ANGAN
Augmenting Nature by Green Affordable New-habitat
A Courtyard for Revolutionary Change in Building Energy Efficiency
An International Conference on Building Energy Efficiency
9th-11th September, 2019 | Hotel The LaLiT, New Delhi
THIS PRESENTATION WAS SHARED BY

Mr. Pramod Adlakha
Managing Director, Adlakha Associates Pvt. Ltd. & Adlakha Affordable Homes

FOR THE SESSION:

“Emerging Construction Practices & Technologies”

DURING ANGAN 2019
International Conference and Exhibition on Building Energy Efficiency

Augmenting Nature by Green Affordable New-Habitat (ANGAN)

Emerging Energy-Efficient Intermediate Construction Technologies

PRAMOD ADLAKHA
Managing Director
- Adlakha Associates Pvt. Ltd
- Adlakha Affordable Homes LLP
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Technology Selection Parameters

- Cost effectiveness
- Compatible to Architecture
- Simple to understand
- Ease of construction
- Study & durable
- Energy conscious
- Security, safety
- Ease of maintenance
- Optimisation of material strength
- Conservation of natural resources
- Conservation of cement & steel
- Conservation of energy
- Employment generation, skill development
- Quality off-site & on-site
- Availability
What ails the Construction Industry

ISSUES
(Brick and Mortar + Conventional In-Situ-Technology)

- Quality
- Time
- Labour intensive
- Supervision
- Non-skill agriculture labour

TRANSFORMING INDIA

- From Brick and mortar to block w/o mortar
- From CIT to on-site Prefabrication
- Transition from manual to mechanisation (Quality & productivity)
Western Criteria of Technology Acceptance

• Focus on only thermal insulation of cold weather abroad.
• Focus on housing for one generation

Indian Criteria of technology acceptance

• Cost Affordability
• Life styles & comforts are not equivalent to western countries
• Focus on life of building for generations
• In the name of Technology Innovation we have forgotten our own “Make in India” and “Made for India” Technologies in the Building Industry.
• TAC Approvals and BIS Codes, CPWD are oriented towards specifications and not the “cost or performance”
• Western Technologies are based on principles of Heating & Cooling, with higher comfort levels than required for EWS and LIG in India
CONCEPT OF APPROPRIATE TECHNOLOGIES FOR AFFORDABLE HOUSING

LEVEL of TECHNOLOGIES

• Low & traditional
  • Intermediate
  • Hi-Tech
Emerging Intermediate Construction Technologies
Walling Systems

- Fly ash bricks (Fal-G)
- Perforated mechanised clay bricks
- Modular bricks
- Compressed stabilised soil bricks (CEB)
- Hollow concrete blocks (CMU)
- Reinforced HCB
- AAC Blocks
- CLC Blocks
- Stone block masonry
- Interlocking blocks
- Light weight poly concrete panels

Bonds:
- Rat-trap bond
- 190 mm stretcher bond
- Zig-zag bond
- Cavity wall
- Confined masonry
- Filler slab, RBC
- Hollow ‘Kulars’ slab
- Precast RB Panel
- Precast Brick Arch. Panel
- Precast funicular shell
- Precast channel
- Precast RC planks and joists
- Thin RC Ribbed slab
- L-panels
- Precast Ferro-crete panels
- Monolithic shear wall
- MCR tiles
- Vernacular – Vaults, corbel, pyramid, arched, semi arched
Emerging Intermediate Construction Technologies

Other Technologies

- Under reamed piles
- Arched foundations
- Strip floating foundations
- Ferro-cement Technology
  - Steps
  - Boundary wall
  - Water tank
  - Sunshade
  - Kitchen working platform
  - Window shutters
  - Concrete D/W frames
Emerging Hi-Tech Construction Technologies

- Precast Large Concrete Panel System (PLCP)
- RCC Shear wall System
- Precast Glass Fibre Reinforced Gypsum System (GFRG) also called Rapid Panels
- Light Gauge Steel Framed (LGSF)
- MODUCAST, Precast Concrete Box System
- EPS Core Precast Wall Panels
- Waffle Crete System
- Pre-stressed Hollow Core Panels
- Expanded Steel mesh panel system
- Tunnel Form Technology
- Speed floor Technology
- Reinforced EPS core panel system
- LGSFS-ICP Technology
- Prefabricated fibre reinforced sandwich panels
- Rising EPS (beads) cement panels
- Concrewall system
- 3S System
- Insulating concrete form blocks walling
EWS HOUSING - YEAR 2006
RAJIV GANDHI HOUSING, BAWANA - 3164 HOUSES

