FORCE PROJECT

Forecasting and Communicating Earthquake Risk Bhutan

Technical visits in Bhutan

A series of technical meetings and workshops of the FORCE project – *Forecasting and Communication Earthquake Risk* – were held in Bhutan from the 11th to the 15th of March 2024. One-to-one meetings were organised with the main governmental departments involved in Disaster Risk Reduction activities in the country, along with a workshop held in Thimphu on 12th March 2024, that included an important group of stakeholders. Moreover, a presentation to students and college staff from the Royal University of Bhutan in Phuentsholing was held on the 14th of March 2024. Representatives of the GEM Foundation and the College of Science and Technology (CST) from the Royal University of Bhutan (RUB) attended all meetings and were the coordinators of the visit activities in the country.

The FORCE project, supported by USAID Bureau for Humanitarian Assistance (BHA), aims to enhance earthquake hazard modelling capabilities, as well as to provide better risk models to account for changes in the number of occupants, structures and economic value exposed to earthquakes and the adverse effects of climate change. The project evaluates future earthquake risk losses, thus supporting decision-makers with risk metrics that account for the expected evolution of the built environment, which is fundamental for the design and implementation of long-term risk reduction measures.

Figure 1. Group photo, FORCE project. workshop, March 12th 2024, Thimphu, Bhutan.

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Meetings and discussions with the different stakeholders focused on the project goals in the country:

- to improve the reliability of earthquake hazard and risk assessment;
- to introduce a temporal component in the global exposure model, thus enabling the quantification of future disaster losses,
- to develop communication and dissemination tools to maximize the uptake of disaster risk information in policy making, and
- to define a strategic roadmap for advancing earthquake hazard and risk science capabilities within the country through future collaborations with GEM.

Discussions included the challenges and need to communicate the outputs and results of the project to the relevant authorities and the general audience.

Agenda

Day	Activity
Monday, 11th March, 2024	Bilateral meetings: • Department of Disaster Management (DDM), Sonam Tshewang • Department of Geology and Mines (DGM), Seismology and Geophysics Division, Dowchu Dukpa, Chief Seismologist/Head
Tuesday, 12th March, 2024	Workshop with stakeholders (Venue: City Hotel)
Wednesday, 13th March, 2024	Field visits to places around Thimphu, Do Chula and trip to Phuentsholing
Thursday, 14th March, 2024	College of Science and Technology (CST) from the Royal University of Bhutan in Phuentsholing: • Meeting with the College Management Team. • Presentation of the FORCE project and the OpenQuake software to college students and university staff
Friday, 15th March, 2024	Field trip from Phuentsholing to Paro

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Stakeholders

Governmental offices

DDM: Department of Disaster Management, Ministry Of Home Affairs (MoHA)

DGM: Department of Geology and Mines, Ministry Of Energy and Natural Resources (MoENR)

DST: Department of Surface Transport, Ministry of Infrastructure and Transport (MoIT)

Heritage Sites and Archeology Division, Department of Culture and Dzongkha Development, MoHA

Phuentsholing Thromde

Thimphu Thromde

National institutions

RUB: Royal University of Bhutan

CST: College of Science and Technology, Royal University of Bhutan

GHI: Geohazards international

mHS CITY LAB and mHS Global Impact

CDCL: Construction Development Corporation Limited (coordination of Phuentsholing Township Developemnt Project, PTDP)

Discussions

The following sections briefly describe the outcomes and suggestions collected during the week's visit to Bhutan. Overall, these meetings were a space for updating and discussing the strengths, challenges and recommendations for the development of the project activities in the country.

Meeting with the Department of Disaster Management

The Department of Disaster Management (DDM), within the Ministry of Home Affairs (MoHA) in Bhutan is the governmental institution with the mandate to develop and coordinate awareness raising and building capacities on disaster mitigation, preparedness and response, as well as to develop plans, guidelines and legislation for disaster management. Representatives from the GEM and CST teams met with Mr. Sonam Tshewang, Executive Engineer from DDM, to discuss various aspects of the project. During the meeting, DDM expressed their interest in participating in the capacity building and training component of the project, as well as opening the possibility of hosting the results (maps and models) in Geonode, an online GIS platform expected to be completed by mid-2025 by DDM.

For the coming months, the teams will coordinate to schedule the training sessions and explore further collaboration opportunities between GEM and DDM. Additionally, monitoring the progress of Geonode development for hosting maps and models will be essential for communicating risk results in the country.

