1. Background

Maitreye is an ongoing residential project located in RZ sector 2 on a plot area of approx. 6.8 acres.

The main objective of Maitreye Project is to offer affordable housing facility with good quality of construction.

The first phase of the project has been completed and accommodates 40 people having 16 apartments and 2 office spaces.

The second phase is under construction and planned for 27 apartments for newcomers.

All the infrastructure required like water, electricity, waste water treatment system, access road is already in place and can be utilised for more housing.
2. Location  - Residential zone sector 2

Maitreye  phase 3

- Architectural concept design

- Location
- Residential zone sector 2

- Solar kitchen
- Library
- Crown Road
- Vikas Radial Road
- Kailash
- Vikas
- Realization
- Creativity
- Luminosity
- Prayatna
- Swayam
- Progress
- Prarthana
- Sharanga
- Samasti

Maitreyo

Architectural concept design
2. Location - Residential zone sector 2
3. Site planning - existing Maitreye phase 1
3. Site planning - existing Maitreye phase 1 and 2
3. Site planning - planned phase 3
3. Site planning - galaxy overlay
3. Site planning - approved.

Maitreye phase 3

- Proposed Guest House
- Proposed phase 3 with 20 apartments + office/work spaces
- Phase 1-completed with 16 apartments + 2 offices.
3. Site planning and orientation

Oriented to NE and SW. Staggered buildings blocks creating courtyards in between. The middle block is pushed towards the common green area.
3. Site planning and orientation

View from SE end of the site towards proposed buildings.
40m. wide green area in between allows passage for NE breeze.
3. Site planning and orientation
3. Layout and design - Ground floor plan

1. Office
2. Bicycle parking + laundry
3. Entrance Courtyard
4. Singles Apartment
3. Layout and design

View of the entrance court

The entrance court acts as a transition space which connects the pedestrian street and the staircase leading to apartments.

View of the middle court

The central portion with the office spaces opens onto the three courtyards and also links the two common green areas of phase 1 and phase 2.
3. Layout and Design - First floor Plan

- One bedroom apartment (5)
- Three bedroom apartment (6)
- Studio Apartment (8)

**FIRST FLOOR PLAN**

- Architectural concept design

Maitreye phase 3
3. Layout and Design - Second floor Plan

SECOND FLOOR PLAN

6 Three bedroom apartment
7 Two bedroom apartment
8 Studio Apartment
3. Layout and Design - Terrace floor Plan

Maitreye phase 3

Two bedroom apartment

Common Terrace - Open to sky

TERRACE FLOOR PLAN

+8.32m lvl.
+9.90m lvl.
+8.32m lvl.
+9.90m lvl.
### 3. Layout and design - Floorwise distribution

<table>
<thead>
<tr>
<th>Floor</th>
<th>Apartment Type</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Floor</td>
<td>Singles Apartment</td>
<td>4 nos.</td>
</tr>
<tr>
<td>First Floor</td>
<td>Studio Apartment</td>
<td>2 nos.</td>
</tr>
<tr>
<td></td>
<td>Singles Apartment</td>
<td>4 nos.</td>
</tr>
<tr>
<td></td>
<td>Three bed Apartment</td>
<td>2 nos.</td>
</tr>
<tr>
<td>Second Floor</td>
<td>Three bed Apartment</td>
<td>2 nos.</td>
</tr>
<tr>
<td></td>
<td>Two bed Apartment</td>
<td>2 nos.</td>
</tr>
<tr>
<td></td>
<td>Studio Apartment</td>
<td>2 nos.</td>
</tr>
<tr>
<td>Terrace Floor</td>
<td>Two bed Apartment</td>
<td>2 nos.</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>20 nos.</td>
</tr>
</tbody>
</table>
3. Layout and Design - Section through the buildings

Section through middle court

Section through side courts

Maitreye phase 3

Architectural concept design
4. Apartment Plans - studio

1. Studio Apartment
   Carpet area = 27.03 sq.m.
   Covered Terrace = 15.29 sq.m.
4. Apartment Plans - 1 bedroom type 1

2. One Bedroom Apartment-type 1
   Carpet area= 34.85 sq.m.
   Covered Terrace=17.90 sq.m.

LEVEL 0

LEVEL 1

LEVEL 2

LEVEL 3

Maitreye phase 3

Architectural concept design
4. Apartment Plans - 1 bedroom type 2

2. One Bedroom Apartment-type 2
Carpet area = 34.48 sq.m.
Covered Terrace = 19.25 sq.m.
3. Two Bedroom Apartment-type 1
Carpet area= 72.52 sq.m.
Open to sky Terrace= 20.36 sq.m.
4. Apartment Plans - 2 bedroom

