synergistic heterogeneity
fostering resilience through inclusive development for a transient population
contents

01 background & problem
02 location
03 design research
04 design
05 building technology
06 analysis
struggling seasonal migrants

Image source: REUTERS/Anindito Mukherjee
middle class
lower-middle class households

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vendors</td>
<td>30%</td>
</tr>
<tr>
<td>Food industry</td>
<td>13%</td>
</tr>
<tr>
<td>Leather work</td>
<td>8%</td>
</tr>
<tr>
<td>Painters/Carpenters</td>
<td>7%</td>
</tr>
<tr>
<td>Construction</td>
<td>6%</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>7%</td>
</tr>
<tr>
<td>Cloth shop/washing</td>
<td>5%</td>
</tr>
<tr>
<td>Security services</td>
<td>5%</td>
</tr>
<tr>
<td>Unspecified</td>
<td>4%</td>
</tr>
<tr>
<td>Welding and repairing</td>
<td>4%</td>
</tr>
<tr>
<td>Cable/electrical works</td>
<td>2%</td>
</tr>
<tr>
<td>Driver/transport services</td>
<td>2%</td>
</tr>
<tr>
<td>Data entry</td>
<td>2%</td>
</tr>
<tr>
<td>Imitation jewellery makers/Zari makers</td>
<td>2%</td>
</tr>
</tbody>
</table>
paying guests
problem statement

Migrant workers form the base of the Indian economy, working in its most prominent sectors however, they are treated inhumanely, with no access to vital services (such as running water, healthcare, education), no legal identity and no provision of adequate housing. These people are living far below an adequate standard of living, which is contrary to many of the United Nation’s Sustainable Development Goals.
research question

How can a development that integrates flexible accommodation into the existing lower-middle class fabric accommodate the needs and aspirations of seasonal migrants while helping them transition to life in the city?
hypothesis

A flexible mid-to-high-rise housing block that cohouses the two groups (lower-middle class families and seasonal migrant workers) will ensure that dwellings are maintained in use throughout the year and allow each group to foster its own social network.

A promising model will be one that allows both groups to gain from their co-existence, reduces the concentration of poverty in cities, aids in removing the stigma associated with migrant workers and proves as a viable model for new lower-middle class housing developments. The solution should be one that can be implemented across India.
LOCATION
Sri Prastha
Has a regular grid
Access to lower-middle class
Needs diversification
Needs redevelopment
Example & Starting Point
future scenarios

current situation

developer proposal

greater diversity
patterns of inhabitation

Flexible street border

Working & living side-by-side

Work space by day, sleeping area by night

Social Corridor

Appropriation of corridor

Intimate alleyways for women

Renting out space for extra income
forms of co-habitation
precedents

De Muzen

WindSong Cohousing
key takeaways

- Streets & inward-facing dwellings foster community
- Do include amenities
- A mix of dwelling types = better social mix
- Make space for income generation
DESIGN
redevelopment

Existing Amenities

- educational
- health care
- religious
- restaurant/food
- commercial

Filling the Gap
Redevelopment Process

Current Situation

Phase I
Final Phase

Future
building design

Existing plot: 40m x 32m
32 dwellings, (16 each)
with small courtyards

Type I
35 dwellings
large courtyard space

Type II
51 dwellings
2 courtyards, public & private
Type I
FSI = 2.0
35 Dwellings
8 for migrants
27 for the lower-middle class
4 amenities
9 storeys

Type II
FSI = 2.8
51 Dwellings
11 for migrants
40 for the lower-middle class
4 amenities
9 storeys
type I
Level 2
Level 7
South Elevation
type II
unit types

