

**TECHNOLOGY PROFILE  
OF  
MONOLITHIC CONCRETE  
CONSTRUCTION SYSTEM USING  
ALUMINIUM FORMWORK**



**Building Materials & Technology Promotion Council  
Ministry of Housing & Urban Poverty Alleviation  
Government of India  
New Delhi**

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## System in Brief

In this system instead of traditional column and beam construction; all walls, floors, slabs, columns, beams, stairs, together with door and window openings are cast in place in one operation at site by use of specially designed, easy to handle (with minimum labour and without use of any equipment) modular form work made of Aluminium Plastic composite. Using the formwork system, rapid construction of multiple units of repetitive type can be achieved.

| Basic Material Requirements                                     | Formwork system                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Concrete           | Reinforcement       |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------|
| <b>Whether Indian Standard Available</b>                        | No.<br>However, IS 14687:1999 Guidelines for falsework for concrete is available.<br>This does not cover requirements by special type of formwork system.                                                                                                                                                                                                                                                                                                                                                                                                                          | Yes<br>IS 456:2000 | Yes<br>IS 1786:2008 |
| <b>Specification as per Indian Standard</b>                     | No,<br>Formwork system is propriety system and designed as per requirements.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Yes                | Yes                 |
| <b>If IS not available, what is the specification for used.</b> | <p>The formwork systems used are made of light weight Aluminium and manufactured by Wall Ties &amp; Forms, Inc (WTF), USA.</p> <p>The concrete forms use robotics welding system for manufacturing. A soft alloy weld wire is utilized in the concrete form weld process. Fixing of the formwork is done using tie, pin &amp; wedges system. Does not require very skilled labour to do the job.</p> <p>The formwork can be designed based on requirements of dwelling unit and the project. A repetition of about 1000 cycle is claimed (This, however, needs, verification).</p> |                    |                     |

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|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Structural Requirements of the Construction</b> | <p>The Monolithic Concrete Construction is considered as shear wall type construction. The maximum spacing between cross wall shall be limited to 1.5 times the floor height if supported on two edges and 2.0 times the floor height, when supported on all four walls.</p> <p>Walls are designed for vertical loading, in plane shear loading and out of plane loading due to wind load and earthquake forces as per relevant Indian Standard Code IS 875(Pt.3):1987 and IS1893(Pt.1):2002 respectively. For out of plane loading the plate can be assumed to be supported by floor slabs / diaphragm and cross walls and continuity can be assumed, wherever applicable. The detailing requirement is as per IS 456:2000 code of practice for plane &amp; Reinforced Concrete and IS 13920:1993 Code of Practice for ductile detailing of reinforced concrete structure.</p> <p>A Guideline on Monolithic Concrete Construction with material requirements &amp; design aspects has been prepared and circulated to manufacturer &amp; user agencies by BMTPC.</p> |
| <b>Durability</b>                                  | <p>Durability of concrete structure can be achieved by using proper ingredient, Grade of concrete &amp; mix design as per Is 456:2000.</p> <p>Thickness of the wall is generally 100 mm with the reinforcement placed in the middle. Therefore adequate cover is likely to be maintained.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Thermal Behaviour of Structure</b>              | <p>100 mm RCC Walls and Roof has thermal transmittance value as 3.59 W/m<sup>2</sup>k) (as per IS 3792:1978)</p> <p>Since it is more than brick wall, it is advised that implementing agency shall ensure proper planning for air ventilation provisions in housing units.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Acoustic</b>                                    | <p>Average Sound reduction for 100 mm concrete is <math>\geq 45</math>db (as per IS1950:1962)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Ease of fixing services</b>                     | <p>All electric and plumbing fixtures, lines has to be preplanned and placed before concreting is done. Post construction alternation is not durable.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Scale of Economy</b>                            | <p>Scale of economy depends upon the volume of work and number of repetition of the formwork. For very small project of less than 500 units, this may not be economical.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

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|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                | Minimum 100 repetitions are disenable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Other features</b>          | <ol style="list-style-type: none"> <li>1) Pre designed formwork acts as assembly line production and enables rapid construction of multiple units of repetitive type.</li> <li>2) A Slab cycle of 4 days can be achieved, which reduces the construction time considerably.</li> </ol>                                                                                                                                                                                                                                                |
| <b>Limitation</b>              | <ol style="list-style-type: none"> <li>1) Initial investment for the formwork system is high compared to other forms &amp; minimum of 500 houses in a year need to be built for economy.</li> <li>2) Not much saving in construction in one storey structure.</li> <li>3) A lead time of about 3 months is required for initiation of work, as the formwork are designed and manufactured.</li> <li>4) Post construction alterations are not possible.</li> <li>5) All the service lines are to be pre-planned in advance.</li> </ol> |
| <b>Major Project Completed</b> | <ol style="list-style-type: none"> <li>1) Houses in Bangalore for Karnataka Slum Clearance Board.</li> <li>2) Houses in Bangalore for Bangalore Development Authority &amp; several other projects in major cities of India.</li> </ol>                                                                                                                                                                                                                                                                                               |

### **Standards/Guidelines referred:**

|                         |   |                                                                                                              |
|-------------------------|---|--------------------------------------------------------------------------------------------------------------|
| IS 456:2000             | - | Code of Practice for plain and reinforced concrete.                                                          |
| IS 875 (Pt.3):1987      | - | Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Part 3 : Wind Loads |
| IS 1786:2008            | - | High strength deformed steel bars and wires for concrete reinforcement-                                      |
| IS 1893 (Pt.1):2002)    | - | Criteria for Earthquake Resistant Design of Structures - Part 1 : General Provisions and Buildings           |
| IS 1950: 1962           | - | Code of practice for sound insulation of non-industrial buildings                                            |
| IS 3792: 1978           | - | Guide for heat insulation of non-industrial buildings                                                        |
| IS 13920 : 1993         | - | Ductile detailing of reinforced concrete structures subjected to seismic forces - Code of practice           |
| IS 14687:1999           | - | Guidelines for falsework for concrete structures                                                             |
| BMTPC Guidelines : 2011 | - | Guidelines on Monolithic Concrete Construction                                                               |