QUAKE ZONE

Newsletter of EERI IIT Bombay
Student Chapter

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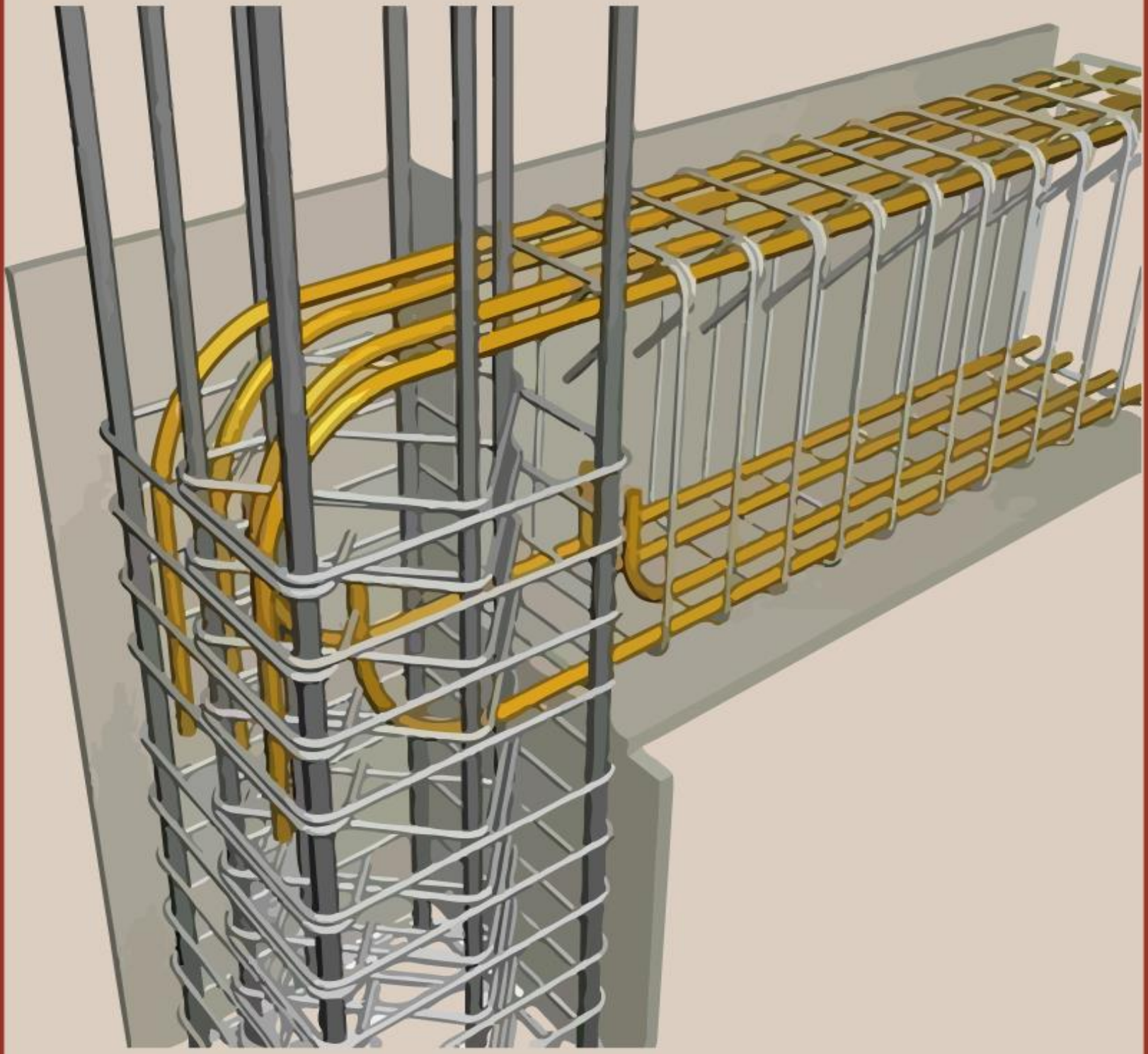


