ASSOCIATION OF CONSULTING CIVIL ENGINEERS (INDIA)
KAKINADA CENTRE

INVITES YOU TO ATTEND THE WEBINAR ON

FORENSIC STRUCTURAL ANALYSIS ON FAILURE OF STRUCTURES AT RECENT BANGKOK EARTHQUAKE

Speaker: Dr. Koka Venkata Narasimha Rao

Chief Consultatnt, Aakruthi Consultants, Kakinada

On Sunday, 20th April, 2025, 11.00Am

Please Join Through the Webex Link

https://acceindia.webex.com/acceindia/j.php?MTID=m05e4021adaef5328937dff50dbbef43b

Meeting number: 2517 102 0100
Password: 12345

No Registration Fee

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TERM 2023 - 2025

PRAGATI ENGINEERING COLLEGE

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Learning is Supreme Duty

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DEPARTMENT OF CIVIL ENGINEERING

PEC/CE/Circular

Date: 17-04-2025

CIRCULAR

This is to inform that Department of CIVIL ENGINEERING In Association with Association of Consulting Civil Engineers (India), Kakinada centre cordially organizing a Webinar on **"FORENSIC STRUCTURAL ANALYSIS ON FAILURE OF STRUCTURES AT RECENT BANGKOK EARTHQUAKE"** by **"Dr. KOKA VENKATA NARASIMHA RAO, Chief consultant AKRUTI Consultants, KAKINADA"** on Sunday 20Th April 2025.

Link:https://acceindia.webex.com/acceindia/j.php?MTID=mddbad0f3ef9455dd03bfef3e1566c9db

All the students and faculty members are requested to utilize this opportunity with your presence.

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Circulate among Faculty,
Class Rooms of II, III & IV years

Report

"FORENSIC STRUCTURAL ANALYSIS ON FAILURE OF STRUCTURES AT RECENT BANGKOK EARTHQUAKE"

– Dr. KOKA VENKATA NARASIMHA RAO, Chief consultant AKRUTI Consultants, KAKINADA

Date: 21st APRIL ,2025

Department of CIVIL ENGINEERING and Association of Consulting Civil Engineers (India), PRAGATI Engineering College, SURAMPALEM organized a WEBINAR on "**FORENSIC STRUCTURAL ANALYSIS ON FAILURE OF STRUCTURES AT RECENT BANGKOK EARTHQUAKE**" by "**Dr. KOKA VENKATA NARASIMHA RAO, Chief consultant AKRUTI Consultants, KAKINADA**" on 20th April 2025, 11:00 Am (IST) Onwards. He explained various concepts about **FORENSIC STRUCTURAL ANALYSIS** and **causes for FAILURE OF STRUCTURES DUE TO EARTHQUAKES.** He explained about forensic structural analysis on failure of structures.

Overview of Forensic Structural Analysis Methodology

- **Definition and Purpose:** The initial segment defined forensic structural analysis as the systematic investigation of structural failures to determine the root cause, contributing factors, and lessons learned. Its purpose extends beyond liability to improving design practices and building codes.
- **Phases of Investigation:** The typical phases include:
  - **Data Collection:** Gathering site observations, photographs, building plans, construction records, material specifications, seismic data (ground motion records), and eyewitness accounts.
  - **Visual Inspection and Damage Assessment:** Documenting damage patterns, crack mapping, and identifying areas of concentrated stress.

- Material Testing: Laboratory analysis of concrete, steel, and other construction materials to verify properties against design specifications and assess quality.
  - **Structural Analysis and Modeling:** Performing detailed engineering analyses, including finite element modeling and reverse engineering, to simulate the structural behavior under seismic loads and compare it with observed damage.
  - **Failure Mechanism Identification:** Determining the specific mode of failure (e.g., shear failure, flexural failure, buckling, liquefaction, pounding).
  - **Reporting and Recommendations:** Presenting findings, conclusions, and recommendations for preventing future failures.

Common Structural Failure Modes in Earthquakes

Speakers elaborated on typical failure modes observed in earthquake-prone regions, providing context for the Bangkok incident:

- **Soft Story Collapse:** Disproportionate flexibility or weakness in a particular story, often the ground floor, leading to excessive deformation and collapse. This can be due to open ground floors for parking or commercial spaces.
- **Pounding:** Collision between adjacent buildings during an earthquake dueating to insufficient separation gaps.
- **Column Failure:** Shear failure, flexural failure, or buckling of columns, especially in older structures with inadequate confinement reinforcement.
- **Beam-Column Joint Failure:** Weak connections between beams and columns, leading to brittle failure.
- **Shear Wall and Infill Wall Damage:** Diagonal cracking (X-shaped cracks) or crushing of shear walls, and damage to non-structural infill walls that can interact negatively with the structural frame.
- **Foundation Failure and Soil Liquefaction:** Loss of bearing capacity of the soil, especially saturated sandy soils, leading to settlement, tilting, or flotation of structures. Bangkok's soft soil basin was highlighted as a significant factor amplifying ground motion and potentially contributing to such issues.
- **Non-structural Damage:** Failure of non-structural elements (e.g., cladding, partitions, suspended ceilings, MEP systems) which, while not leading to collapse, can pose significant hazards and render buildings unusable.

