LOW INCOME HOUSING
CONTENTS

1. INTRODUCTION
   1.1 The Need
   1.2 Approach

2. GOALS AND OBJECTIVES
   2.1 Long Term Goals
   2.2 Pilot Phase Goals
   2.3 Pilot Phase Objectives

3. PARTNERS

4. CASE STUDY
   4.1 Housing Schemes
   4.2 BBMP
   4.3 JNNURM
   4.4 Fedina + HFH

5. POLICY STUDY
   5.1 Pradhan Mantri Awas Yojana
   5.2 The Gaps

6. SITE STUDY
   6.1 Old Baiyappanahalli
   6.2 Lingarajapuram

7. COMMUNITY PROFILING
   7.1 Housing Infrastructure

8. SPATIAL ANALYSIS

9. TECHNICAL DETAILS
   9.1 Construction Data
   9.2 Design Guidelines
   9.3 Compressed Stabilised Earth Blocks

LOW INCOME HOUSING REPORT --------- JANUARY 2017
1. INTRODUCTION

1.1 The Need
India has a growing population of 1.27 billion, with almost 20% of the population in constant need of housing in both urban & rural regions. With engineers and architects reaching out to less that 3% of people with their designer expertise, a large percentage of the population lives in homes that are either self-built or constructed with local assistance by those not formally educated in the field. These self-built housing structures have raised concerns of safety, quality and moreover are devoid of any formal planning strategies. This segment of the population will continue to build and invest in housing infrastructure, with or without professional assistance, which poses the following threats:

- **Inefficient living conditions**, with lack of natural lighting and ventilation, lack of planning for essential services such as energy, water and sanitation.
- **Ad-Hoc Planning**
  - Standardized construction practices, non contextual designs and material usage.
- **Inaccessibility to financial institutions**
  - minimal flow of funds, absence of appropriate loan packages, lack of appropriate financial planning.

The Griha Kendra project aims to establish a platform which would assist in bridging not only the knowledge gaps (through engaging with local contractors and community) but provide access to designer expertise and relevant financial institutions that could completely facilitate the entire process of building a safe and healthy home.

How might we assist in providing healthier & safer living environments in slums?
How might we improve housing technology and help raise the quality of life for those at the bottom of the pyramid?

1.2 The Approach
2. GOALS AND OBJECTIVES

2.1 Long Term Goals
To establish a community driven process that provides design and financial assistance to those wanting to build a house.

To facilitate the dissemination of the established process through government policies and housing schemes

2.2 Pilot Phase Goals
To establish a replicable process involving finance institutes, technical experts and ground partners through project implementation

2.3 Pilot Phase Objectives
To conceptualize, develop & construct 10 homes in low-income communities that will showcase innovative planning techniques, low-cost construction solutions and ecological design.

To establish a framework encompasses selection mechanisms, financial processes and professional collaboration.
To develop credibility through financial partners
## 3. Partners

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Their Role</th>
<th>Outcomes from Pilot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical</td>
<td>Planning for Lighting and Ventilation&lt;br&gt;Significance:&lt;br&gt;The physical environment directly affects the health and well being of people. Proper ventilation and lighting, especially in kitchens and bathrooms, is required to maintain health and hygiene.</td>
<td>- Guidelines and recommendations for construction of houses with site area below 30 sq.m</td>
</tr>
<tr>
<td></td>
<td>Structural Detailing&lt;br&gt;Significance:&lt;br&gt;Planning for future incremental construction is very critical for safety of the structure. Thus, the foundation and load bearing structure need to be designed keeping in mind future expansion plans.</td>
<td>- Establishment of importance of structural detailing in house construction (with emphasis on incrementality).</td>
</tr>
<tr>
<td></td>
<td>Mason Training&lt;br&gt;Significance:&lt;br&gt;The technical expertise available to low income communities is that of the local masons. Thus, it is important for the masons to understand the importance of the aforementioned aspects in housing construction.</td>
<td>- Mason training manual highlighting the importance of developing technical skills within beneficiary communities.</td>
</tr>
<tr>
<td>INTERVENTION</td>
<td>THEIR ROLE</td>
<td>OUTCOME FROM PILOTS</td>
</tr>
<tr>
<td>-------------</td>
<td>------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Financial</td>
<td><strong>Formal financing</strong>&lt;br&gt;Significance: Recognized slums are mostly only given allotment papers which are not recognized by the government. Thus, they informal loans with high interest rates are sought for house construction.&lt;br&gt;&lt;br&gt;<strong>Loan packages</strong>&lt;br&gt;Significance: Banks do not offer smaller loan packages with lesser interest rates for the low income population. Thus, there is lack of financial access for slum communities.&lt;br&gt;&lt;br&gt;<strong>Lack of planning</strong>&lt;br&gt;Significance: Most beneficiaries and masons are unable to plan finances for the timeline of construction. Thus, sudden funds are required to be sought at the last moment.</td>
<td>- Establishment of processes to finance housing loans for beneficiaries without ownership papers.&lt;br&gt;- Development of smaller loan packages at lower rates of interest for low income beneficiaries.&lt;br&gt;- Establish significance of financial planning for project execution in terms of savings.</td>
</tr>
<tr>
<td>Implementation</td>
<td><strong>End user engagement</strong>&lt;br&gt;Significance: The involvement of the end user at every stage of the project is crucial for successful implementation. The needs and requirements of the occupants need to be considered.</td>
<td>- Participatory design approach.</td>
</tr>
<tr>
<td></td>
<td><strong>Local mason involvement</strong>&lt;br&gt;Significance: Local masons within the community are the implementation authorities of construction projects. Hence there is a need to involve them as stakeholders to gather community trust.</td>
<td>- Involvement of masons as project stakeholder.</td>
</tr>
</tbody>
</table>
4. CASE STUDY