3. Two Bedroom Apartment-type 2
   Carpet area = 75.87 sq.m.
   Open to sky Terrace = 12.65 sq.m.

LEVEL 0

LEVEL 1

LEVEL 2

LEVEL 3
4. Apartment Plans - 3 bedroom

4. Three Bedroom Apartment
   Carpet area = 89.13 sq.m.
   Open to sky Terrace = 19.50 sq.m.
4. Apartment Plans - Open plan Office / Atelier

Office Area 5.00m. X 10.06 m.

5. Open Office space
Carpet area = 50.30 sq.m.
4. Apartment Plans - Modular office

5. Modular Office space
Carpet area= 11.85 sq.m. (one module)
total Shared area=14.68
Covered Terrace=14.86 sq.m. (one module)
5. Design Features

Heirarchy of open spaces.

Common Green Area

Pedestrian street opening onto courtyards in between the buildings.
5. Design Features - Terrace

Extension of living area - creating an outdoor room.

Private terraces looking onto the green area.
5. Design Features

View of the staggered terraces.

Covered Terrace for singles Apartment
Open to sky Terrace for 2/3 bed apartments.

Overhang to on all sides.

‘Screen’- to shade openings.
5. Design Features - Roofs

The end blocks have ‘service roof’ with solar photovoltaics integrated in the roof form. The other part will be used as a common terrace.

Each block can accommodate 70 nos. pf solar panels equivalent to 13KW power generation for lights and fans for 8 apartments.

Maitreye phase 3 will be in harmony with the existing buildings by adopting similar design features like:

1. Continuous overhang all around the building to protect the walls from sun and rain.
2. Exposed brick work in some places-like staircase walls.
3. Covered terraces opening to the green area.
4. Horizontal / Vertical louvres to match window openings.
6. Building technology and materials

The cost of construction and time period for building is escalating every year.

1. Increasing cost of labour.
2. Increasing cost of building materials
3. Non availability of building materials like sand, blue metal, bricks.

To create affordable housing, time span for construction is a crucial factor.

This has lead us to try this new technology which is under exploration.
6. Building technology and materials

Salient features of the technology (as stated by practicing construction companies)

Cold formed steel has light thickness and is manufactured at room temperature which makes it easier and economical to mass produce, install and transport.

Corrosion Resistant - Steel products are coated with ‘Galvalume’ preventing it from corrosion.

Higher wind Resistance - Can withstand extreme loads such as 3 feet of snow and 240km/h winds.

Superior Seismic Performance - supremely robust. Meets international standards for every seismic zone.

Greater Durability - Steel framing is unaffected by temperature and humidity changes, making the building more stable and durable.

Expeditious Construction - Time taken for construction can be reduced by 50% using modular building technique.

Steel is Recycled - Steel is 100% recyclable and hence does not contribute to depletion of resources or degradation of the environment.
6. Building technology and materials

Less Waste Less pollutants– Reduces waste and subsequently lowers waste disposal and removal costs. Each component is manufactured to exact lengths. Any waste generated is recycled in the production centre.

90% less vehicle movements– to and fro from the site. Noise and dust levels on the site are also minimized.

Less water use – dry wall construction.

Enhanced thermal efficiency– Compared with conventional brickwork, these walls conduct 90% less heat, ensuring interiors to remain cool during summer and warm during the winter. Since steel framing will not shrink or move over time, gaps or thermal bridges that result in excessive air leakages will not be formed. This makes the building to heat or to cool with significantly less use of energy.
6. Building technology and materials

1_SECTION @ FLOOR

2_SECTION @ ROOF

AEXTERNAL WALL

BINTERNAL WALL

CINTERNAL WALL FOR
BATH/WC AREAS
6. Building technology and materials

Exterior and interior finishing can be paints/cladding which are aesthetically similar to conventional construction.

So Steel Framed Houses look no different from conventionally built structures.
7. Construction Sequence

**STEP 1:**
Construction of Plinth Beam in Progress

**STEP 2:**
Ground Floor Wall Erection Complete,
Joist Erection Underway

**STEP 3:**
First Floor Joist Erection Complete,
First Floor Wall Erection Commences

**STEP 4:**
Truss Erection Commences
7. Construction Sequence

**STEP 5:**
External Boarding Complete, EIFS Work in Progress.

**STEP 6:**
Electrical and Plumbing Work Underway

**STEP 7:**
Wall Insulation, Internal Boarding and Painting Completes Building Interiors

**STEP 8:**
Tiling, Door & Window Installation. The Building is now Complete.
8. Specifications

Structure: Light weight steel frame with prefabricated insulated panels.

