ASSOCIATION OF CONSULTING CIVIL ENGINEERS(INDIA)

KAKINADA CENTRE

WEBINAR ON

CHENAB BRIDGE GEOTECHNICAL INVESTIGATION -A CASE STUDY

359m

324m

World's Highest Rail Bridge and the World's Highest Arch Bridge.

Speaker: Dr. Gali Madhavi Latha

Professor,Department of Civil Engineering, IISc, Bangalore

On Saturday, 11th January 2025, 06.00Pm

Please Join Through the WebEx Link

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Meeting number: 2515 041 6771 Password: 12345

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PEC/CE/Circular

Date: 04-01-2025

CIRCULAR

This is to inform that Department of CIVIL ENGINEERING In Association with Association of Consulting Civil Engineers (India), Kakinada centre cordially organizing an Webinar on **"CHENAB BRIDGE GEOTECHNICAL INVESTIGATION – A CASE STUDY"** by **"Dr. GALI MADHAVI LATHA Professor, Department of Civil Engineering, IISC, Bangalore"** on Saturday 11th January 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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DEPARTMENT OF CIVIL ENGINEERING

Report

CHENAB BRIDGE GEOTECHNICAL INVESTIGATION – A CASE STUDY

– Dr. GALI MADHAVI LATHA Professor, Department of Civil Engineering, IISC, Bangalore

Date: 20th Jan, 2025

Department of CIVIL ENGINEERING and Association of Consulting Civil Engineers (India), PRAGATI Engineering College, SURAMPALEM organized a WEBINAR on "**CHENAB BRIDGE GEOTECHNICAL INVESTIGATION – A CASE STUDY**" by **Dr. GALI MADHAVI LATHA Professor, Department of Civil Engineering, IISC, Bangalore**" on 09th Jan 2025, 11:00 Am (IST) Onwards. She explained various concepts about **CHENAB BRIDGE GEOTECHNICAL INVESTIGATION**. She also explained about importance of geotechnical investigations and ground behavior considerations in infrastructure projects. She also explained some key reasons why geotechnical investigations are important:

Geotechnical Investigations Overview

The geotechnical investigations for the Chenab Bridge were crucial in evaluating the subsurface conditions of the site, determining the appropriate foundation system, and understanding potential geohazards such as landslides, seismic activity, and liquefaction. The investigations were conducted in multiple phases, which included:

- **Site Survey and Mapping:** Detailed geological mapping of the site to identify surface and subsurface conditions, including the type of rock and soil formations.
- **Borehole Drilling and Sampling:** Boreholes were drilled at various locations along the planned alignment to obtain soil and rock samples for laboratory testing.
- **Laboratory Testing:** Soil samples from boreholes underwent laboratory analysis to determine key parameters such as shear strength, compressibility, permeability, and the potential for liquefaction.

- **In-situ Testing:** In-situ tests like Standard Penetration Test (SPT), Cone Penetration Test (CPT), and Dynamic Cone Penetration Test (DCPT) were conducted to evaluate the soil's behavior under various load conditions.
- **Geophysical Surveys:** Geophysical techniques were employed to assess the rock quality, seismicity, and integrity of the subsurface materials.

4. Key Findings from the Geotechnical Investigations

The investigations provided critical information about the site's geological and geotechnical properties, leading to the following major findings:

1. **Rock Quality**: The region consists primarily of hard sedimentary rocks, including limestone, shale, and sandstone. The rocks exhibited high compressive strength, which was ideal for supporting the bridge piers. However, some areas contained pockets of fractured rock, requiring additional stabilization measures.
2. **Soil Conditions**: The soil conditions along the riverbed and slopes were primarily composed of loose, granular soil, which could lead to settlement under heavy loading. In certain locations, thick layers of alluvium were found, requiring specific foundation design measures to prevent excessive settlement.
3. **Groundwater Levels**: Groundwater levels in the area fluctuated significantly, especially near the riverbed, where artesian conditions existed. This posed challenges for excavation and foundation design, necessitating special waterproofing and drainage techniques.
4. **Seismic Activity**: The region lies in a seismically active zone, with the potential for high seismic forces during an earthquake. The geotechnical investigations included seismic studies to assess the soil's response to ground shaking. The results influenced the design of the foundation to resist seismic forces.
5. **Soil Liquefaction Potential**: Liquefaction analysis was conducted for the sandy soils found near the riverbed. The results indicated a moderate risk of liquefaction during strong seismic events, requiring mitigation strategies such as soil compaction and deep foundations.
6. **Landslide and Slope Stability**: The steep slopes surrounding the bridge site were identified as potentially unstable during heavy rainfall or seismic shaking. Slope stability analysis was conducted, which influenced the design of retaining walls and other stabilization measures to prevent landslides.