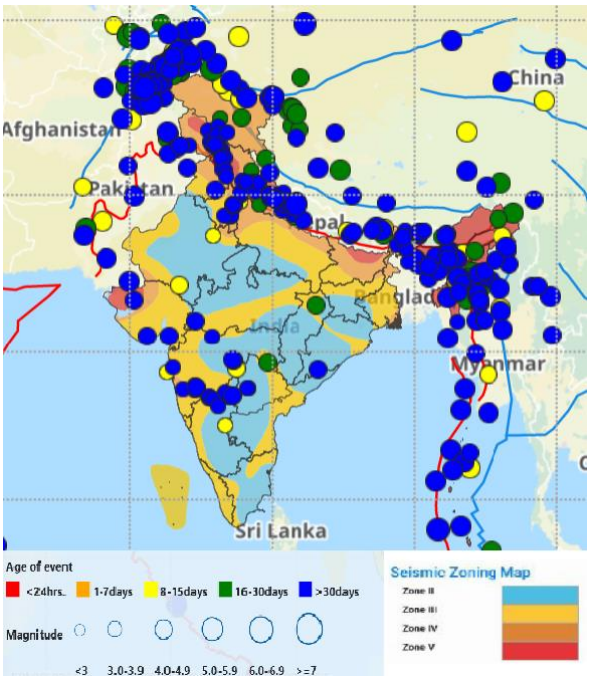
IN THIS ISSUE

DUCTILE DETAILING: A NOVEL IDEATION TOWARDS SEISMIC DESIGN OF RCC STRUCTURES

The basic philosophy behind any load resisting system is to dissipate the energy imparted by the applied load either through deformation or by development of cracks/damages or both. Accordingly, two types of behaviours are recognized, viz., brittle and ductile behaviour. Brittle behaviour leads to abrupt system failure and there is no warning of collapse. On the other hand, ductile behaviour involves substantial deformation of the system before collapse and thus provides an indicator to take the rescue measures before it is too late. Ductile detailing is an approach adopted in the design of reinforced concrete structures to make them behave as ductile systems corresponding to selected critical modes of failure. This is achieved by a combination of a) Stronger brittle mode of failure relative to a ductile one, e.g., bending failure preceding the shear failure not vice versa, and b) Premediated sequential failure of the structural elements, e.g., column to fail later than a beam. This principle give rise to what is called dual design philosophy where structure experiences non-structural damage during minor earthquake and structural damage without collapse during severe earthquake. *(Know more)*

RECENT EARTHQUAKES

Seismic activity in the Indian subcontinent from Jan 01, 2023 to March 31, 2023.



Source: https://seismo.gov.in/MIS/riseq/earthquake

LEARNING FROM EARTHQUAKES
SUMATRA–ANDAMAN EARTHQUAKE

Source: India_Srilanka_tsunami_eeri_socsci_report.pdf

On Dec 26, 2004, many countries including India experienced a mega earthquake of magnitude 9.3 Mw with a depth of 30 km below the mean sea level. The hypocenter of the earthquake was on the junction of India and Burma tectonic plates (3.316°N, 95.854°E). Due to the location of its source being below the Indian ocean, the megathrust led to a huge tsunami across the southern Asia and some part of Africa, with a maximum wave height of around 30 m. It claimed around 2,27,898 reported lives and 2.1 million people were displaced across 14 countries. The event raised the importance of early warning systems during under ocean earthquake. Further awareness was raised towards designing of structures in coastal area as tsunami resistant in addition to seismic loading to avoid such cataclysm in future. *(Know more)*

SHAPE MEMORY ALLOYS FOR EARTHQUAKE ENGINEERING

Shape memory alloys (SMAs) are smart materials that exhibit the amazing properties of superelasticity and shape memory. Superelasticity gives these materials a large elastic strain capacity and shape memory allows to recover from large inelastic strains under the application of heat. From the perspective of earthquake engineering, SMAs provide high energy dissipation capacity via hysteretic damping and large strain capacity with full shape recovery to zero residual strain. Consequently, these materials can be used in the manufacture and design of seismic dampers, base isolation systems, and dissipative braces. SMAs can be embedded or attached to important structural components, and changes in their characteristics, after an earthquake, can be used to detect seismic damage. Engineers can use this to determine the structural intregity of a building following an earthquake and to plan the necessary upgrades or repairs.*(Know more)*

