Earthquake Hazard and Risk Assessment of Bangladesh

TECHNICAL PANEL SESSION #1

GLOBAL EARTHQUAKE MODEL FOUNDATION

9 October 2023
Previous Efforts, and Need for a Nationwide Earthquake Risk Assessment
Our Methodology

We collect and process data worldwide, related to the main components of risk.

Currently GEM has fully functional global model components to assess earthquake impact worldwide.

**Hazard**
Characterizing the potential locations, intensity or magnitude, frequency or probability of earthquakes.

**Exposure**
Characterizing the built environment and people in hazard-prone areas.

**Vulnerability**
Factors which increase the susceptibility of an individual or assets to the impacts of hazards.
Seismic Hazard Assessment

- Identification of active faults
- Historical earthquakes
- Hypothetical future scenarios
- Soil characterization using secondary data
- Ground motion model
- Probabilistic seismic hazard assessment

Active fault map of Bangladesh

Subduction plate boundaries


Source: Michael Steckler / Lamont-Doherty Earth Observatory
Exposure Modelling

- **Buildings**
  - Residential
  - Commercial
  - Industrial
  - Healthcare
  - Education

- **Infrastructure**
  - Roads
  - Railways

- **Population**
  - 2022 Census

- **Attributes**
  - Location
  - Typology
  - Valuation
  - Age

Residential Buildings

Railway Lines
Seismic Vulnerability Analysis

Percentage Distribution of Main Dwelling Structure by Materials of Wall and by Year

<table>
<thead>
<tr>
<th>Material</th>
<th>HIES 2022</th>
<th>HIES 2016</th>
<th>HIES 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brick/Cement</td>
<td>47.84</td>
<td>41.97</td>
<td>38.46</td>
</tr>
<tr>
<td>C.I. Sheet/Wood</td>
<td>30.50</td>
<td>25.12</td>
<td>16.72</td>
</tr>
<tr>
<td>Mud/Unburnt brick</td>
<td>11.02</td>
<td>8.80</td>
<td>0.25</td>
</tr>
<tr>
<td>Hay/Straw/Bamboo/leaves</td>
<td>7.25</td>
<td>10.21</td>
<td>0.35</td>
</tr>
<tr>
<td>Others</td>
<td>4.06</td>
<td>6.59</td>
<td>4.41</td>
</tr>
</tbody>
</table>

Macro-taxonomy
- Tin/Corrugated Iron
- Concrete
- Wood
- Adobe/Earth
- Unreinf. Masonry
- Other

Proportion of exposed value

Number of buildings
Total replacement value
Seismic Risk Assessment; Hazard and Risk Maps

- GEM has published division-level maps of seismic hazard, exposure, and risk for Bangladesh.
- The spatial resolution will be improved to upazila level in this project.
Request for Data from BBS and Previous Ministry Projects

- **BBS**: Population and Housing Census (PHC) 2022 – Upazila level tables
- **BBS**: Household Income and Expenditure Survey (HIES) 2022 – Microdata
- **CDMP**: Engineering Geological Maps for Dhaka, Chittagong, and Sylhet City Corporations
- **CDMP**: Engineering Geological Maps for Bogra, Dinajpur, Mymensingh, Rajshahi, Rangpur, and Tangail Pourashava and City Corporation Areas
- **CDMP**: Building Inventory for Dhaka, Chittagong, and Sylhet
- **MoDMR**: Any other datasets you would like us to include in the risk assessment
Project Activities (August to December 2023)

- Needs and Gaps Assessment (Aug–Sep 2023)
- Technical Panel Formation and Initial Consultations (Oct–Dec 2023)
- Seismic Hazard Mapping (Aug-Nov 2023)
- Exposure Mapping (Aug-Oct 2023)
- Seismic Vulnerability Assessment (Oct-Nov 2023)
- Seismic Risk Mapping and Interpretation (Nov–Dec 2023)
- Stakeholder Consultation and Validation; Preliminary Model Dissemination and Training Workshop (~Feb 2024)
Technical Panel Formation and Engagement

- **Panel formation** – Technical Leadership by MoDMR
- **Engagement** – Wider Expertise on Earthquake in BD
- **Online sessions** – 3-5 Online Session
- **Workshops** – 2-3 Days with different stakeholders
Highly Relevant Domain Expertise of the Technical Panel


Siddique, S., & Sharmin, F. (2023). *Seismic Hazard Maps of Bangladesh*. Design Planning and Management Consultants Ltd. [http://dx.doi.org/10.13140/RG.2.2.23257.29286](http://dx.doi.org/10.13140/RG.2.2.23257.29286)
Technical Panel – Proposed Sessions

- Oct 09 – Introductory session (today)
- Oct 3rd/4th week – Probabilistic seismic hazard and scenarios
- Nov 3rd/4th week – Exposure and seismic vulnerability
- Dec 2nd/3rd week – Seismic risk and social vulnerability
- Feb 2024 – In person workshops, data and model transfer
Further clarification, questions and answers
Thank you!

Please attribute to the GEM Foundation with a link to:
https://www.globalquakemodel.org

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