5. Foundation Design Recommendations

Based on the geotechnical investigation results, several foundation types and design recommendations were proposed:

1. **Deep Pile Foundations:** Due to the loose soil layers and the presence of fractured rock in some areas, deep pile foundations were recommended to provide sufficient load-bearing capacity and minimize settlement. The pile foundations would anchor the bridge to more stable rock layers beneath the soil.

2. **Drilled Shafts**: In areas with harder rock formations, drilled shafts were suggested as a cost-effective alternative to pile foundations, offering additional stability for the high piers of the bridge.
3. **Soil Stabilization**: Areas with loose granular soils along the riverbed required soil stabilization techniques, including soil compaction and grouting, to prevent settlement and ensure the bridge's long-term stability.
4. **Seismic Design Considerations**: The foundation design incorporated provisions to resist the effects of seismic forces, including flexible connections between the foundation and the bridge superstructure to absorb and dissipate seismic energy.
5. **Retaining Walls and Slope Stabilization**: Retaining walls and ground anchoring techniques were recommended for areas with steep slopes to prevent landslides and ensure the safety of the bridge and surrounding infrastructure.

6. Challenges and Mitigation Strategies

Several challenges were encountered during the geotechnical investigation process:

1. **Difficult Terrain**: The remote and rugged terrain of the Chenab River gorge made site access challenging for drilling and testing equipment. Helicopter transportation and manual labor were used to overcome access limitations.
2. **Fluctuating Groundwater Levels**: The fluctuating groundwater levels made drilling and soil sampling difficult. To mitigate this, groundwater monitoring wells were installed to track water level fluctuations over time.
3. **Seismic Risk**: The high seismic risk of the region required careful design to ensure that the bridge could withstand significant earthquakes. The geotechnical team worked closely with structural engineers to incorporate seismic-resistant features into the foundation design.
4. **Environmental and Safety Concerns**: The site is located in a sensitive ecological zone, requiring environmental impact assessments and adherence to safety protocols to protect the local ecosystem and workers during the investigation and construction phases.

A total number of 40 participants attended the webinar out of which 22 Pragati students attended.