Floors: Light weight steel frame finished with cement board - a layer of plain cement concrete. With gypsum board false ceiling.

Floor finish: Cement oxide.

Walls: Emulsion paints on exterior and interiors.

Doors: Country wood frame - flush doors.

Windows: Country wood frame with mosquito mesh and glass panel-openable.

Bathrooms: Ceramic tiles on floors and walls.

Kitchen platform: Polished granite with shelves in cudappah stone.

Electrification: Legrand for switches.

Sanitary fittings: Parryware and GURU for taps/faucets etc.
9. Costing

e.g. studio apartment

Area Calculations
A. Built up area (including walls) = 34 sq.m.
B. Covered Terrace = 15 sq.m.
C. Open to sky Terrace = nil
D. Staircase = 7 sq.m.
E. common facilities = 4 sq.m.

Salable area = A + B/2* + C/4* + D/2* + E
= 34 + 15/2 + 0 + 7/2 + 4
= 49 sq.m.

The Cost of construction @ INR 24,000/- sq.m. (including cost of construction + infrastructure + service charges)
(excluding the contribution to housing service)

The cost of the apartment = Salable area X Rate per sq.m.
= 49 sq.m. X 24,000
= 11,76,000/-
say 12 lakh.

* The rate of construction of semi-covered area and staircase is calculated as half of the fully covered area and open roof sky terrace as 1/4 th of the fully covered area.
## 9. Costing

<table>
<thead>
<tr>
<th>Sr.no.</th>
<th>Apartment type</th>
<th>carpet area</th>
<th>built up area</th>
<th>covered verandah area</th>
<th>open to sky terrace</th>
<th>Staircase area</th>
<th>Common facilities</th>
<th>Total salable area (A+B/2+C/4+D/2+E)</th>
<th>Rate per sq.m.</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Studio</td>
<td>27</td>
<td>34</td>
<td>15</td>
<td>0</td>
<td>7</td>
<td>4</td>
<td>49</td>
<td>24,000</td>
<td>11,76,000</td>
</tr>
<tr>
<td>2</td>
<td>1 bedroom</td>
<td>35</td>
<td>42</td>
<td>18</td>
<td>0</td>
<td>8</td>
<td>5</td>
<td>60</td>
<td>24,000</td>
<td>14,40,000</td>
</tr>
<tr>
<td>3</td>
<td>2 bedroom type 1</td>
<td>73</td>
<td>84</td>
<td>0</td>
<td>20</td>
<td>14</td>
<td>8</td>
<td>104</td>
<td>24,000</td>
<td>24,96,000</td>
</tr>
<tr>
<td>4</td>
<td>2 bedroom type 2</td>
<td>76</td>
<td>92</td>
<td>0</td>
<td>13</td>
<td>14</td>
<td>8</td>
<td>110</td>
<td>24,000</td>
<td>26,40,000</td>
</tr>
<tr>
<td>5</td>
<td>3 bedroom</td>
<td>89</td>
<td>105</td>
<td>0</td>
<td>20</td>
<td>17</td>
<td>9</td>
<td>128</td>
<td>24,000</td>
<td>30,72,000</td>
</tr>
<tr>
<td>6</td>
<td>Open plan Office/Atelier</td>
<td>50</td>
<td>56</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>4</td>
<td>64</td>
<td>24,000</td>
<td>15,36,000</td>
</tr>
<tr>
<td>7</td>
<td>Modular Office</td>
<td>12</td>
<td>17</td>
<td>15</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>29</td>
<td>24,000</td>
<td>6,96,000</td>
</tr>
</tbody>
</table>
Objectives of the project

- Speed of construction
- Cost of construction
- Quality of construction
- Transparency
- Experimentation
- Sustainability

*Lessons learnt from Maitreye 1*
10. Project management

Speed of construction

- Parallel work streams
- Access to funds
- Thinking 6 months in advance
- Appropriate technology
- Standardisation
Cost of construction

- Cost effective technology
- Controlling time frame
- Purchasing in advance
- Lock-in contracts
10. Project management

Quality of construction

• Effective market research
• Reliable partners
• Clarity on what is agreed and deliver what is agreed
10. Project management