4.1 Housing Schemes
Studies were carried out to understand the various housing schemes available through the government as well as through private entities and non-profit organizations. The studies outlined mechanisms and processes of

1. Beneficiary selection
2. Financial framework
3. Design & Construction process
4. Monitoring & Evaluation
5. Awareness & Capacity building

4.2 BBMP
The Bruhat Bengaluru Mahanagara Pallike (BBMP) is the administrative body responsible for the civic and infrastructural assets of the Greater Bangalore metropolitan area. Through the BBMP urban poor can avail of schemes

Selected location for case study: Rejendra Nagar (ward no. 150) Beneficiary: Mr. Basha & Son
Year of construction: 2013 - 2014

4.2.1 Beneficiary Selection
1. The scheme is applicable for those who are disabled/disadvantaged families. Around 15 households were constructed in the Rajendra Nagar area under this scheme, which provides 100% subsidy to the beneficiary.

4.2.2 Financial Framework
1. Beneficiary needed to have a bank account into which installments of 75,000/- were deposited (4 installments)
2. Amounts are to be handed over to an appointed contractor by means of cheque.

4.2.3 Design & Construction Process
1. 15' x 20' - size of house
2. Design of the house was standardized by the contractor
3. Additional under ground sump included by beneficiary
4. The construction material, labour and supervision was undertaken by the contractor
5. The time taken for construction was 6 months

4.2.4 Monitoring & Evaluation
1. The contractor is the only link between donor (govt.) and beneficiary.
2. Absence of any reporting format on the progress or completion of construction, except the BBMP signage painted on the front wall of the house.
4.3 JNNURM

Government of India has extended a helping hand to the urban local bodies of Bangalore through Jawaharalal Nehru National Urban Renewal Mission (JNNURM). The JNNURM aims to encourage cities to initiate steps to bring about improvements in the existing service levels in a financially sustainable manner. The primary objective of JNNURM is to create economically productive, efficient, equitable and responsive city. The JNNURM consist of two submission

1. Urban Infrastructure and Governance (UIG)
2. Basic Services to the Urban Poor (BSUP)

Selected location for case study:

Rejendra Nagar (ward no.150) Beneficiary: Multiple
Year of construction : 2013 - 2014

4.3.1 Beneficiary Selection

1. The individual house scheme by JNNURM is applicable to those families who register themselves with appropriate papers and a Demand Draft deposit amount.

4.3.2 Financial Framework

1. Beneficiaries register through submission of DD of 26,500/-
2. Money is provided as materials & labour from the government
3. Costs of extension and deviation from the basic house design is borne by the beneficiary
4. Typical house cost would be between 3.5 to 4 lakhs (G+1). Where almost 50% of cost is borne by the beneficiary.
5. Apart from materials provided, families do not avail of any further loans to extend or build the house.

4.3.3 Design & Construction Process

1. Size of house is 15’x20’
2. Contractor allocated by govt. constructs the foundation, plinth, flooring, 4 corner pillars, first floor slab, lintels and walls. Any additional internal walls, staircase, windows, doors are provided by the beneficiary.
3. Total construction time is spread over 1 year.