Meeting with the Department of Cultural Heritage

The Department of Cultural Heritage and Dzongkha Development, within the Ministry Of Home Affairs (MoHA) in Bhutan, is the central agency under the Department of Culture responsible for the management and protection of heritage sites. It oversees the inventorying and development of databases for these sites, as well as the formulation of policies and regulations aimed at their management and protection. Representatives from the GEM and CST teams met with Dr. Phuntsho Wangmo, Deputy Executive Engineer.

During the meeting, Dr. Phuntsho provided insights into the department's ongoing efforts, highlighting the creation of a database of heritage buildings in Bhutan categorized as Special, Important, and Registered; including characteristics of building materials for the “Important” buildings and two risk maps prepared with the support of the Japan International Cooperation Agency, JICA.

MoHA also emphasized on the potential benefit that the training and capacity building of the activities can have in their division. There is an interest in using OpenQuake and its data interpretation, to which the GEM team offered flexibility in modifying training to provide specialized workshops tailored to the department's needs.

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All parties, including GEM, the department, and RUB representatives, reached a consensus on the project's potential long-term benefits in effectively reducing earthquake risks. They acknowledged the pivotal role of RUB in facilitating collaboration between GEM and different departments, ultimately working towards achieving these goals.

Figure 2. Bilateral meetings in Thimphu, Bhutan, in the context of the FORCE Project. ***Top****: meeting with the Department of Disaster Management (DDM).* ***Bottom:*** *meeting with the Department of Culture and Dzongkha Development, MoHA.*

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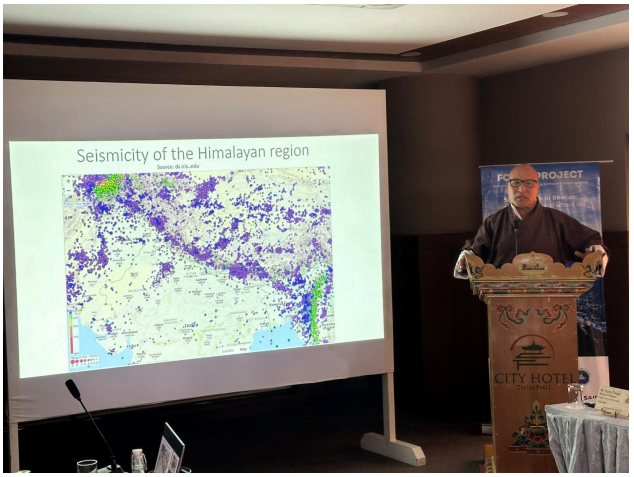
FORCE workshop with stakeholders in Thimphu

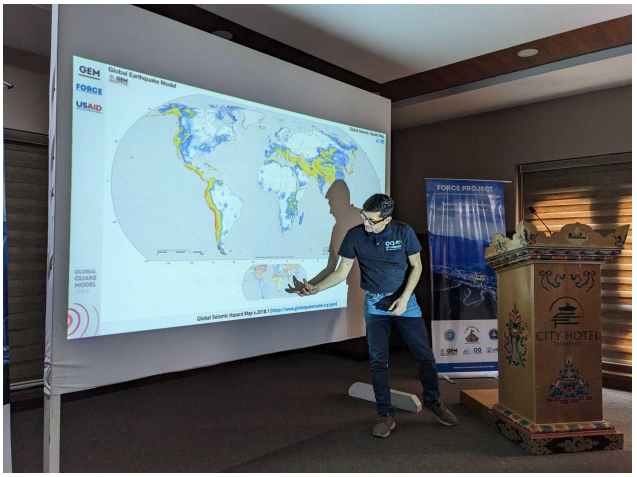
A one-day workshop titled *"Seismic Risk in Bhutan: What we know and where we are headed"* was organized to present the project's activities in the country, engage stakeholders in discussions on outcomes, and explore their implications for shaping policies and future decisions related to seismic hazard and risk. This workshop provided an invaluable opportunity to personally connect with key stakeholders in Bhutan, inviting them to actively participate in the project and gain deeper insights into their needs and priorities for disaster risk reduction initiatives in the country.

Meeting attendees

Mr. Jigme Wangdi, MoIT



Dr. Dowchu Drukpa, DGM



Alejandro Calderón, GEM Foundation

Figure 3. FORCE Project workshop with stakeholders, presentations.