TECHNOLOGIES

Roofing
- Precast RC planks & joists roofing
- Precast ferrocement elements

Walling
- Perforated mechanized modular bricks
- FAL-G modular bricks

Other Components
- Single stack system of plumbing
Emerging Energy-Efficient Intermediate Construction Technologies

EWS HOUSING - YEAR 2008
BAWANA, DELHI - 1184 HOUSES

TECHNOLOGIES

- Modular perforated Brick Walls
- Precast RC Planks & Joists Slab
- Precast Ferrocement Elements
EWS HOUSING - YEAR 2006
NARELA, DELHI - 1892 HOUSES

TECHNOLOGIES

• Modular perforated Brick Walls
• Precast RC Planks & Joists Slab
• Precast Ferrocement Elements
EWS HOUSING - YEAR 2009
NARELA (NEAR CETP), DELHI, 1652 HOUSES

TECHNOLOGIES
• Modular perforated Brick Walls
• Precast RC Planks & Joists
Emerging Energy-Efficient Intermediate Construction Technologies

HOUSING FOR URBAN POOR – YEAR 2011
BHORGARH, DELHI, 1272 HOUSES

TECHNOLOGIES

- Modular perforated Brick Walls
- Precast RC Planks & Joists Slab
- Precast Ferrocement Elements
Emerging Energy-Efficient Intermediate Construction Technologies

**EWS HOUSING - YEAR 2010**
**BAPROLA, DELHI, 5568 HOUSES**

**TECHNOLOGIES**
- Modular perforated Brick Walls
- Precast RC Planks & Joists Slab
- Precast Ferrocement Elements
EWS HOUSING - YEAR 2008
BAWANA, DELHI – 896 HOUSES

TECHNOLOGIES
Monolithic technology
Emerging Energy-Efficient Intermediate Construction Technologies

EWS HOUSING – YEAR 2016
BAKARWALA, DELHI – 240 HOUSES

TECHNOLOGIES
- Mechanized bricks
- Flyash bricks
- Precast R.C. Planks and Joists Roof
Emerging Energy-Efficient Intermediate Construction Technologies

EWS HOUSING
POOTHKHURD, DELHI - 10140 HOUSES

TECHNOLOGIES

• RC Planks & Joists
  Roof in framed structure

• Flyash brick walls
EWS HOUSING
KALKAJI, DELHI - 3024 HOUSES

TECHNOLOGIES
• Waling - CLC Blocks
Emerging Energy-Efficient Intermediate Construction Technologies

EWS HOUSING
FARIDABAD & PALWAL (ERA GROUP) - 578 HOUSES

TECHNOLOGIES
• Modular perforated bricks
• Precast RC Planks & Joists Roof

Era Adel Divine, Era Divine Court, Era Redwood Residency
Emerging Energy-Efficient Intermediate Construction Technologies

EWS HOUSING
SUSHANT GOLF CITY, LUCKNOW
2750 HOUSES

TECHNOLOGY :- Monolithic RCC
EWS HOUSING
ASHRRAY, SULABH AWSAS YOJANA, LUCKNOW
4500 HOUSES
EWS HOUSING - YEAR 2009
GHOGHA, DELHI – 3680 HOUSES

TECHNOLOGY :- Monolithic RCC
EWS HOUSING - ONGOING
TIKRI KALA, DELHI – 4560 HOUSES

TECHNOLOGIES

• RC Planks & Joists Roof In framed structure
• Flyash brick walls
EWS HOUSING - YEAR 2013
BAWANA, DELHI – 704 HOUSES

TECHNOLOGY
Monolithic Technology
EWS HOUSING - YEAR 2010
OMICRON, GREATER NOIDA, 1848 HOUSES

TECHNOLOGIES

• Modular perforated Brick Walls
• Precast RC Planks & Joists Slab
• Precast Ferrocement Elements
LIG AFFORDABLE HOUSING
GREATER NOIDA - 800 HOUSES