Preliminary Findings and Analysis of the Bangkok Collapse

While official investigations are ongoing, the webinar presented preliminary insights into the 30-story building collapse:

- **Amplified Ground Motion:** The soft soil conditions in Bangkok significantly amplified the ground motion from the Myanmar earthquake, leading to higher seismic forces on structures.
- **Under-Construction Status:** The fact that the building was under construction was a critical factor. An incomplete structural system may not have developed its full intended

strength and stiffness, making it more vulnerable to seismic forces. The structural system might not have been "acting as a system" at the time of the earthquake.

- **Potential Material Deficiencies:** Reports indicated that at least one steel bar used in the collapsed building was substandard. This raises concerns about material quality control and compliance with specifications.
- **Design and Construction Protocol Adherence:** The ongoing investigation is scrutinizing whether proper building protocols, design codes, and construction practices were rigorously followed. This includes assessing the seismic design provisions applied (or not applied) to the structure.
- **Lack of Redundancy/Ductility:** Early observations suggest potential issues with the building's ability to deform without losing its load-bearing capacity (ductility) or having alternative load paths (redundancy) if primary elements failed.

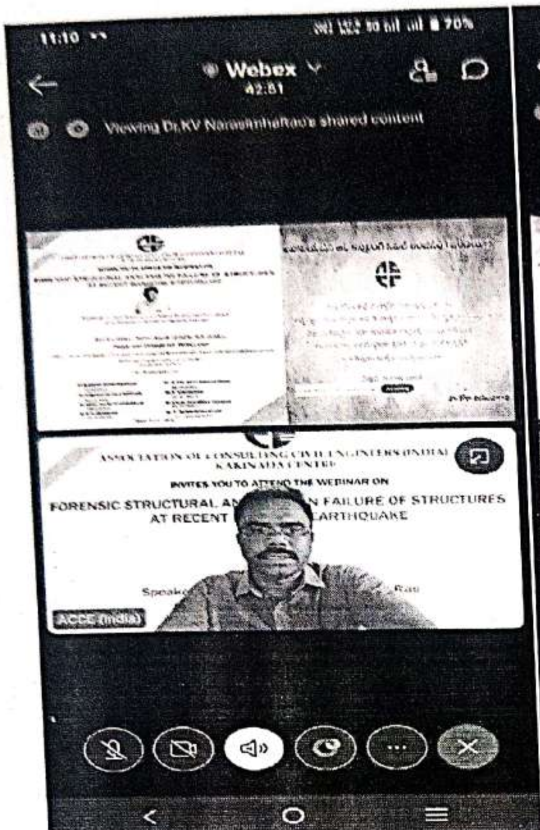
Implications for Seismic Design and Building Codes in Thailand

The Bangkok earthquake has underscored the urgency of reviewing and reinforcing seismic design and building code enforcement in Thailand, particularly for high-rise structures:

- **Stricter Seismic Design Requirements:** The need for updated and rigorously enforced seismic building codes tailored to Bangkok's specific geotechnical conditions (soft soil basin) was emphasized. This includes considering increased seismic coefficients and design for amplified ground motion.
- **Quality Control and Supervision:** The incident highlighted the paramount importance of stringent quality control during construction, including material testing and independent third-party inspections.
- **Importance of "As-Built" Documentation:** Accurate "as-built" drawings and construction records are crucial for forensic investigations and future structural assessments.
- **Retrofitting Existing Structures:** While the webinar focused on the recent collapse, discussions touched upon the broader challenge of assessing and retrofitting existing buildings that may not meet current seismic standards.
- **Public Awareness and Education:** The event prompted a significant increase in public concern regarding building safety, emphasizing the need for public awareness campaigns on earthquake preparedness and structural integrity.

Total number of 55 members attended the session out of which 40 Pragati students had participated the session.