4.3.4 Monitoring & Evaluation

1. Absence of any reporting format on the progress or completion of construction, except the Jnnurm signage painted on the front wall of the house.
4.4 FEDINA + HFH

Habitat for Humanity (HFH) India is a non-profit organization devoted to build "simple, decent, and affordable" housing for the underprivileged families. HFH Bangalore is an operational wing with a vision to eliminate poverty, housing and homelessness.

Homes are built using volunteer labor and are sold at no profit. The affiliate’s family selection committee chooses homeowners based on their level of need, their willingness to become partners in the program and their ability to repay the loan.

Foundation For Educational Innovations in Asia (FEDINA) is a network that empowers the marginalised, the oppressed and the poorest of the poor to demand their rights. FEDINA develops its own programmes for the vulnerable and poor people, with Health and Housing as one of their main activities.

Selected location for case study: Old Baiyyapanahalli
Year of construction: 2013 - 2014

4.4.1 Beneficiary Selection
1. Paper work: the family needs to possess land ownership/lease/khata/haq patra documents that show proof of land ownership from the government
2. The family must be able to contribute towards the construction in terms of labour (group of families/men in the house)
3. The families must prove the ability to repay the loan amount. This would be based on the family income, job security. Though this is one of the last criteria for selection (as priority is given to need)
4. Land security for a minimum of 5 years is preferred, in which case government plans for the locality are also considered.

4.4.2 Financial Framework
1. HFH has an upper limit of 60k grant amount
2. HFH provides a 60k loan amount to the beneficiary
3. The remaining amount (total 2lakhs) is raised by the family which could be in the form of labour, material procurement etc.
4. The funds are released at 3 stages: completion of foundation, walls and roofing.
5. FEDINA as the ground partner monitors the money disbursement and the collections as monthly interest free installments.
6. The repayment of loan begins 2 months after the construction of the house.
7. The estimate costing is prepared by the families. Repayments are done on a monthly basis.
4.4.3 Design & Construction Process
1. HFH provides a basic criteria for the house construction; a minimum house size of 10'x12', and prohibits the usage of asbestos as roofing.
2. In most cases the process of construction and procurement is managed by the beneficiaries themselves. (when they have a labour/construction background)
3. In cases where families have no in-house labour assistance / technical know how of construction, HFH provides technical assistance both in terms of design as well as construction planning, supervision and labour help in the form of volunteers.
4. Construction phase lasts for avg of 3 months.

4.4.4 Monitoring & Evaluation
1. MoU is signed between HFH & Fedina, and Fedina & beneficiary, which outlines the roles of each party, which is applicable for the duration of the project.
2. FEDINA continues to engage and monitor the families for whom houses are constructed, as part of their regular engagement and activism.
5. POLICY STUDY

5.1 Pradhan Mantri Awas Yojana (PMAY) is a scheme aimed at providing support to slum dwellers to obtain better houses. The states that adopt the scheme are provided assistance to implement projects either through the state housing development board or in partnership with private entities.

The scheme defines four approaches for the provision of housing to low income sections of society:

5.1.1 In-situ redevelopment: Slum dwellers shall be rehabilitated in better houses within their own settlements with participation of either the state housing board, cooperatives or private developers. The carpet areas of these houses shall be determined by the NBC, or as per availability/requirement.

5.1.2 Affordable housing in partnership: Development of affordable housing stock by incentivizing private developers to match the gap between demand and supply.

5.1.3 Credit-linked interest subsidy: Beneficiaries who want to construct/improve/buy houses are eligible for an interest subsidy of 6.5% on a maximum loan amount of 6 lakhs. The subsidy will be calculated at a Net Present Value of 9% and shall be credited upfront to the beneficiary bank account.

Subsidy for beneficiary led construction: For beneficiaries who are unable to procure houses through any of the above schemes, a subsidy of 1.5 lakhs shall be provided. This shall be released in installments and beneficiaries who do not belong to slum communities selected for redevelopment are also eligible.