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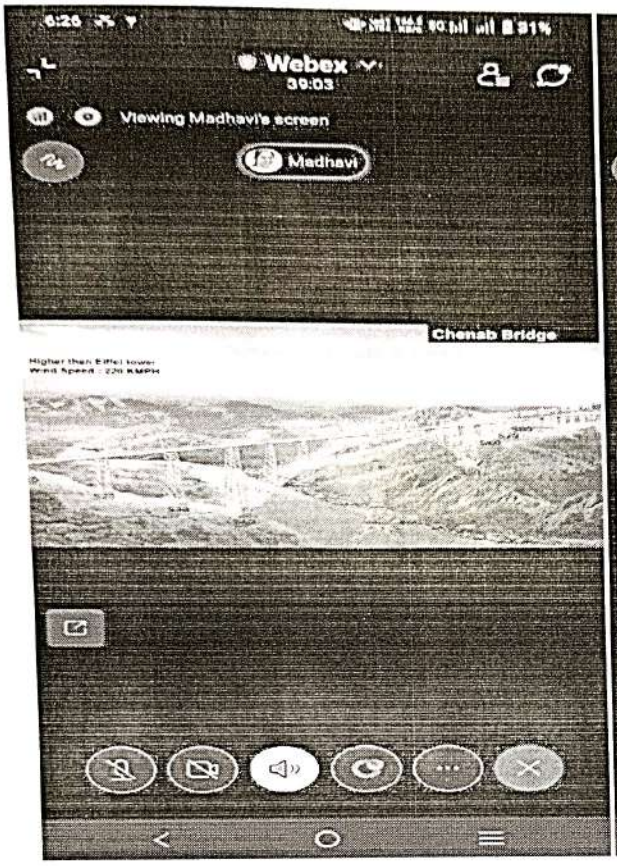
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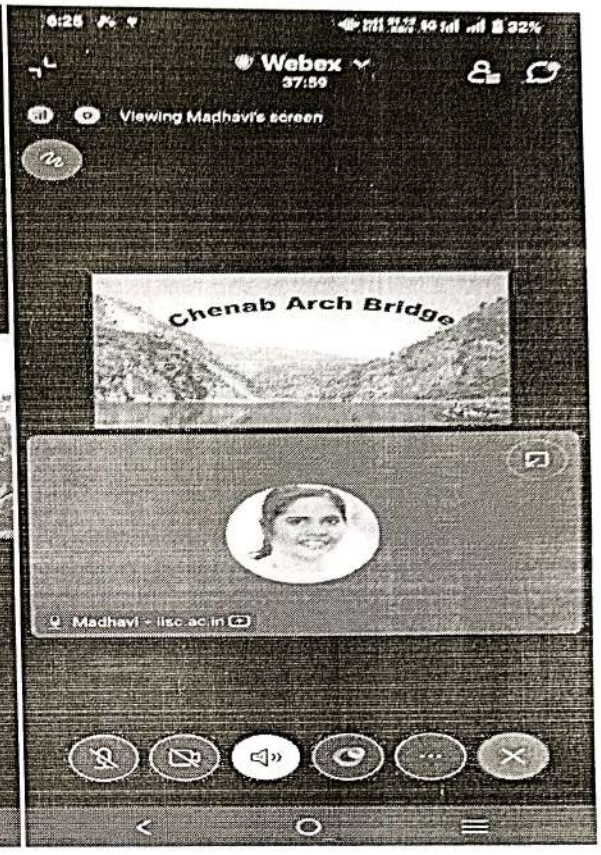
Madhavi
Chenab Bridge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Participants (40)
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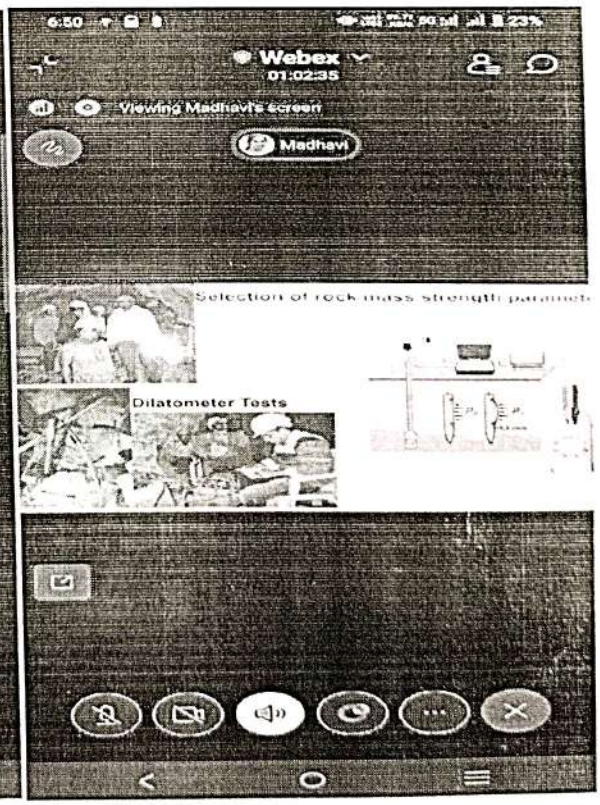
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Dilatometer Tests

DEPARTMENT OF CIIVL ENIGNEERING
ACCE (I) STUDENT CHAPTER
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Event: "CHENAB BRIDGE GEOTECHNICAL INVESTIGATION – A CASE STUDY"

Date: 09-01-2025

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