RESILIENT SHELTER IN FLOOD PRONE AREAS: CASE OF GORAKHPUR

- Rapid and Unplanned Urbanization
- Waterlogging
- Housing Safety
KEY MESSAGES

• Cost effective compared to disaster recovery
• Costs below current construction practices
• Design and material innovations
• Educating and empowering builders
Climate Analysis

Community Risk Reduction Options

- Raised plinth
- Hook on roof
- Almira construction
- Concrete shelf
Key Characteristics of Resilient Design

- Rat Trap Bonds
- Arches
- Jali Walls
- Raised Plinth
- Sloping Roof

Design competition – India
## Investigation of Costs & Benefits

<table>
<thead>
<tr>
<th>Risk Reduction Measure</th>
<th>Without Climate Change</th>
<th>With Climate Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almira Construction</td>
<td>0.54</td>
<td>0.62</td>
</tr>
<tr>
<td>Concrete Shelf</td>
<td>2.24</td>
<td>2.61</td>
</tr>
<tr>
<td>Hook on Roof</td>
<td>42.44</td>
<td>49.49</td>
</tr>
</tbody>
</table>

### Resilient Housing Design

| Additional cost to build a climate resilient house with reinforced concrete cement | 1.0 | 1.2 |
| Additional cost to build a climate resilient house with bamboo reinforcements   | 44.7 | 49.5 |

## Impacts expected

- **Community benefits**
  - Health and security benefits to women and children
  - Reduced impact on livelihoods
  - Improved savings and living quality
- **Govt and other organizations**
  - Improvement in relief and rehabilitation efforts
  - Reduction in recurring expenditure on housing
Policy Implications

• **Household**
  – Climate resilient designs are cost effective
  – Health and security benefits to women and children

• **Public Policy**
  – Access to affordable finance
  – Training of builders/masons
  – Investment into development of materials and technologies
  – Government housing programs good entry point