TECHNOLOGIES
Walls: Rat Trap Bond

Cassia Estate
Gulmohar Estate
AFFORDABLE HOUSING - ONGOING
DELHI POLICE HOUSING, DHEERPUR, DELHI - 5202

TECHNOLOGY
Projects using Monolithic Technology
AFFORDABLE HOUSING - YEAR 2013
INNO GEOCITY, CHENNAI - 500 HOUSES

TECHNOLOGIES

- Hydraform interlocking block walls
- Precast RC Planks & Joists Roof
- Stone Block masonry in foundation
- Precast Boundary wall
Under reamed piles
Under reamed piles

CASTING THROUGH TREME

REINFORCEMENT CAGE IN PILE

AUGUR BORING IN PROGRESS
Modular perforated mechanized Bricks
Modular perforated mechanized Bricks
Modular perforated mechanized Bricks
Modular perforated mechanized Bricks

Project – EWS Housing at Bawana, Delhi
Modular fly-ash bricks
dular fly-ash bricks
AAC block walls
Project: EWS housing, for DDA, at Kalkaji
Monolithic technology
Laying RCC strip foundation with dowel bars and wall reinforcement

Form work for Walls below plinth
Monolithic technology

External wall corner Formwork

Internal Walls & Ceiling Form work
Monolithic technology

Form work & Reinforcement for slab ready for casting along with the walls

Casting of Staircase Monolithically
Monolithic technology

Ceiling view after removal of Formwork

External wall formwork for First Floor structure
Monolithic technology

another view of external wall formwork for first floor structure

External wall Formwork for Second Floor
Multistoreyed Building under Construction with Monolithic Technology in Mumbai

View of multi-storeyed building at Lucknow

Multistoreyed building in Progress
Monolithic technology

View of completed building at Delhi
CASE STUDY

RAJIV GANDHI HOUSING, BAWANA, 3164 HOUSES

✓ The FIRST Mass Housing scheme with cost effective alternative technologies.

✓ The LARGEST Industrial Workers Housing scheme in organized sector in Asia.

✓ The FIRST Housing Project to use fly ash and fly ash products on a large scale.

✓ The FIRST Mass housing Scheme with mechanized perforated modular bricks

✓ The FIRST Housing Scheme with largest number of precast concrete and ferrocement elements (approx. 4 lacs elements)

✓ The FIRST Low Cost housing ISO-9001 Certified project.
RECOGNITION BY Ministry of Housing, Govt. of India & Govt. of NCDT, Delhi

FAÇADE IN PRAGATI MAIDAN “DELHI PAVILION” MADE TO REPRESENT “RAJIV GANDHI HOUSING PROJECT”
RECOGNITION BY Ministry of Housing, Govt. of India & Govt. of NCDT, Delhi
DEMONSTRATING COST EFFECTIVE TECHNOLOGIES
(A CASE STUDY OF BAWANA INDUSTRIAL WORKERS HOUSING PROJECT)

PRAKASH ADLAKHA
ADLAKHA ASSOCIATES PVT. LTD.
GOOGLE VIEWS

RAJIV GANDHI HOUSING, BAWANA, 3164 HOUSES
• Layout Plan
• Space Visualization
Fig. 1 – Pile Casting through a Tremie
Fig. 2 – Reinforcement Cage in Under-ream Borehole

Fig. 3  
Casting of Under-reamed Piles in Progress

Fig. 4
Grade Beam & Vertical Reinforcement (for Earthquake Resistance)
Plinth band & Vertical Reinforcement (for Earthquake Resistance)
Photograph of roof band
Vertical Reinforcement L - Junction

Vertical Reinforcement T - Junction
The plank and joist technology consists of 60mm thick specifically designed precast planks supported over precast joists.