5.2 The Gaps

This project aims to create processes that can be incorporated into the components of beneficiary led house construction/up gradation. The following factors play an important role in developing a holistic approach to providing good quality housing in low income communities:

5.2.1 Availability of finance: For the construction of houses, there is a need for affordable finance to be available to the end users. Affordability can be defined as 40% of the total household income, after calculating non-housing expenditure. This finance should be available to residents of slums settled on tenable land. The lack of land ownership papers restricts access to formal sources of finance; hence there is a need for finance institutions to expand their services to beneficiaries of identified slums.

5.2.2 Access to technical knowledge: The technical knowledge of architects and engineers in the field of construction is not available to communities belonging to the low income bracket. There is a lack of awareness among low income communities on the importance of technical assistance in construction. On the other hand, architects and engineers are yet to acknowledge the large low income population as a client base.

5.2.3 Process of implementation: For this purpose various organizations such as slum dwellers federation, resident welfare associations and other cooperatives formed under NULM may be utilized. However the policy does not state this as a compulsory component to be undertaken by the implementation agency, hence it is not considered a requirement under the tendering process either.
6. SITE STUDY

6.1 Old Baiyappanahalli

6.1.1 About the community: There are 350-400 households with an average of 4 members per household. Most of the families belong to middle and poor income levels. The men are predominantly employed as contracted labour, cooks, tailors, factory workers, and petty shop owners. Residents have land allotment papers that have been allotted to them by the BDA. Plot size is 10’x15’.

6.1.2 Infrastructure:
1. Houses are predominantly made of GI and asbestos corrugated sheets and a few of RCC (Reinforced Cement Concrete).
2. Unplanned and haphazard, community follows basic row houses, with narrow street widths, varying from 0.9m to 1.8m. Some streets are cemented while others are just compacted earth.
3. There is a water access point at the beginning of every street, and all houses have a drainage connection, piped to sewage. Almost all households are electrified and are metered.
4. Lights (both CFL and fluorescent), television and fans are the major appliances commonly used by the households.
6.2 Lingarajapuram

6.2.1 About the community: There are 2000-2500 households with an average of 4 members per household. Most of the families belong to middle and poor income levels. The men are predominantly employed as contracted labour, cooks, tailors, factory workers, and petty shop owners. The community profile is similar to that of the Old Baiyyappanahalli community. Land allotment papers are issued by the BDA. Plot size is predominantly 15' x 20'.

6.2.2 Infrastructure:
Houses are predominantly made of GI and asbestos corrugated sheets and a few of RCC (Reinforced Cement Concrete). The community is organized, and consists of a mix of low income and lower middle income households. There is a water access point at frequent distances. All houses are electrified and metered. Sewage lines run through the side of the street, hence most households have toilets connected to the lines. Lights (both CFL and fluorescent), television and fans are the major appliances commonly used by the households.
7. COMMUNITY PROFILING

7.1 Housing infrastructure:

1. Simple rectangular homes measuring an avg. of 10'x15'.
2. Most homes do not have internal partition walls.
3. One room serves a multi-functional purpose that includes, living, sleeping, cooking, washing, bathing and sanitation.
4. Most often the toilets are within the home with an outlet pipe.
5. Some homes have mezzanine levels created for storage.
8. SPATIAL ANALYSIS
9. TECHNICAL DETAILS

1. Wet areas such as toilets, washing platforms are placed adjacent to the street, for ventilation.
2. Beds are located at the far end of the house, for ease of circulation.
3. Kitchens are an integral part of ‘living’ areas of houses, where presumably congregation while eating happens.
4. Storages located adjacent to the bed or toilet for ease of access.
5. Street is an integral part of the house, interaction with other people from other houses often takes place on the street.
6. Houses can be broken down into 3 necessary requirements, area for sleeping, area for cooking and wet areas/toilets.
7. The importance of the front wall as a multi-functioning element, for access, lighting and ventilation of the house is to be considered as the other three walls are blocked.

9.1 Construction data

1. Per square feet rate of construction is Rs. 1700.
2. Constructing an RCC roof is advisable for incremental development.
3. Walls to be made from adobe blocks made locally.
4. No of days for construction – 1 month.
5. RCC roof to be made using filler material.
6. Masons to be trained in sustainable construction techniques through the course of project.
7. Beneficiary to contribute for unskilled labour requirements.

9.2 Design Guidelines

1. Aspects of lighting and ventilation to be incorporated.
2. Incremental construction planning to coordinate with finance availability.
3. Modularity of design to allow user customization.
4. Incorporation of end user requirements in design.
9.3 Compressed Stabilised Earth Blocks (CSEB)

CSEB are a mix of soil, sand and 5% cement

![Image of soil, cement, sand, gravel, and mixing molding curing process]

9.3.1 A Local Material

ideally, production is made on the site itself or in the nearby area. Thus, it will save transportation, fuel, time and money.

