : 1959 Methods of test for strength of concrete

Part 5.1.15 IS 1199 : 1959 Methods of sampling and analysis of concrete

Part 5.1.16 (Part I) : 1982 Mild steel and medium tensile steel bars (third revision)

Part 5.1.17 IS 1786 : 1985 Specification for high strength deformed steel bars and wires for concrete reinforcement (third revision)

Part 5.1.18 IS 6523 : 1983 Specification for precast reinforced concrete door and window frames (first revision)

Part 5.1.19 IS 12440 : 1988 Specification for precast concrete stone masonry blocks

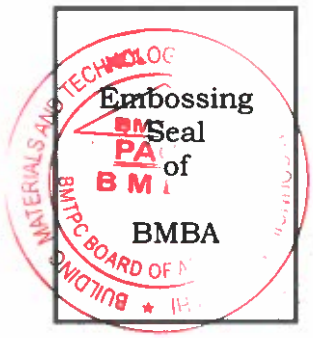
Part 5.1.20	IS 13990 : 1994 Specification for precast reinforced concrete planks and joists for flooring and roofing
Part 5.1.21	IS 875 (Part I) : 1987 Code of practice for design loads (other than earthquake) for buildings and structures Part I Dead loads – Unit weights of building materials and stored materials (second revision)
Part 5.1.22	IS 8888 (Part I) : 1993 Guide for requirements of low income housing : Part I Urban area (first revision)
Part 5.1.23	IS 13920 : 1993 Code of practice for ductile detailing reinforced concrete structures subjected to seismic forces
Part 5.1.24	IS 4326 : 1993 Code of practice for earthquake resistant design and construction of buildings (second revision)
Part 5.1.25	IS Codes for Ferrocement under preparation (CED-2 A2-25)
Part 5.1.26	IS:3812(Part1) : 2003 Flyash
Part 5.1.27	IS:2542-2(1981) Gypsum
Part 5.1.28	IS :4948-2002 - Galvanised wire mesh
Part 5.1.29	IS :4948 -2002 – Galvanised chicken mesh
Part 5.1.30	IS : 9103 – 1999 - Admixture
Part 5.1.31	IS : 1725-1982 – test for compressive strength
Part 5.1.32	IS : 3495 (Part II) : Test for water absorption
Part 5.133	IS : 4139-1989 – Drying shrinkage
Part 5.1.34	IS : 1725 – 1982 – Weathering
Part 5.1.35	IS : 12894 – 2002 – Compressive test

CERTIFICATION

In the opinion of Building Materials & Technology Promotion Council's Board of Agreement (BMBA), **Integrated Hybrid Solution–ONE (IHS–ONE)** bearing the mark manufactured by M/s Aap Ka Awas LLP, New Delhi is satisfactory if used as set out above in the text of the Certificate. This **Certificate PAC No.: 1048-S/2020** is awarded to **M/s Aap Ka Awas LLP, New Delhi.**

The period of validity of this Certificate is for a period of one year i.e. from 13/01/2020 to 12/01/2021 as shown on Page 1 of this PAC.

This Certificate consists of a cover page and pages 1 to 45.



On behalf of BMTPC Board of Agreement, Chairman, Technical Assessment Committee (TAC) of BMBA & Member Secretary, BMTPC Board of Agreement (BMBA) under Ministry of Housing and Urban Affairs, Government of India

Place: New Delhi, India
Date: 13.1.2020

Dr. Shailesh Kr. Agrawal
Chairman, TAC
& Member Secretary, BM
Building Materials and Technology Pro
Ministry of Housing and Urban Affairs, G
Core 5A, 1st Floor, India Habitat Cent
Lodhi Road, New Delhi-110003

PART 6 ABBREVIATIONS

Abbreviations

BMBA	Board of Agreement of BMTPC
BMTPC	Building Materials and Technology Promotion Council
CPWD	Central Public Works Department
ED	Executive Director of BMTPC
IO	Inspecting Officer
MS	Member Secretary of BBA
PAC	Performance Appraisal Certificate
PACH	PAC Holder
PACS	Performance Appraisal Certification Scheme
SQA	Scheme of Quality Assurance
TAC	Technical Assessment Committee (of BMBA)

Performance Appraisal Certification Scheme - A Brief

Building Materials & Technology Promotion Council (BMTPC) was set up by the Government of India as a body under the Ministry of Housing &Urban Poverty Alleviation to serve as an apex body to provide inter-disciplinary platform to promote development and use of innovative building materials and technologies laying special emphasis on sustainable growth, environmental friendliness and protection, use of industrial, agricultural, mining and mineral wastes, cost saving, energy saving etc. without diminishing needs of safety, durability and comfort to the occupants of buildings using newly developed materials and technologies.

During the years government, public and private sector organizations independently or under the aegis of BMTPC have developed several new materials and technologies. With liberalization of the economy several such materials and technologies are being imported.

However, benefits of such developments have not been realized in full measure as understandably the ultimate users are reluctant to put them to full use for want of information and data to enable them to make informed choice.

In order to help the user in this regard and derive the envisaged social and economic benefits the Ministry of Housing &Urban Poverty Alleviation has instituted a scheme called Performance Appraisal Certification Scheme (PACS) under which a Performance Appraisal Certificate (PAC) is issued covering new materials and technologies. PAC provides after due investigation, tests and assessments, amongst other things information to the user to make informed choice.

To make the PACS transparent and authentic it is administered through a Technical Assessment Committee (TAC) and the BMTPC Board of Agreement (BMBA) in which scientific, technological, academic, professional organizations and industry interests are represented.

The Government of India has vested the authority for the operation of the Scheme with BMTPC through Gazette Notification No. 1-16011/5/99 H-II in the Gazette of India No. 49 dated 4th December, 1999.

Builders and construction agencies in the Government, public and private sectors can help serve the economic, development and environmental causes for which the people and Government stand committed by giving preference to materials and technologies which have earned Performance Appraisal Certificates.

Further information on PACS can be obtained from the website: www.bmtpc.org