- Flat - 65 sq. m
- Rentable street level unit - Rental 30 sq. m
  Level 2
- Rentable Live-Work Unit - 50 sq. m
  Ground floor
- Live-work unit - 60 sq. m
  Ground floor
- Maisonette - 62 sq. m
  Level 7
- Rentable street level unit - 100 sq. m
  Upper level
- Owner Occupied Live-Work Unit - 50 sq. m
  Upper level
- Live-work unit
  Upper level
- Maisonette
  Upper level
flexibility
clustering

direct replacement
16 Families

2 x type I

society
32 Families

type I

Cost: 75,384,000 Rs
• 11 Families
• 28 Migrants

Market sales:
54,800,000 Rs

Loan amount needed:
20,584,000 Rs

Cost: 150,768,000 Rs
• 22 Families
• 56 Migrants

Market sales:
102,600,000 Rs

Loan amount needed:
41,168,000 Rs

Cost: 109,254,000 Rs
• 8 Families
• 34 Migrants

Market sales:
45,290,000 Rs

Loan amount needed:
63,964,000 Rs

Open space created:
261 m²
4 societies
128 Families

2 x type I & 2 x type II

+0 families
+124 migrants

Loan amount needed: 237,564,728 Rs

Open space created:
1000 - 1600 m²

2 x type I & 2 x type II

+32 families
+136 migrants

Loan amount needed: 229,860,364 Rs

Open space created:
500 - 1000 m²

4 x type II
urban context
impressions

Main Road
Common Circulation Space
Internal Street
BUILDING TECHNOLOGY
climate
water management
structure
# Load-bearing walls

<table>
<thead>
<tr>
<th>Material</th>
<th>Dry Density</th>
<th>Compressive Strength</th>
<th>Water Absorption</th>
<th>Water Requirement</th>
<th>Breakage</th>
<th>Environmental Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay Brick</td>
<td>1600 - 1750 kg/m³</td>
<td>30-35 kg/m³</td>
<td>15-25%</td>
<td>More. Curing</td>
<td>10-12%</td>
<td>More CO₂ and energy used due to firing.</td>
</tr>
<tr>
<td>Fly Ash Brick</td>
<td>1700 - 1850 kg/m³</td>
<td>90-100 kg/m³</td>
<td>10-14%</td>
<td>Less. Steam Curing</td>
<td>~ 0%</td>
<td>Use fly ash (waste from power plants) Curing reduces energy use. Low CO₂ emissions</td>
</tr>
<tr>
<td>AAC Block</td>
<td>1600 - 1920 kg/m³</td>
<td>&lt; 10%</td>
<td>Less. Steam Curing</td>
<td>~ 0%</td>
<td>AAC waste material is recycled during manufacturing. Low CO₂ emissions</td>
<td></td>
</tr>
</tbody>
</table>
Fly-ash bricks

Fly Ash Bricks

Paint Colour Options

Rat Trap Bond with Reinforcement
## Floors

<table>
<thead>
<tr>
<th></th>
<th>Weight</th>
<th>Concrete Required</th>
<th>Formwork</th>
<th>Time Required</th>
<th>Span to Depth Ratio</th>
<th>Quality &amp; Durability</th>
<th>Ceiling Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinforced Concrete Slab</td>
<td>100%</td>
<td>100%</td>
<td>Formwork Needed</td>
<td>Time Consuming Ex 36 mo construction</td>
<td>1/40</td>
<td>Relatively durable.</td>
<td>If dropped ceiling, height is decreased</td>
</tr>
<tr>
<td>Clay Pot (Hollow) In Situ</td>
<td>65%</td>
<td>80%</td>
<td>Formwork Needed</td>
<td>Slightly More Time Consuming Ex 37 mo construction</td>
<td>1/24</td>
<td>Relatively durable.</td>
<td>Decreased height due to floor thickness</td>
</tr>
<tr>
<td>Prefabricated Hollow Core</td>
<td>65%</td>
<td>50%</td>
<td>None</td>
<td>Less Time Consuming Ex 24 mo construction</td>
<td>1/40</td>
<td>Very durable.</td>
<td>Greatest floor-to-ceiling height</td>
</tr>
</tbody>
</table>
materiality