9.3.2 Coat Effectiveness

1. CSEB are generally cheaper than fired bricks. In India with manual equipment (AURAM press 3000), it is usually within these figures:
2. Labour: 20 - 25% > Soil & sand: 20 - 25% > Cement: 40 - 60 % > Equipment: 3 - 5 %, a finished m3 of CSEB wall is generally: 48.4 % cheaper than wire cut bricks and 23.6 % cheaper than country fired bricks

Note: Costs vary largely on site context, labour charges, availability and cost of soil etc. The above study has been conducted by the Auroville Earth Institute, Tamil Nadu and recorded data is based on sites in and around Auroville.

9.3.3 A Bio Degradable Material

– even after the buildings’ lifetime, the material used to build it will not be a burden as a waste product, but will go back to mother earth

AURAM PRESS 3000

Available force: 150 KN (1.5 tons)
Compression ratio : 1.60 or 1.83
Earth Block : 20 and 50, then up to 100 in 5 mm
Theoretical output : 125 strokes per hour
Practical daily output : 1600 plain half blocks (2 blocks per stroke)
1000 plain blocks (1 block per stroke)
Manpower needed: 3 men on machine, plus 4 more mixing and handling
Net Weight: 365 to 415 kg
Lid opening : Automatic
Package weight : 485 kg to 535 kg
Working encumbrance : 4.0 x 1.5 x 2.9 m (l x w x h)
Transportation encumbrance : 0.8 x 0.7 x 1.4 m (l x w x h)
9.3.4 Sustainability:
1. Compared to conventional materials, mud has a much lesser embodied energy.
2. Compressed Stabilized Earth Blocks uses 5 times less energy than wire cut bricks and 15 times less energy than country fired bricks.

<table>
<thead>
<tr>
<th>Product and thickness</th>
<th>No of units (Per m²)</th>
<th>Energy consumption (MJ per m²)</th>
<th>CO₂ emission (Kg per m²)</th>
<th>Dry compressive crushing strength (Kg/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSEB – 24 cm</td>
<td>40</td>
<td>110</td>
<td>16</td>
<td>40 – 60</td>
</tr>
<tr>
<td>Wire Cut Bricks – 22 cm</td>
<td>87</td>
<td>539</td>
<td>39</td>
<td>75 – 100</td>
</tr>
<tr>
<td>Country Fired bricks – 22 cm</td>
<td>112</td>
<td>1657</td>
<td>126</td>
<td>30 – 50</td>
</tr>
<tr>
<td>Concrete blocks – 20 cm</td>
<td>20</td>
<td>235</td>
<td>26</td>
<td>75 – 100</td>
</tr>
</tbody>
</table>

---

**Embodied Energy in Building Materials**

<table>
<thead>
<tr>
<th>Material</th>
<th>Watt-Hr. / Kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straw bale</td>
<td>67</td>
</tr>
<tr>
<td>Adobe block</td>
<td>117</td>
</tr>
<tr>
<td>Rammed earth</td>
<td>117</td>
</tr>
<tr>
<td>Local stone</td>
<td>219</td>
</tr>
<tr>
<td>Concrete</td>
<td>361</td>
</tr>
<tr>
<td>Plasterboard</td>
<td>1,694</td>
</tr>
<tr>
<td>Portland cement*</td>
<td>2,167</td>
</tr>
<tr>
<td>Plywood</td>
<td>2,889</td>
</tr>
<tr>
<td>Fiberglass insulation</td>
<td>8,416</td>
</tr>
</tbody>
</table>

*Worldwide production of cement is estimated to be responsible for 7 - 10% of the world's CO₂ emissions, second only to electricity generation.

Source: Centre for Building Performance Research
9.3.5 People Participation and Job Creation:

1. It is a simple technology requiring skill that can be easily transferred to a local labour force.

2. This technology can then be easily replicated to other local projects.

3. The Blocks can be made on site by volunteers and end users themselves.

9.3.6 Life Cycle Costs:

1. As soil that is used for creating the material is not fired, it retains its properties of breathability.

2. This makes the building have excellent temperature control and keeps the interiors at an optimum temperature throughout the year, thus bringing down life-cycle costs apart from the construction costs.