Cast in situ concrete is poured over the slab forming a monolithic structure.
Step 1: Preparation and collection of materials

Reinforcement mesh in planks
Step 1: Preparation and collection of materials
Step 2: Preparing the machine for casting of planks
Step 2: Preparing the machine for casting of planks

Setting up the trays with reinforcement mesh on plank machine
Step 2: Preparing the machine for casting of planks

Setting up the trays with reinforcement mesh on plank machine
Step 2: Preparing the machine for casting of planks

Locking the mould in position over the trays.
Step 2: Preparing the machine for casting of planks

Locking the mould in position over the trays.
Step 2: Preparing the machine for casting of planks

Locking the mould in position over the trays.
Step 2: Preparing the machine for casting of planks

Locking the mould in position over the trays.
Step 3: Casting of precast planks

Pouring in concrete over the mould.
Step 3: Casting of precast planks

Pouring in concrete over the mould.
Step 3: Casting of precast planks

Filling of concrete in the mould.
Step 4: Process of disassembly of planks

Unlocking the mould.
Step 4: Process of disassembly of planks

Unlocking the mould.
Step 4: Process of disassembly of planks

Unlocking the mould.
Step 4: Process of disassembly of planks

Casted planks are ready.
Step 5: Stacking and curing of planks
Step 5: Stacking and curing of planks

Curing complete. Stacking yard of planks.
Step 7: Casting of joists

Mould preparation for joists using channels.
Step 7: Casting of joists

Casting joists in moulds.
Step 8: Stacking and curing of joists

Curing of casted joists.
Step 9: Placing joists on floor slab

Lifting joists to be taken to construction site.
Step 9: Placing joists on floor slab

Transporting joists to construction site.
Step 9: Placing joists on floor slab

Transporting joists to construction site.
Step 9: Placing joists on floor slab

Transporting joists to construction site.
Step 10: Placing planks on the floor slab

Planks taken away from yard to the construction site.
Step 10: Placing planks on the floor slab

Lifting and placement of planks on roof using a crane.
Step 10: Placing planks on the floor slab

Crane for lifting of planks.
Step 11: Negative reinforcements over planks

Negative reinforcements in haunches of planks.
Step 11: Negative reinforcements over planks

Negative reinforcements in haunches of planks.
Step 12: Pouring cast in situ concrete

Pouring cast in situ concrete over planks.
Step 12: Pouring cast in situ concrete

Leveling the cast in situ concrete.
Completed slab
VIEW OF CEILING.
JOINTS ARE FINISHED WITH POINTING/POP.
NO NEED FOR CEILING PLASTER.
QUALITY ASSURANCE
R.C. PLANK LOAD TEST

R.C. PLANK LOAD TEST
QUALITY ASSURANCE
R.C PLANK LOAD TEST

MOCK ASSEMBLY TEST
FERRO-CEMENT
HOW IS THIS TECHNOLOGY ENERGY EFFICIENT:
• Thin element, saves cement
• Saves shuttering
• Casted at site, no external transportation
• Less water consumption
Precast Ferro-cement steps
Precast Ferro-cement steps
Precast ferrocement sunshades
PRECAST FERRO-CEMENT

Precast Ferro-cement

Precast ferro-cement Kitchen platform

Precast ferro-cement water tank
ENERGY EFFICIENCY

- Reduction in consumption of
  - Bricks
  - Concrete
  - Cement
  - Sand
  - Steel reinforcement
- Elimination of ceiling plaster & external plaster
- Almost no shuttering/form work
- Reduction in internal wall plaster
- Perforated bricks/fly-ash bricks provide better insulation
- On site production – no outside transportation
- Low maintenance
- No heavy/large equipment required
- Less consumption means saving of embodied energy.
SAVINGS IN EMBODIED ENERGY

Consumption of reinforcement steel

Cost effective housing: less than 1.0 kg per sq ft.

Conventional housing: 3 to 4 kg per sq ft.

Consumption of cement

Cost effective housing: 0.25 BAGS per sq ft.

Conventional housing: 0.45 BAGS per sq ft.

Thus, savings in
✓ Resource Material
✓ Embodied energy
✓ CO2

Case examples were taken of each housing block from 4 of our projects (ie. Bawana, Baprola, Bhorgarh and Narela) and estimates were prepared using one example of a conventional technology and one using precast systems.
 ✓ During construction – due to less volume of masonry, concrete, no ceiling plaster, no external plaster.

 ✓ The precast slab panels, stairs, sunshades, shelves (thin elements) cured with spray of water.

 ✓ The mechanised bricks & high strength blocks, have high compressive strength and low water absorption.

 ✓ Ferrocement elements being thin elements – consume less water.

