Construction of 10 Storied Building in 48 Hours in Mohali

Technical Highlights

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Executed by:
M/s Synergy Thrislington, Mohali

Organization

- **Introduction**
  - **CSIR-SERC**
  - **Topic**
- **Emerging Trends**
- **Seismic Experimental & Analytical Studies**
- **Launch & Construction - Highlights**
- **Concluding Remarks**

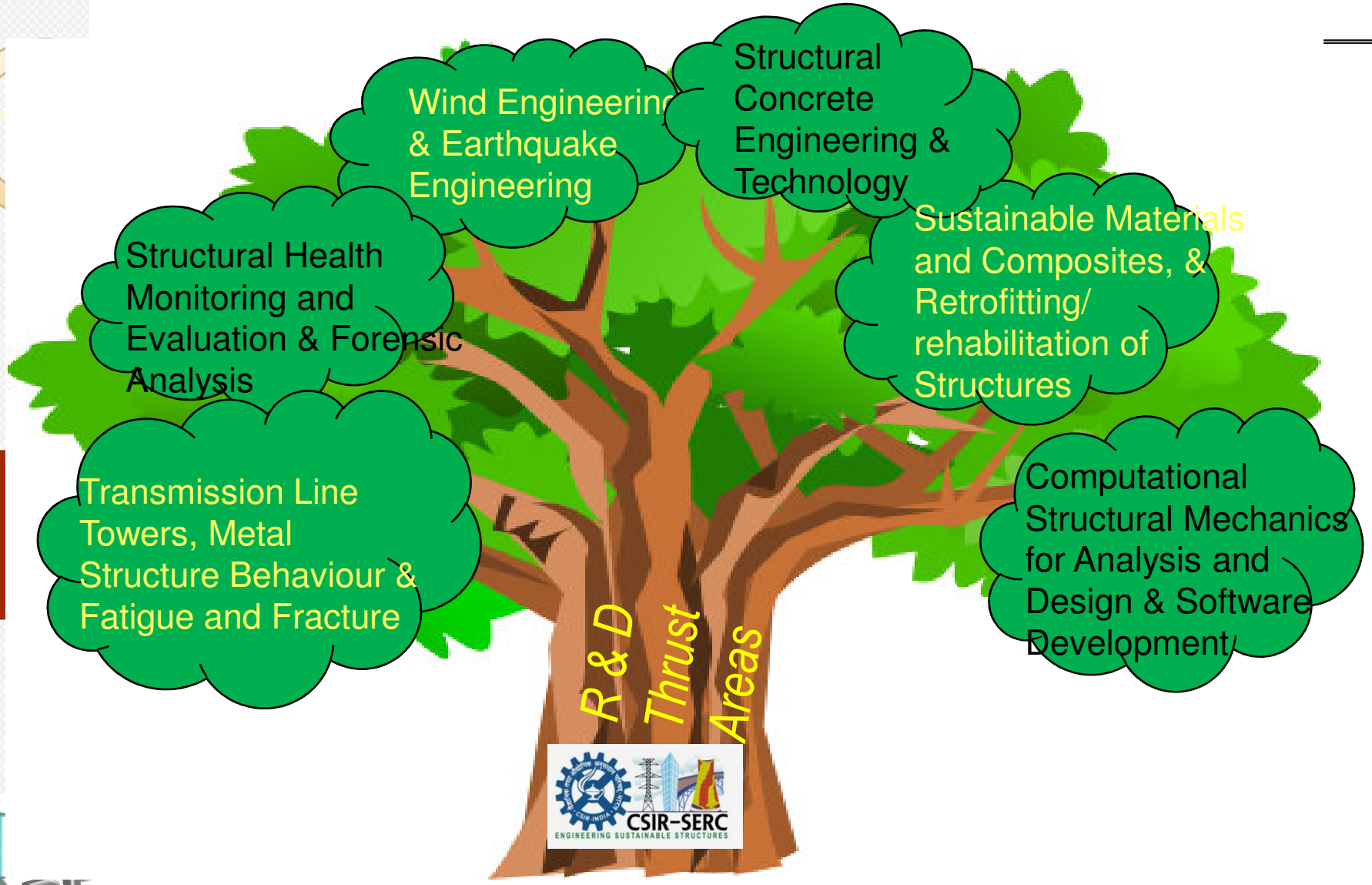
CSIR - Structural Engineering Research Centre