SEISMOTECH
SHAKE2000

SHAKE2000 is a software tool used in earthquake engineering for analysing the response of a system of soil layers to earthquake shear waves. It is widely used for designing foundations and retaining walls, which are critical elements in ensuring the safety and stability of civil infrastructure during earthquake. SHAKE2000 models the soil layers as a series of one-dimensional layers, each with its own properties such as density, shear modulus, and damping ratio. The software can also account for the presence of water in the soil layers, which can significantly affect their behaviour during earthquakes. The software uses Equivalent Linear Method (ELM) to simulate the non-linear behaviour of soil layers subjected to seismic waves. The method employs an iterative procedure to arrive at a strain-compatible shear modulus and damping ratio for each soil layer. *(Know more)*

Download: Shake2000

EARTHQUAKE ENGINEERING CONFERENCES AND EVENTS

- 9th International Conference on Computational Methods in Structural Dynamics and Earthquake Engineering. Athens, Greece, June 12-14, 2023. Check out for more at https://2023.compdyn.org/
- 10th International Conference on Experimental Vibration Analysis for Civil Engineering Structures, Politecnico di Milano, Italy, Aug 30- Sep 1 2023. Check out for more at https://www.evaces2023.polimi.it/

EERI IIT BOMBAY NEWS
SEMINAR ON DESIGN & CONSTRUCTION OF CABLE-STAYED & EXTRADOSED BRIDGES

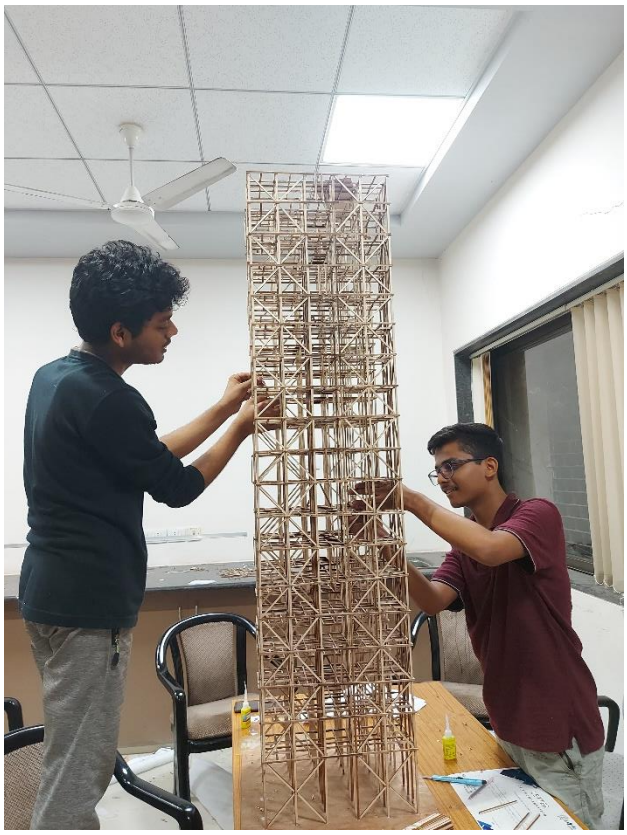
On, March 02, 2023, a seminar on the "Design and Construction of Cable-stayed and Extradosed bridges was organized by the EERI IIT Bombay Student Chapter. Mr. Umesh Rajeshirke, Managing Director, Spectrum Consultants Pvt. Ltd, delivered the talk. The seminar was attended by undergraduate as well as postgraduate students of the civil engineering department. The students were made aware of the important considerations in the design of these bridges. Moreover, a brief introduction of the challenges that are typically encountered in the field during the construction stage of these bridges was also provided.