 ✓ Hardy plants species used which require less water (Acacia Arabica, Baryan, Pelpal, Ashok, Cedar etc)
## AFFORDABILITY IN TECHNOLOGY COMPARISON CHART – SAVINGS IN COST

<table>
<thead>
<tr>
<th>Item</th>
<th>Conventional</th>
<th>Alternative technology used</th>
<th>Advantages</th>
<th>Savings In Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundations</td>
<td>Isolated and step footings</td>
<td>Under-reamed piles</td>
<td>Economical as well as speedy construction</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In load bearing Structure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Walls               | 230 mm Brick wall in English bond (using conventional FPS, Clay Bricks) | 200 mm thick brick wall in Flemish bond (using machine made modular perforated bricks) | • Reduction in wall thickness due to high strength bricks
                                                                         |                                                                             | • No plaster on external faces
                                                                         |                                                                             | • Heat & Sound resistance                                                  | 20%             |
| Intermediate floors & roof | Cast-in-situ RCC slab                      | Precast RC Plank system                                         | • Saving in cement, Steel & shuttering                                       | 21%             |
| Stair case          | Cast-in-situ RCC joist slab               | Precast ferrocement steps 25 mm thick (tread & riser unit)       | • Cost effective (no Plaster required)                                       | 30%             |
| Sunshades Cum Lintels | Cast-in-situ RCC slab                     | Precast RC                                                      | • Controlled conditions                                                     | 25%             |
| Kitchen Platforms   | Cast-in-situ RCC slab                     | Precast ferrocement 25 mm thick                                 | • Speedy construction                                                        | 30%             |
|                     |                                           |                                                                  | • Better finishes & Aesthetics                                              |                 |
| Water Tanks         | RCC, PVC                                  | Ferrocement                                                     |                                                                             | 20%             |
Table 3: Perceived Indoor Environmental Conditions

Cross tabulation of householder responses on perception of indoor temperature, air quality and air movement with their corresponding response for overall experience **DURING SUMMER**

<table>
<thead>
<tr>
<th>Perceived indoor temperature in summer</th>
<th>Unsatisfactory</th>
<th>Bearable</th>
<th>Satisfactory</th>
<th>Row total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsatisfactory</td>
<td>45</td>
<td>11</td>
<td>0</td>
<td>56</td>
</tr>
<tr>
<td>Bearable</td>
<td>4</td>
<td>64</td>
<td>5</td>
<td>73</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>0</td>
<td>6</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>Column total</td>
<td>49</td>
<td>81</td>
<td>18</td>
<td>148</td>
</tr>
</tbody>
</table>

Perceived indoor air quality in summer

<table>
<thead>
<tr>
<th>Perceived indoor air quality in summer</th>
<th>Unsatisfactory</th>
<th>Bearable</th>
<th>Satisfactory</th>
<th>Column total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stuffy</td>
<td>43</td>
<td>24</td>
<td>1</td>
<td>68</td>
</tr>
<tr>
<td>Bearable</td>
<td>6</td>
<td>54</td>
<td>13</td>
<td>73</td>
</tr>
<tr>
<td>Fresh</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Column total</td>
<td>49</td>
<td>81</td>
<td>18</td>
<td>148</td>
</tr>
</tbody>
</table>

Perceived indoor air movement in summer

<table>
<thead>
<tr>
<th>Perceived indoor air movement in summer</th>
<th>Unsatisfactory</th>
<th>Bearable</th>
<th>Satisfactory</th>
<th>Column total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draughty dw (door &amp; window)</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Still</td>
<td>24</td>
<td>31</td>
<td>4</td>
<td>59</td>
</tr>
<tr>
<td>Well-ventilated</td>
<td>24</td>
<td>49</td>
<td>14</td>
<td>87</td>
</tr>
<tr>
<td>Column total</td>
<td>49</td>
<td>81</td>
<td>18</td>
<td>148</td>
</tr>
</tbody>
</table>
### Table 4: Perceived Indoor Environmental Conditions

Cross tabulation of householders' responses for their perception of indoor temperature, air quality and air movement with their corresponding response for overall experience **DURING WINTER**

