

Earthquake Hazard and Risk Assessment of Bangladesh

AT UPAZILA LEVEL



GLOBAL EARTHQUAKE MODEL FOUNDATION

14 AUGUST 2023

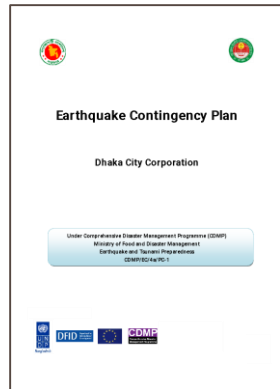
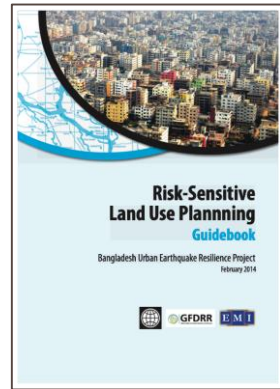
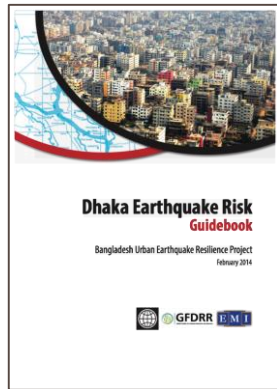
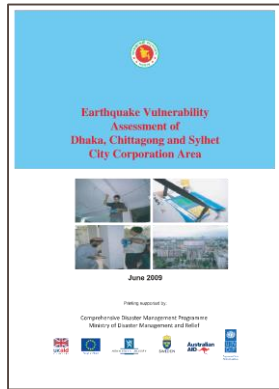
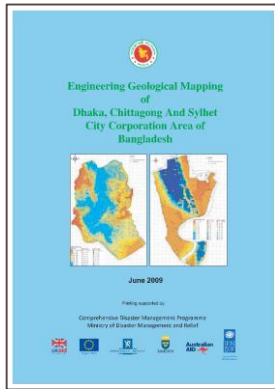
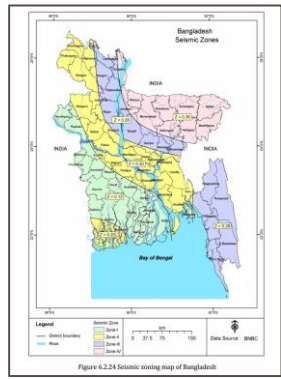
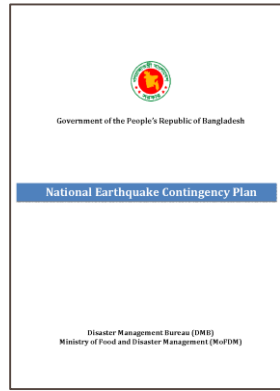
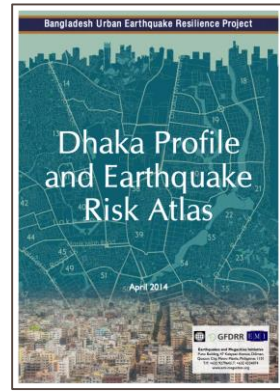
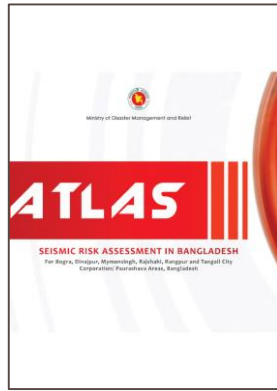
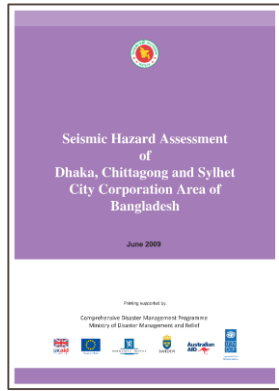
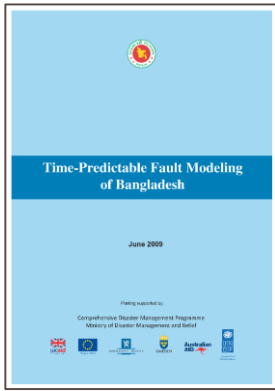


working together
to assess risk

GEM
GLOBAL EARTHQUAKE MODEL

OO
OPENQUAKE

Previous Efforts, and Need for a Nationwide Earthquake Risk Assessment



About GEM Foundation

- Non-profit scientific NGO, founded in 2009
- Global, public-private partnership
- We develop open software, tools and data for use in earthquake risk assessment worldwide