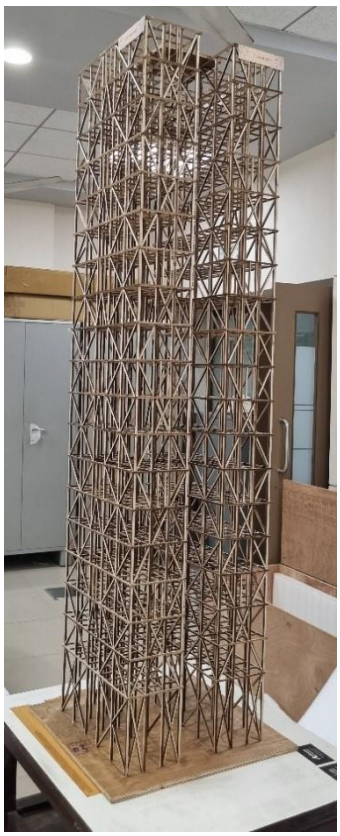
SEISMIC DESIGN COMPETITION 2023

Seismic Design Competition (SDC) is a prestigious competition for undergraduates held annually by EERI Student Leadership Council (SLC). This year it was held in San Francisco, USA during 11-14 April 2023. A total of 37 teams from different universities worldwide participated in the competition with IIT Bombay being the only Indian team.

MODEL CONSTRUCTION

IIT Bombay SDC team was divided into Architectural, Structural, and Construction groups. With drawings from the Architectural and Structural groups, the Construction group built two similar and stunning 19-story Bay View twin-tower building models using balsa wood. One of the models was tested on the shake table in Heavy structures laboratory at IIT Bombay and the other model was transported for the competition day.





PRESENTATION

The presentation aimed to discuss various functional and design requirements that were considered during the planning and designing stage of the constructed model. The finalized model was designed to be safe as per the geotechnical investigations of the designated site. Moreover, the architectural and structural aspects including the green construction potential exhibited by the proposed model were discussed.

SHAKE DAY

The day of competition involved subjecting each team's model to two devastating ground motions. The models were subjected to shaking in only one direction that was selected randomly based on a coin toss. Our model withstood both the ground motions without collapsing. It was a good learning experience for the entire team.

Team IIT Bombay (20th SDC 2023)


Shashank Nyol


Shivam Thanke


Mihir Sangode


Daksh Bansal


Sairaj Gaddam


Piyush Raj


Hrithik Mhatre


Mariyam Saqib


Manish Bhavsar


Udank Jain


Aditya Umate


Shubhang Shanghvi


Rushikesh Kachhava


Pintu Kumar Saw


Vinay Kahar


Divyansh Agarwal


Anmol Bhatwalkar

EERI IIT Bombay Student Chapter

ALL ABOUT EERI

The Earthquake Engineering Research Institute (EERI) is the leading non-profit membership organization dedicated to understanding earthquake risk and increasing earthquake resilience in communities worldwide. EERI membership includes researchers, practitioners, and students in engineering, geoscience, social science, architecture, planning, government, emergency management, public health, and policymaking. For more info https://www.eeri.org/

EERI IIT BOMBAY STUDENT CHAPTER

The EERI IIT Bombay student chapter aims to learn about earthquakes and their social, economic, and environmental impact and practices to reduce earthquake risk.This Chapter motivates students to pursue a career in the field of earthquake engineering and related fields. EERI Student Chapter at IIT Bombay provides a platform to participate in several EERI competitions and activities.

SUPPORT US

Sponsors from a variety of industries and academic areas are invited to support the EERI IIT Bombay Students Chapter. Our alliance will be built on teamwork, with reciprocal benefits for both parties.

BECOME EERI MEMBER

EERI membership will help you stay current with the latest scientific and engineering advances, better understand the social and economic impacts of earthquakes and serve as an advocate for seismic safety. Follow the link: join-eeri-today

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OBEROI REALTY

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EXECUTIVE MEMBERS: CHARU SRIVASTAVA, DAKSH BANSAL

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