A premier R&D Institution under CSIR pursuing advanced and high quality Research in Structural Engineering augmented with

- **State-of-the-art Unique Facilities for Structural Testing & Evaluation**

- **Computational Facilities**

R&D Thrust Areas



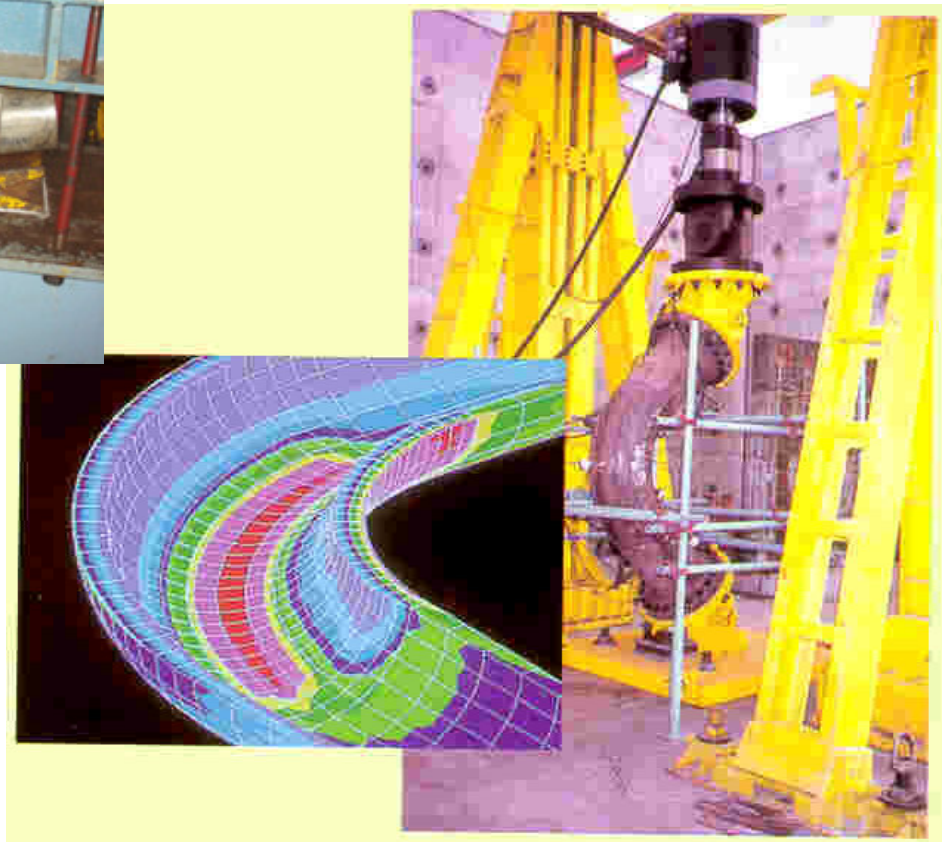
Major Facilities

- Structural Health Monitoring Laboratory
- ASTaR Laboratory
- Library
- Steel Structures Research Facility
- Structural Testing Laboratory
- Advanced Computational Mechanics Facilities
- Advanced Concrete Testing & Evaluation Laboratory
- Tower Testing Research Station
- Advanced Materials Laboratory
- Wind Engineering Laboratory
- Fatigue & Fracture Laboratory

SERC

Wind Engineering Laboratory

Fatigue & Fracture Laboratory



Advanced Seismic Testing & Research Laboratory (ASTaR Lab)

Tri-axial Shake Tables (4mx4m & 2mx2m)