Our Vision

For a world that is resilient to earthquakes and other natural hazards

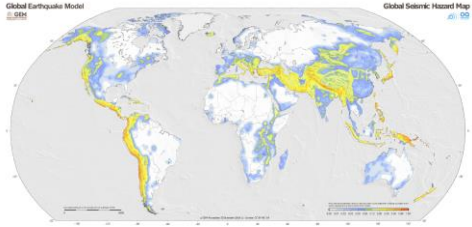
www.globalquakemodel.org



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

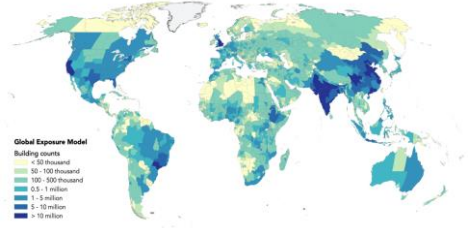


Hazard

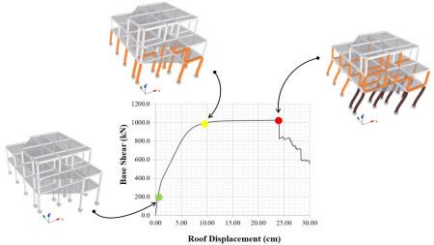
The seismic potential at any location

Exposure

The built environment at risk



Global Exposure Model
Building counts
■ < 50 thousand
■ 50 - 100 thousand
■ 100 - 500 thousand
■ 0.5 - 1 million
■ 1 - 5 million
■ 5 - 10 million
■ > 10 million

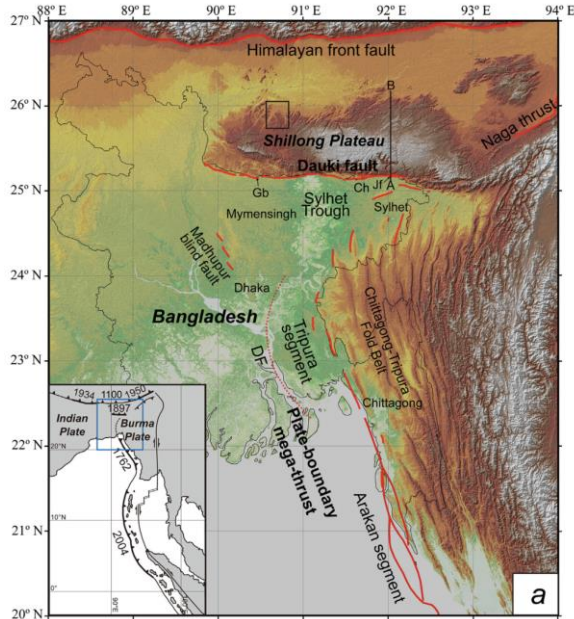


Vulnerability

The expected damage to an event

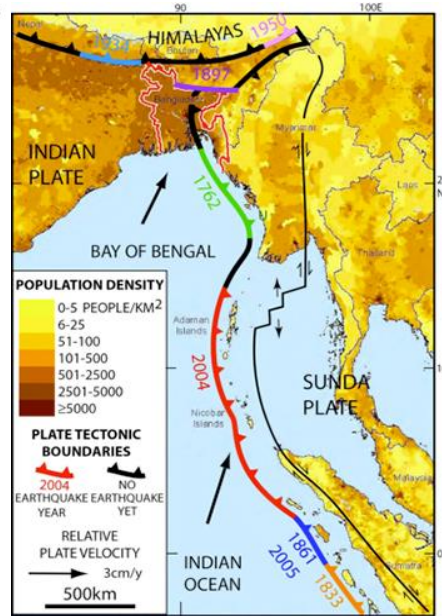


Seismic Hazard Assessment



Active fault map of Bangladesh

Morino et al. (2014). A paleo-seismological study of the Dauki fault at Jaflong, Sylhet, Bangladesh: Historical seismic events and an attempted rupture segmentation model. *Journal of Asian Earth Sciences*, 91, 218–226.

