PRESS RELEASE

IIT Mandi researchers develop an easy visual-based method to assess earthquake-prone structures in the Himalayan region

The RVS method developed by researchers can be used by any person or organization, responsible for the safety of the vulnerable building stock to assess the reinforced concrete (RC) buildings.

MANDI, 25th November 2022: Researchers at the Indian Institute of Technology Mandi have developed a method to assess the ability of buildings in the Himalayan region to withstand earthquakes. The method is simple and allows decision-makers to prioritize any strengthening and repair work that must be undertaken to enhance the building's resistance to earthquakes.

The findings of the research have been published in the Bulletin of Earthquake Engineering. The research has been led by Dr Sandip Kumar Saha, Assistant Professor, School of Civil and Environmental Engineering, IIT Mandi and co-authored by his Ph.D. student Ms Yati Aggarwal.

The Himalayas are among the most earthquake-prone regions in the world, because of an ongoing collision between the Indian and the Eurasian plates. There have been periodic earthquakes that have been devastating to these regions in terms of both life and property loss. The Great Kashmir Earthquake of 2005 killed over 1,350 on the Indian side of Kashmir, injured at least 100,000 people, ruined tens of thousands of houses and buildings, and rendered millions of people homeless.

While earthquakes cannot be prevented, damage can certainly be prevented through the design of buildings and other infrastructures that can withstand seismic events. The first step for ensuring earthquake safety of existing structures, is to assess their current vulnerabilities and strengths. It is neither physically nor economically viable to conduct detailed seismic vulnerability assessment of every building. Rapid Visual Screening (RVS) of buildings is often performed to assess building vulnerabilities at large scale. RVS uses visual information to decide if a building is safe to occupy, or requires immediate engineering work for enhancing earthquake safety.

Existing RVS methods are based on data from different countries and are not particularly applicable to the India Himalayan region because of some characteristics that are unique to the buildings in this region. For example, the Himalayan region (as with much of India) has many non-engineered structures. There is also chaotic distribution and growth of infrastructure due to a lack of awareness among the local construction workers and poor planning by the stakeholders. It is therefore essential to use a region-specific RVS guideline that considers factors like local construction practices, typology etc.

Explaining the research, Dr Sandip Kumar Saha, said, "We have devised an effective method to screen reinforced concrete (RC) buildings in the Indian

Himalayan region so that repair work may be prioritized according to the condition of the buildings and the risk from impending earthquakes can be minimized."

Through extensive field surveys, researchers have collected a large amount of data on the types of buildings present in the Mandi region of the Himalayas and the typical attributes present in these buildings that are connected to their earthquake vulnerability. A numerical study was also carried out to establish guidelines for counting the number of stories in hilly buildings for their RVS. Further, based on the vulnerable characteristics present in buildings, an improved RVS method was proposed.

The methodology developed for screening buildings is a simple single-page RVS form that does not require much expertise to fill. It takes into account the various vulnerability attributes that are unique to the buildings in the case study region.

Calculations made using these observations produce a seismic vulnerability score for buildings, which differentiates vulnerable buildings from the more robust ones, and allows better decision-making for maintenance and repair. The computation process is designed such that it minimizes the possibility of human bias or subjectivity of the assessor in scoring a building.

While talking about the benefits of the research, Ms Yati Aggarwal, PhD Scholar, IIT Mandi, said, "We have shown that the proposed method is useful for segregating reinforced concrete buildings in hilly regions according to the damage that they are expected to experience in the event of an earthquake."

The assessment of buildings in the Himalayan region is urgent and essential not only because of the region's general earthquake vulnerability but also because a big earthquake is expected anytime due to the "seismic gap" of the past two centuries. It is believed that a seismic gap (the absence of a large earthquake) represents the time taken to accumulate stress, which is then released in a large earthquake. It's time that human habitats in these areas are bolstered so that they can withstand any mild or severe earthquakes that may occur in the future.

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ABOUT IIT MANDI

IIT Mandi has nine Academic Schools and four major Research Centers. The Schools are the School of Biosciences and Bioengineering, School of Chemical Sciences, School of Mathematical and Statistical Sciences, School of Physical Sciences, School of Mechanical and Materials Engineering, School of Civil and Environmental Engineering, School of Computing and Electrical Engineering, School of Humanities and Social Sciences, and School of Management. The Centers are Advanced Materials Research Centre (AMRC; set up with an investment of Rs. 60 crores), Centre for Design and Fabrication of Electrical Devices (C4DFED; has Rs. 50 crores worth of fabrication tools), BioX Centre (has acquired research equipment worth Rs. 15 crores), and Indian Knowledge System and Mental Health Applications Centre (IKSMHA Centre).

The Institute offers B.Tech. programs in seven different streams, one M.A. program, ten M.Tech. programs, four Ph.D. programs, and one iPh.D. program. The unique, project-oriented B.Tech. curriculum is centered around its 4-year long Design and Innovation

stream. Since the inception of the Institute, IIT Mandi faculty have been involved in over 275 Research and Development (R&D) projects worth more than Rs. 120 crores.

IIT Mandi set up the IIT Mandi iHub and HCI Foundation (iHub; a section-8 company) on its campus at Kamand with significant funding of INR 110 crores from the Department of Science and Technology (DST), Government of India. The iHub is planned to fuel research and technology development, skill development, startup and innovation, and collaborations in the HCI and allied AI/ML areas in India. IIT Mandi is the only second-generation IIT to be featured at rank 7 in the Atal Ranking of Institutions on Innovation Achievements of the Innovation Cell, Ministry of Education, Govt. of India.

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