Testing of Multi-Storied Frame

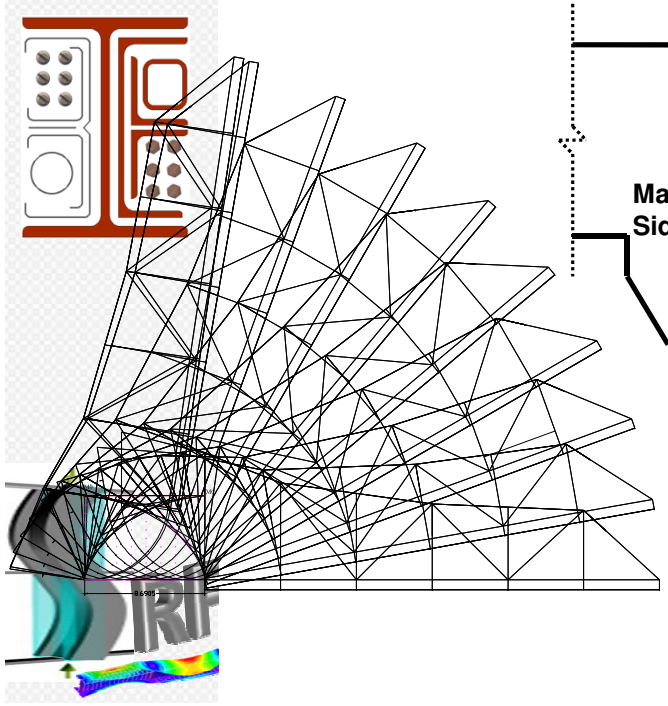
Tower Testing Research Station

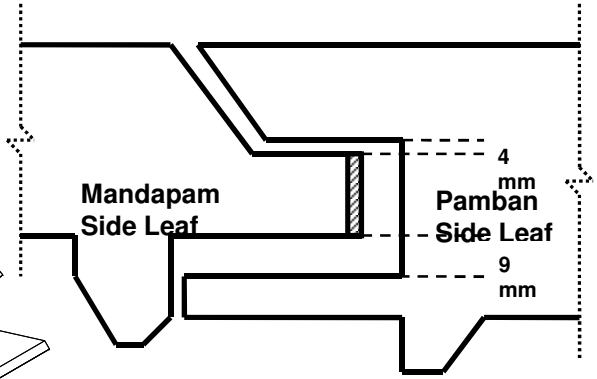
Testing of Microwave/
Transmission Line
Towers in progress

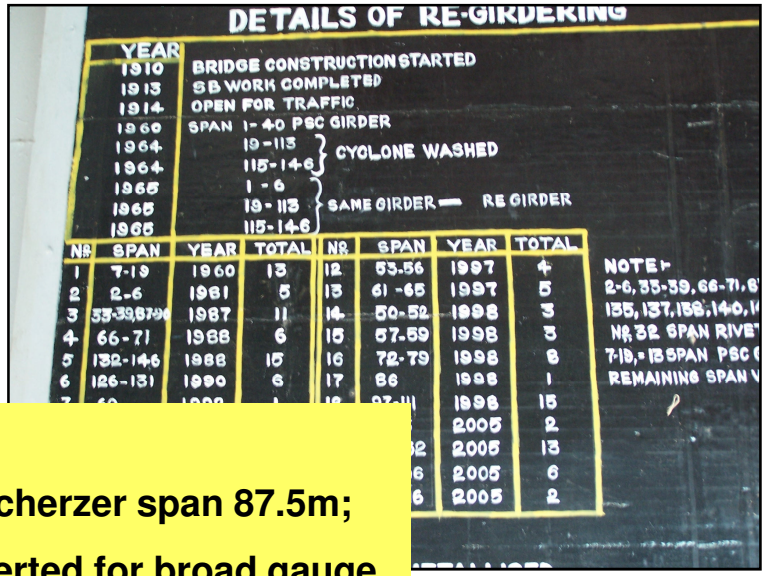
Load Tests on a Bridge

FEA & Design of Pamban Railway Bridge

What are the challenges? & Why SERC?