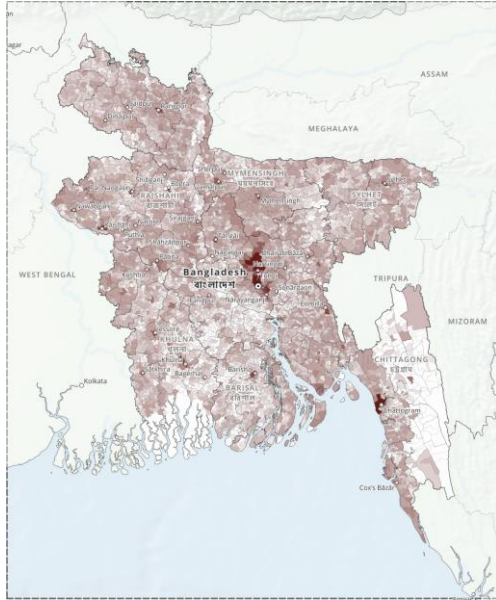


Subduction plate boundaries

Source: Michael Steckler / Lamont-Doherty Earth Observatory

- Identification of active faults
- Historical earthquakes
- Soil characterization using secondary data
- Ground motion model
- Probabilistic seismic hazard assessment
- National liquefaction susceptibility assessment

Exposure Modelling



Residential Buildings

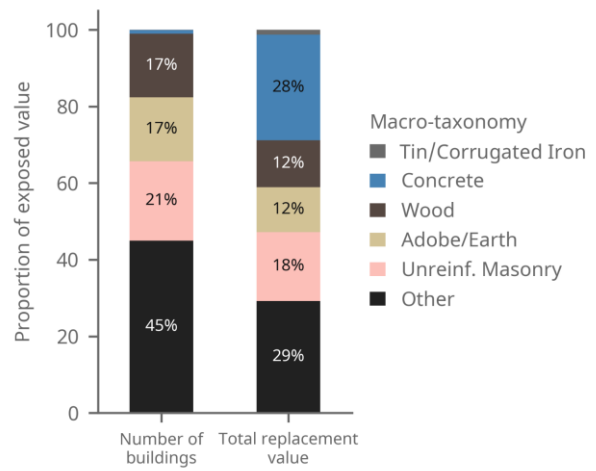


Railway Lines

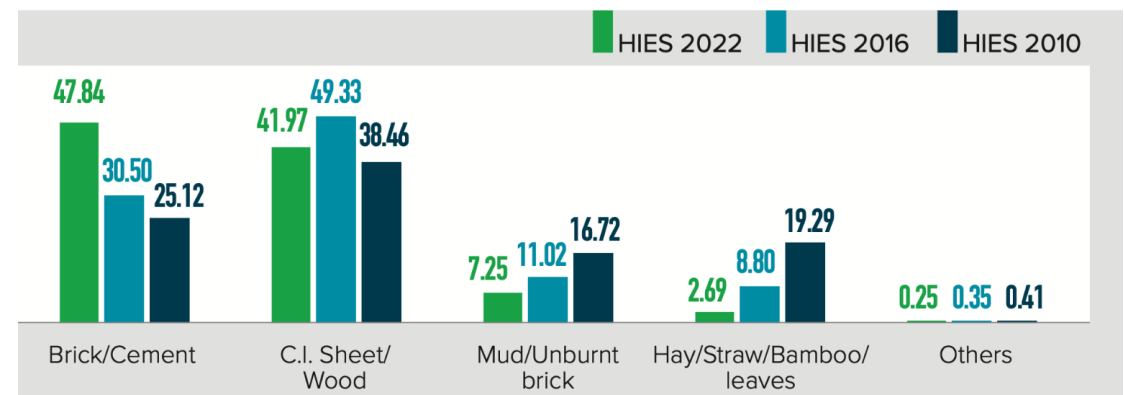
- Buildings
 - Residential
 - Commercial
 - Industrial
 - Healthcare
 - Education
- Infrastructure
 - Roads
 - Railways
- Population
- Attributes
 - Location
 - Typology
 - Valuation
 - Age