<table>
<thead>
<tr>
<th>Perceived indoor temperature in winter</th>
<th>Unsatisfactory</th>
<th>Bearable</th>
<th>Satisfactory</th>
<th>Row total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsatisfactory</td>
<td>12</td>
<td>7</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Bearable</td>
<td>4</td>
<td>85</td>
<td>5</td>
<td>94</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>0</td>
<td>8</td>
<td>24</td>
<td>32</td>
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<tr>
<td>Column total</td>
<td>16</td>
<td>100</td>
<td>30</td>
<td>146</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Perceived indoor air quality in winter</th>
<th>Stuffy</th>
<th>Bearable</th>
<th>Fresh</th>
<th>Column total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stuffy</td>
<td>9</td>
<td>15</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>Bearable</td>
<td>6</td>
<td>84</td>
<td>22</td>
<td>112</td>
</tr>
<tr>
<td>Fresh</td>
<td>1</td>
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<td>7</td>
<td>9</td>
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<td>Column total</td>
<td>16</td>
<td>100</td>
<td>30</td>
<td>146</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Perceived indoor air movement in Winter</th>
<th>Draughty dw (door &amp; window)</th>
<th>Still</th>
<th>Well-ventilated</th>
<th>Column total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draughty dw (door &amp; window)</td>
<td>6</td>
<td>24</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Still</td>
<td>6</td>
<td>43</td>
<td>10</td>
<td>59</td>
</tr>
<tr>
<td>Well-ventilated</td>
<td>4</td>
<td>33</td>
<td>20</td>
<td>57</td>
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</tbody>
</table>
MORTAR-LESS INTERLOCKING BLOCK TECHNOLOGY

**Project:** InnoGeocity
Oragadam, Chennai

**Project:** Staff Workers housing
Anjar & Vapi, Gujrat

**Project:** Ministry of Animal Husbandry
Balabgarh, Faridabad
An alternate to conventional bricks & mortar

- Male/Female Interlocking – Vertical / Horizontal Shear keys
- Suitable for Load/Framed Structures Compatible to incorporate V/H reinforcements
- Suitable for Seismic structures
- Speedier construction
HOW IS THIS TECHNOLOGY ENERGY EFFICIENT:
• Locally available resources used
  - Fly-Ash
• No burning – eco friendly
• No transportation – can be casted at site.

• Low embodied energy – minimal cement.
• No plaster - hence reduction in cement and CO2
• Reusable and recyclable blocks
• Thermally efficient
• Fast construction
DOOR FRAMES & STAIRCASE
Actual Completed Building Photographs

Project: InnoGeocity (Phase 1)
500 houses in Oragadam, Chennai, India

Owners: Inno Group Holdings
Architecture consultants:
Adlakha Associates Pvt. Ltd., India

HYDRAFORM INTERLOCKING BLOCKS
Actual Completed Building Photographs

HYDRAFORM INTERLOCKING BLOCKS

Project: Staff Workers housing
Anjar & Vapi, Gujrat, India
(Technology used in Zone V earthquake zone)

Owner: M/S Welspun Group, India
Architecture consultants:
Adlakha Associates Pvt. Ltd., India
Actual Completed Building Photographs

HYDRAFORM INTERLOCKING BLOCKS

Project: Ministry of Animal Husbandry, Balabgarh, Faridabad, India

Architecture consultants: Adlakha Associates Pvt. Ltd., India
PRECAST STONE BLOCK MASONRY

Project: Staff Workers housing
Anjar & Vapi, Gujrat

Project: Staff housing, Bhopal
A Building in Housing Rajasthan With Stone Block Masonry
View of stone block masonry housing at Bhopal

Foundation at Vapi site with Concrete Blocks
CASE STUDY
VERNACULAR TECHNOLOGIES

POETRY IN BRICKS,
Manesar
ART
ARCHITECTURE
ENGINEERING
POETRY IN BRICKS
THE BUILT FORM
INTERNAL VIEWS - CEILING
INTERNAL VIEWS - CEILING
INTERNAL VIEWS – FIRE PLACE
INTERNAL VIEWS – ROOMS
INTERNAL VIEWS – ROOMS
FEATURED ELEMENT - STAIRCASE
FEATURED ELEMENT - STEPS
KITCHEN AND GARDEN
MORE PATTERNS IN BRICK
MORE PATTERNS IN BRICK
NIGHT VIEWS - interior
NIGHT VIEWS - interior
NIGHT VIEWS - interior
NIGHT VIEWS - outside