Some of the glimpses of webinar are shown below.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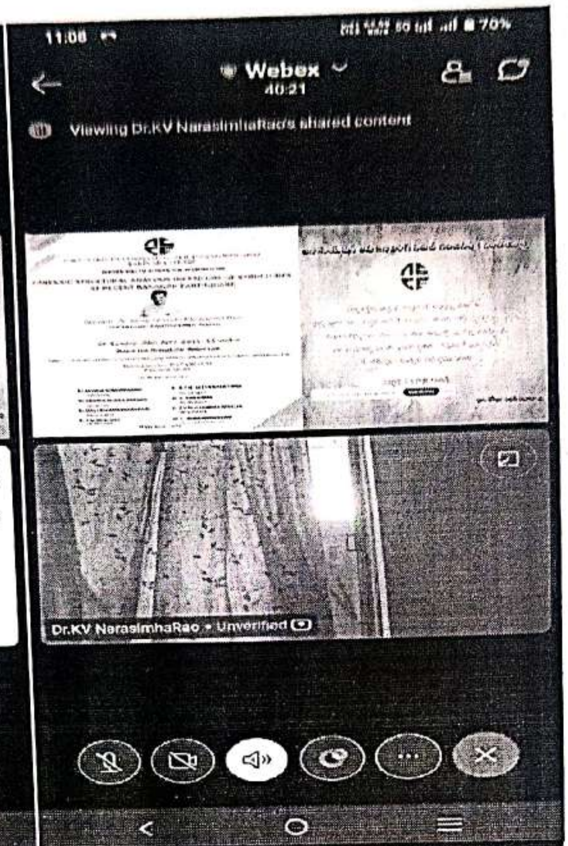
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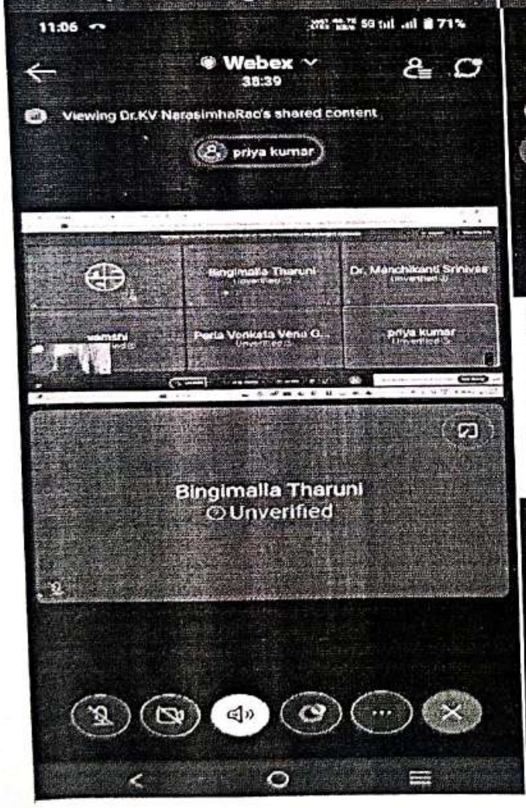
Dr.KV NarasimhaRao • Unverified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Bingimalla Tharuni
Dr. Manchikanti Srinivas
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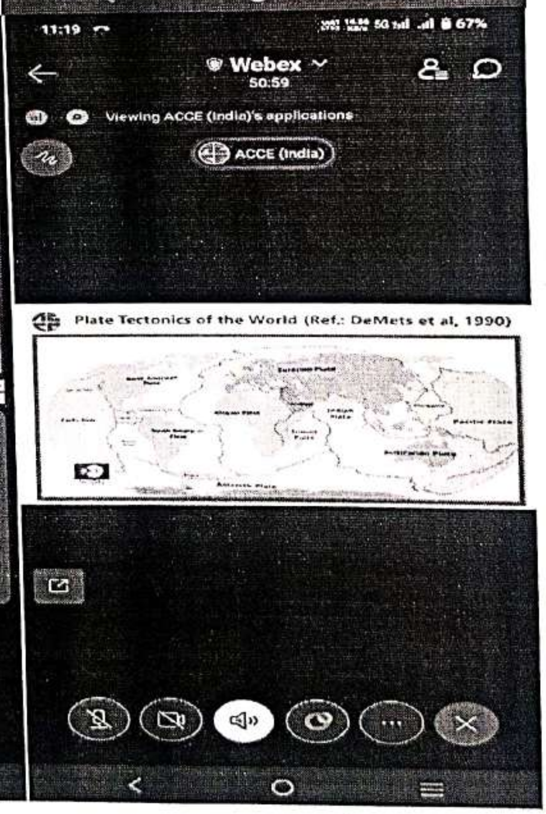
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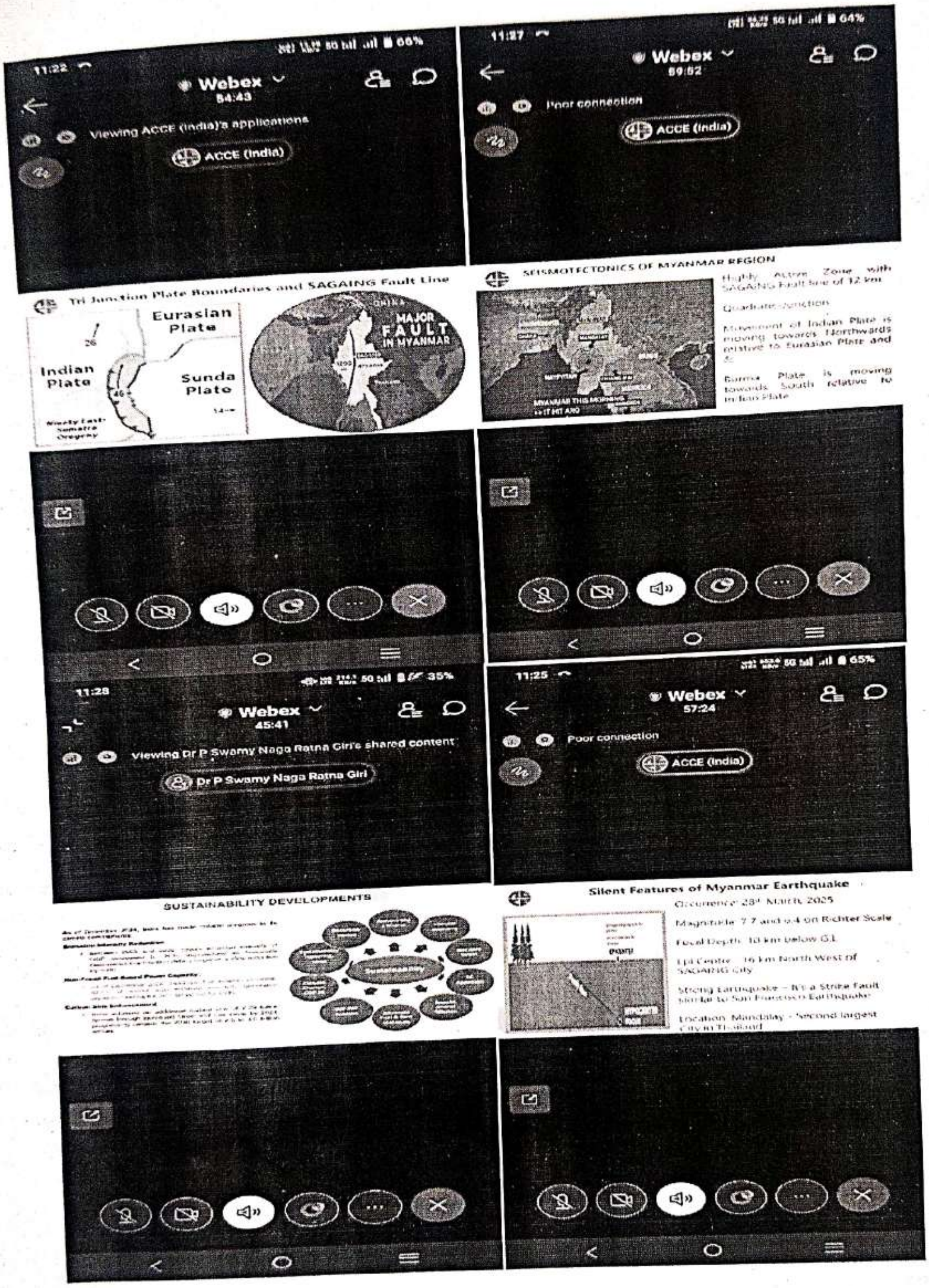
ACCE (India)
Plate Tectonics of the World (Ref.: DeMets et al, 1990)