Waste-tile mosaic

Recycled concrete paver
construction
Roof Gutter
Roof Gutter Section

- 8 mm THK GALVANIZED STEEL GUTTER
- MOSAIC FLOOR TILE FINISH: WHITE BROKEN/WASTE TILES
- CONCRETE, SLOPED
- 85 mm THK CONCRETE PRESSURE LAYER
- 150 mm THICK HOLLOW CORE SLAB
230 mm FLY ASH BRICK WALL RAT TRAP BOND

REINFORCED CONCRETE INFILL

BRICK CAP

MOSAIC FLOOR TILES FINISH, WHITE BROKEN/WASTE TILES

CEMENT, 3° SLOPE

150 mm THK HOLLOW CORE CONCRETE SLAB, BLOCKOUT CUT

PLASTER FINISH

REINFORCED BRICK LINTEL

DRIP EDGE

ADJUSTABLE TIMBER LOUVER

+ 27500

Roof Detail
ANALYSIS
financing structure
financing

<table>
<thead>
<tr>
<th>area</th>
<th>1BHK</th>
<th>1BHK</th>
<th>2BHK</th>
<th>3BHK</th>
<th>commerce</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 m² / 538 sf</td>
<td>60 m² / 645 sf</td>
<td>65 m² / 700 sf</td>
<td>100 m² / 1076 sf</td>
<td>30 m² / 322 sf</td>
<td></td>
</tr>
<tr>
<td>$ price</td>
<td>2,440,000 Rs *</td>
<td>2,900,000 Rs</td>
<td>3,170,000 Rs</td>
<td>6,000,000 Rs *</td>
<td>4,000,000 Rs</td>
</tr>
<tr>
<td>x ? quantity</td>
<td>4</td>
<td>2</td>
<td>17</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>$ price</td>
<td>9,760,000 Rs</td>
<td>5,800,000 Rs</td>
<td>53,890,000 Rs</td>
<td>24,000,000 Rs</td>
<td>16,000,000 Rs</td>
</tr>
</tbody>
</table>

| sales      | 109,450,000 Rs | 75,384,000 Rs | 34,066,000 Rs | 45% |
| construction |        |              |              |    |
| profit     |        |              |              |    |

Financing Option 1: Market Prices
<table>
<thead>
<tr>
<th>Area</th>
<th>Price</th>
<th>Quantity</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 m² / 538 sf</td>
<td>3,012,800 Rs *</td>
<td>4</td>
<td>12,051,200 Rs</td>
</tr>
<tr>
<td>60 m² / 645 sf</td>
<td>1,806,000 Rs</td>
<td>2</td>
<td>3,612,000 Rs</td>
</tr>
<tr>
<td>65 m² / 700 sf</td>
<td>1,960,000 Rs</td>
<td>17</td>
<td>33,320,000 Rs</td>
</tr>
<tr>
<td>100 m² / 1076 sf</td>
<td>3,914,400 Rs *</td>
<td>4</td>
<td>15,657,600 Rs</td>
</tr>
<tr>
<td>30 m² / 322 sf</td>
<td>2,704,800 Rs</td>
<td>4</td>
<td>10,819,200 Rs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sales</th>
<th>Construction</th>
<th>Profit</th>
<th>Profit %</th>
</tr>
</thead>
<tbody>
<tr>
<td>75,460,000 Rs</td>
<td>75,384,000 Rs</td>
<td>76,000 Rs</td>
<td>0%</td>
</tr>
</tbody>
</table>

Financing Option 2: Break Even
<table>
<thead>
<tr>
<th></th>
<th>construction</th>
<th>commerce</th>
<th>dwelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financing Option 1: Market Prices</td>
<td>2030 Rs/sf</td>
<td>12385 Rs/sf</td>
<td>4537 Rs/sf</td>
</tr>
<tr>
<td>Financing Option 2: Break Even</td>
<td>8400 Rs/sf</td>
<td>2800 Rs/sf</td>
<td></td>
</tr>
</tbody>
</table>