Transparency

- Sharing of appropriate project information wherever possible
  - Costing
  - Technologies
  - Research material
  - Timeline
  - Project plan

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Location finalise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Building Technology finalise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design finalise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Impact Assessment</td>
<td>Data collection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Results publish</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costing</td>
<td>Rough costing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Final costing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Funding</td>
<td>Arrange initial capital</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Permission Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LAMC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Launch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contract</td>
<td>Preparation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Negotiation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site clearance and Prep.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foundation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LSF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walls, Floor and Windows</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plumbing and lighting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finishing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landscaping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handover</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Experimentation

- Experimentation is an integral part of living in Auroville. It means
  - Risk
  - Research
  - Reward
  - Lessons learnt
Sustainability

- Embodied and operational environmental impact
  - CO₂
  - Energy
  - Water
  - Preciousness
  - Recyclability

* Reliable regional data is difficult to find
## Environmental Impact Assessment

**Work in Progress:** Comparative Analysis of structural configuration - rectangular room of 3m. X 5m. (Quantities worked out by structural engineer of LSF company)

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Material</th>
<th>Unit</th>
<th>Conventional Qty</th>
<th>Light steel Qty</th>
<th>Reserves left in years</th>
<th>Environmental poisons including waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plain cement concrete (PCC 1: 1.5: 3)</td>
<td>cu.m.</td>
<td>4,243.0</td>
<td>36,315.5</td>
<td>6,364.5</td>
<td>Harmful: danger of serious damage to health by prolonged exposure through inhalation</td>
</tr>
<tr>
<td>2</td>
<td>Steel</td>
<td>kg</td>
<td>33.3</td>
<td>12,837.1</td>
<td>2,207.8</td>
<td>Very toxic/harmful to aquatic organisms</td>
</tr>
<tr>
<td>3</td>
<td>Cold formed steel</td>
<td>kg</td>
<td>33.3</td>
<td>-</td>
<td>529.0</td>
<td>Very toxic by inhalation</td>
</tr>
<tr>
<td>4</td>
<td>Country Fired Brick (Indian average) 22 x 10 x 7 cm - Delivered at 50 Km</td>
<td>unit</td>
<td>7.1</td>
<td>33,107.1</td>
<td>13,440.9</td>
<td>Very toxic by inhalation</td>
</tr>
<tr>
<td>5</td>
<td>Cement sand mortar (CSM 1: 5)</td>
<td>cu.m.</td>
<td>3,322.2</td>
<td>4,053.0</td>
<td>1,926.9</td>
<td>Harmful: danger of serious damage to health by prolonged exposure through inhalation</td>
</tr>
<tr>
<td>6</td>
<td>Cement plaster 20mm thk. 1:2</td>
<td>sq.m.</td>
<td>7,856.3</td>
<td>10,841.7</td>
<td>-</td>
<td>Harmful: danger of serious damage to health by prolonged exposure through inhalation</td>
</tr>
<tr>
<td>7</td>
<td>External Cladding (6mm Fibre Cement Board)</td>
<td>sq.m.</td>
<td>not known</td>
<td>-</td>
<td>52.8</td>
<td>Harmful: danger of serious damage to health by prolonged exposure through inhalation</td>
</tr>
<tr>
<td>8</td>
<td>External Cladding (25mm Polystyrene)</td>
<td>cu.m.</td>
<td>3,518.0</td>
<td>-</td>
<td>1.3</td>
<td>4,643.8</td>
</tr>
<tr>
<td>9</td>
<td>Internal Cladding (12.5mm Gypsum)</td>
<td>sq.m.</td>
<td>not known</td>
<td>-</td>
<td>45.9</td>
<td>Large</td>
</tr>
<tr>
<td>10</td>
<td>Ceiling Cladding (9mm Gypsum)</td>
<td>sq.m.</td>
<td>not known</td>
<td>-</td>
<td>13.6</td>
<td>Large</td>
</tr>
<tr>
<td>11</td>
<td>Roof Cladding (8.5mm PPGI Sheet)</td>
<td>sq.m.</td>
<td>not known</td>
<td>-</td>
<td>15.0</td>
<td>Large</td>
</tr>
<tr>
<td>12</td>
<td>Roof Cladding (50mm Glasswool)</td>
<td>sq.m.</td>
<td>not known</td>
<td>-</td>
<td>15.0</td>
<td>Irritating to skin</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Thank you

Joseba, Min, Sonali, Dhanapal