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Workshop agenda

Seismic Risk in Bhutan: What we know and where we are headed	
Session 1: Understanding of seismic hazard and risk in Bhutan	
09:40 -09:55	Presentation/Discussion from the Department of Geology and Mines, DGM
09:55 - 10:10	Presentation/Discussion from the Department of Culture and Dzongkha Development, MoHA
10:10 - 10:25	Presentation/Discussion from GeoHazards International, GHI
10:25 - 10:40	Presentation/Discussion from MoIT
10:40 - 11:00	Coffee break
Session 2: The FORCE project	
11:00 - 12:00	Global seismic hazard and risk assessment (GEM Foundation) Introduction to the FORCE project Seismic hazard modelling (challenges and limitations) Seismic risk assessment at the national level Forecasting future exposure and risk Infrastructure risk assessment (road network)
12:00 - 12:30	Discussions
12:30 - 1:30	Lunch break
Session 3: Hands-on - exploring models and results	
1:30 - 4:30	Hands-on activity to explore and review the input models and preliminary results produced for the country. Demos on the OpenQuake engine results.
4:30 -5:00	Certificate award & Closing

Meeting with CST

The College of Science & Technology (CST) at the Royal University of Bhutan (RUB) serves as the primary liaison for the FORCE project in Bhutan, facilitating vital communication and strategic partnerships with various stakeholders. During a meeting with the President, Dr. Cheki Dorji, strong support and commitment to the project were expressed. Dr. Dorji also expressed interest in future collaborations with the GEM Foundation, while the GEM team conveyed gratitude for the hosting and expressed enthusiasm for future collaborative endeavors.

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Figure 4. FORCE Project workshop with stakeholders, presentations.

Technical session in the CST

A technical session was conducted for the College of Science & Technology faculty members and students at the Team Work Hall of the College in Phuentsholing. The session covered introductory concepts of earthquake hazard and seismic risk assessment, emphasizing their relevance to the OpenQuake software—an open-source tool developed by the GEM Foundation. Demonstrations of running earthquake scenarios specific to Bhutan were also showcased and very well received by the students, who expressed their interest in the topic. Community members were encouraged to participate in the online training activities planned within FORCE scope and deepen their engagement to actively support the government in making informed and technically robust decisions in the future.

Field visits

A field visit was organized to the industrial complex in Pasakha, in the east part of Phuntsholing, where erosion processes have destroyed important transportation infrastructure built in recent years. Following a visit to Pasakha, the team gained a panoramic perspective of the valley bordering India from Karbandi Monastery. This vantage point also offered a clear contrast in building practices employed by the two countries. Then descended to visit the new infrastructure under construction along the Toorsa river.

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Figure 5. Technical session with faculty members and students of the CST in Phuentsholing, March 14th 2024.

Figure 6. Field visit to the Toorsa river embankment and the historical center of Phuentsholing.

Outcomes and Moving Forward

The meetings and workshops held in Bhutan ratify the importance of human interaction and engagement of the different stakeholders in the project activities. Overall, the various institutions express their interest in participating in the project and receiving the outcomes as a step forward in understanding and monitoring earthquake risk.

The focal point between GEM and the stakeholders in Bhutan will continue to be the College of Science & Technology (CST) from the Royal University of Bhutan (RUB), represented by Karma Tempa (since December 2022 to June 2023) and Mr Nimesh Chettri (since July 2023 to date). The CST will be in charge of facilitating the access of data and surveys existing in the country, as well as the maintenance, distribution and communication of the project outcomes to the other governmental offices and the general public. RUB and GEM will be the main technical support for developing and updating models.

From the different meetings, we highlight the challenges indicated by the different actors:

- Need for an inter-governmental strategy to share, use and maintain information,
- Need for a centralized system of open and transparent models that can reside in local servers,
- Need for capacity building in the use of models developed within the FORCE initiative.

Throughout the discussions, various stakeholders expressed their interest in collaborating on potential future projects related to areas beyond the current project's scope. These include enhancing the seismic hazard components of the PSHA model; conducting seismic microzonation studies; expanding the exposure and vulnerability coverage to include cultural heritage, bridges, and dams; conducting comprehensive studies on the structural and non-structural vulnerabilities of traditional Bhutanese buildings; and extending the collaboration network to address other geological and weather-related hazards such as floods, landslides, and rockfalls.

Disclaimer

This report has been made possible thanks to the support and generosity of the American people through the United States Agency for International Development (USAID) and the Bureau of Humanitarian Assistance (BHA). The opinions, findings, and conclusions stated herein are those of the authors and do not necessarily reflect the views of USAID or the United States Government.