Financing Option 1: Market Prices

Financing Option 2: Break Even
### Rental Income

<table>
<thead>
<tr>
<th>Type</th>
<th>Migrant</th>
<th>Middle Income</th>
<th>Paying Guest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rent Price</td>
<td>50,000 Rs/year</td>
<td>100,000 Rs/year</td>
<td>-</td>
</tr>
<tr>
<td>Monthly</td>
<td>4,160 Rs/mo</td>
<td>8,334 Rs/mo</td>
<td>2,200 Rs/mo</td>
</tr>
</tbody>
</table>

### Accommodation Types

<table>
<thead>
<tr>
<th>Type</th>
<th>1 RK</th>
<th>1 BHK</th>
<th>2 BHK</th>
<th>3 BHK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sq ft</td>
<td></td>
<td>30 m²</td>
<td>50 m²</td>
<td>538 sf</td>
</tr>
<tr>
<td>Rent Price</td>
<td>2,000 Rs</td>
<td>2,200 Rs</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>People</td>
<td>3-4</td>
<td>4-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly</td>
<td>6,000 - 8,000 Rs/mo</td>
<td>8,800 - 11,000 Rs/mo</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Yearly</td>
<td>72,000 - 96,000 Rs</td>
<td>105,600 - 132,000 Rs</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
community comparison

Current

Units per hectare: 200
Open Space: 3.88 m² per person
Families: 1,400
Migrants: 0
Amenities: ~11

Potential Future

Units per hectare: 268
Open Space: 3.5 m² per person
Families: 1,584
Migrants: 1,184
Amenities: 130+
Value

Single Income Group

3 Dwelling Types / Single tenure

Few businesses & job opportunities

Few amenities

Inconsistent or non-existent community & building maintenance

Mix of Income Groups - Inclusive community for seasonal migrants

5+ Dwelling types for different lifestyles & activities / Mixed Tenure

Many commercial units & job opportunities

Plenty of community amenities

Design encourages maintenance, community board in charge of infrastructural maintenance

Flexibility in building height and within units
Current Situation
After Redevelopment
5+ Years Later
usergroup needs

Lower-Middle Class
- Home for a growing family
- Privacy
- Security
- Childcare
- Education for children
- Extra income
- Ability to run business from/near home

Seasonal Migrants
- Income
- Community
- Usefulness of open space
- Nearby amenities
- Entertaiment
- Nearby work opportunities
- Work from home
- Ability to expand
- Flexibility in dwelling & tenure
- Address/ID
- Familiar surroundings
- Education
- Network
- Nearby work opportunities
- Flexibility in dwelling & tenure
- Address/ID
- Familiar surroundings
- Education
- Network
exclusion from housing policies

PMAY (Pradhan Mantri Awas Yojana)*
To build 20 million affordable houses for the poor (including EWS and LIG) by 2022 through:
1. In-situ slum redevelopment with private sector participation using land as resource.
2. Affordable housing through Credit Linked Subsidy.
3. Affordable housing in Partnership with private and public sector

Subsidy part

CLSS* (Credit Linked Subsidy Scheme)*
Interest subsidy of 6.5% on housing loan for 20 years along following rules:
1. Maximum age of 70 years.
2. EWS (Economic Weaker Section) annual income < 3 Lakh.
3. LIG (Lower Income Group) annual income 3 Lakh - 6 Lakh.
4. MIG 1 (Middle Income Group 1) annual income 6 Lakh - 12 Lakh.
5. MIG 2 (Middle Income Group 2) annual income 12 Lakh - 18 Lakh.
6. No family member should own a dwelling unit in any part of India.
Street Profiles

Primary Road

Secondary Road

Neighbourhood Road