Flood Resilient Shelter in Pakistan

Evidence Based Research

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Background

3 years of extreme flooding

18 million affected
Two outputs:

1. Research Report
   a) Methodology
   b) Key findings

2. Shelter Guide
   a) Recommendations
Rigour – Key Criteria and Metrics

1. Safe and resilient
2. Acceptable to occupant
3. Sustainable

- **Waterproof Materials**
  - **Standing Water**
    - How high is the water level inside the building?
    - How long does the water level last?
  - **Standing Water**
    - How long does the water level last?
    - How deep is the water level inside the building?

- **Earthquake Protection**
  - **Seismic Rating**
    - How high is the seismic index?
    - How deep is the water level inside the building?
  - **Seismic Index**
    - What is the seismic index of the area?
    - How deep is the water level inside the building?

- **Drainage**
  - **Drainage Design**
    - How high is the water level inside the building?
    - How deep is the water level inside the building?
  - **Drainage Design**
    - How high is the water level inside the building?
    - How deep is the water level inside the building?
Evidence base – Field surveys

![Graph: Flood Depth vs Elevated Floor Height - By Year of Flood](image)

800 Shelters surveyed
Evidence base – Analytical studies

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Analysis desk studies

- Cost
- Sustainability
- Structural
- Thermal/Ventilation
- Daylighting
Evidence base - Flood and rain testing

24 full scale panels tested
Key findings

- **Stabilised earth can create water resilient, affordable, low carbon construction**
  - **Training** and **testing** are essential
- Designs must respond to the **type** (heavy rain and standing water) and **magnitude of the hazard**
  - Measures to combat each are different
  - Depth of standing water – indicate on shelter?
- **Half measures do not work for standing water**
Heavy rain vs standing water

• Standing water vs heavy rain
• Heavy rain can be resisted through good detailing (roof overhangs, base protection, stabilised plaster)
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Stabilised earth

• Water resilient, affordable, low carbon construction
• Requires training
• (Water bucket) testing is essential!

1. Place a block in water for 24 hours.  
2. Good blocks will not wash away.
Half measures

- Water proof plaster
- Thicker walls
- Base protection
- Fired brick foundations
Shelter Guide - Design Principles

Structure

- Water resistant foundations (into original ground)
- Water resistant walls

People and belongings

- Platform > Plinth > Shelf > Roof
- Roof overhang
- Base protection
- Water resistant plaster
- External drainage

Key:
- Non-water resistant material
- Water resistant material
Key findings

• Stabilised earth can create water resilient, affordable, low carbon construction
  • Training and testing are essential
• Designs must respond to the type (heavy rain and standing water) and magnitude of the hazard
  • Measures to combat each are different
  • Depth of standing water – indicate on shelter?
• Half measures do not work for standing water
Thankyou for listening

For comments or queries, please contact

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