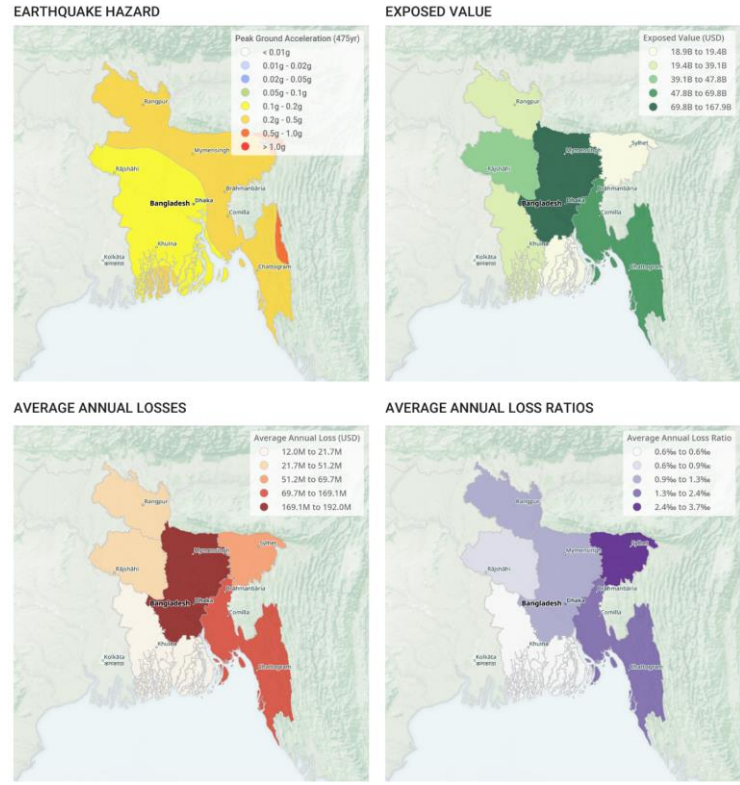
Seismic Vulnerability Analysis



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



Seismic Risk Assessment; Hazard and Risk Maps



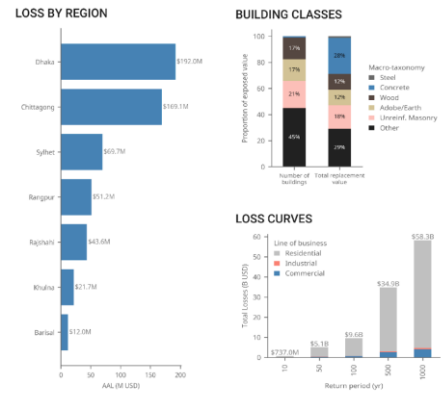
BANGLADESH

SOCIAL INDICATORS

- Population 164.7M
- GDP 250.0B USD
- GINI Index 32.1
- Population Growth 1.05%/year
- GDP per Capita 1,517 USD
- Human Development Index 0.800

RISK INDICATORS

	Replacement cost (Billion USD)	Avg. annual loss (Thousand USD)	Avg. annual loss ratio (%)
Residential	358.0	516,815	1.444
Commercial	27.5	36,888	1.340
Industrial	15.9	5,522	0.348



- 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



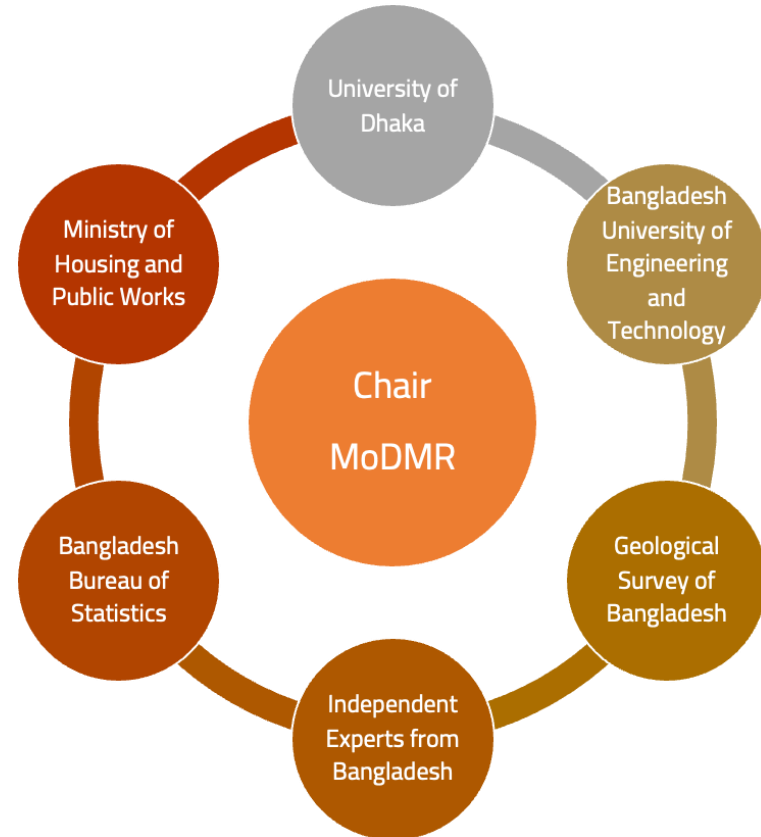
Project Activities (August to December 2023)

- Needs and Gaps Assessment
- Technical Panel Formation and Initial Consultations
- Seismic Hazard Mapping
- Exposure Mapping
- Seismic Vulnerability Assessment
- Seismic Risk Mapping and Interpretation
- Stakeholder Consultation and Validation; Preliminary Model Dissemination and Training Workshop



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



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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