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Poor connection
ACCE (India)
Tri Junction Plate Boundaries and SAGAING Fault Line
Eurasian Plate
Indian Plate
Sunda Plate
MAJOR FAULT IN MYANMAR
SEISMOTECTONICS OF MYANMAR REGION
Highly Active Zone with SAGAING Fault line of 12 km
Quadruple Junction
Movement of Indian Plate is moving towards Northwards relative to Eurasian Plate and
Burma Plate is moving towards South relative to Indian Plate
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Webex
45:41
Viewing Dr P Swamy Naga Ratna Giri's shared content
Dr P Swamy Naga Ratna Giri
11:25
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57:24
Poor connection
ACCE (India)
SUSTAINABILITY DEVELOPMENTS
Silent Features of Myanmar Earthquake
Occurrence 28th March 2025
Magnitude 7.7 and 6.4 on Richter Scale
Focal Depth 10 km below G.L
Epi Centre - 16 km North West of SAGAING city
Strong Earthquake - It's a Strike Fault Similar to San Francisco Earthquake
Location Mandalay - Second largest City in Thailand

HOD-CE

DEPARTMENT OF CIIVL ENIGNEERING
ACCE (I) STUDENT CHAPTER
LIST OF STUDENTS ATTENDED

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Date: 20-04-2025

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