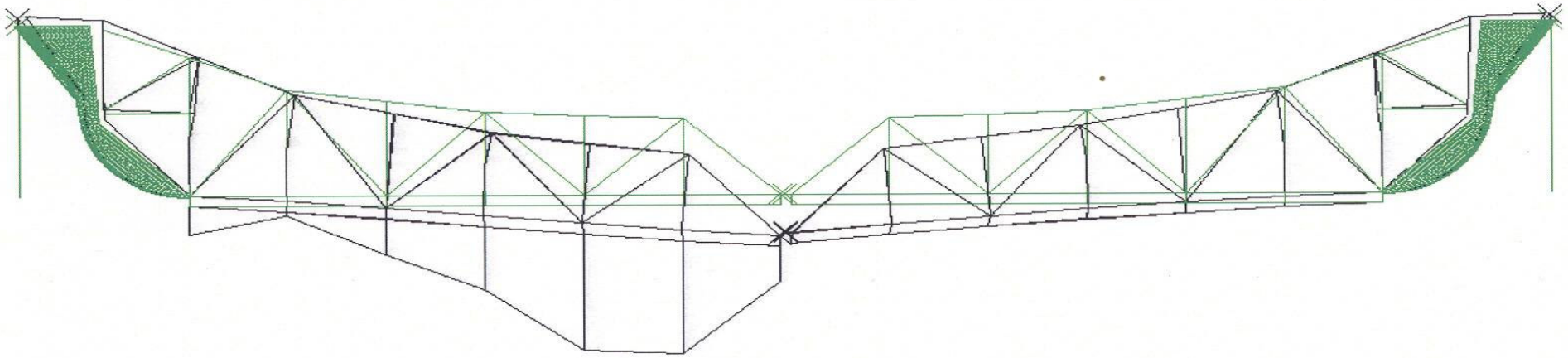


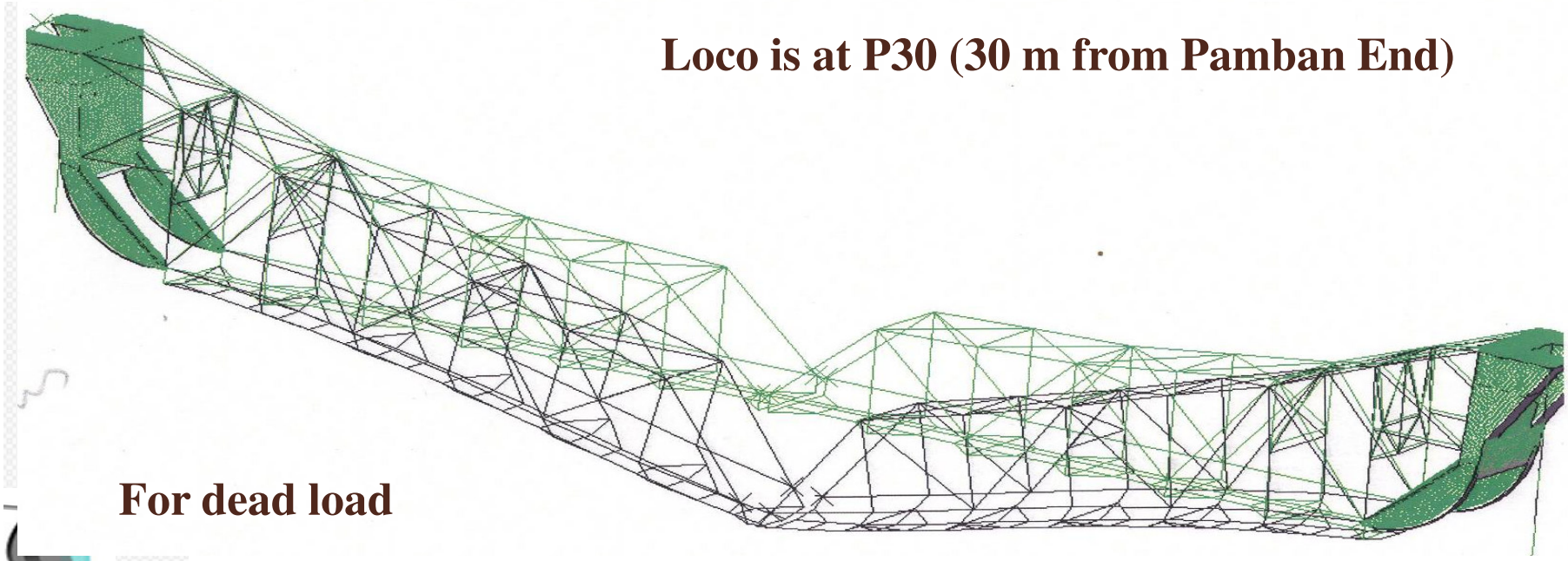
Built in 1911-1913

Total length about 2km, Scherzer span 87.5m;

Bridge successfully converted for broad gauge based on recommendations of CSIR-SERC

FEA & Design of Pamban Railway Bridge

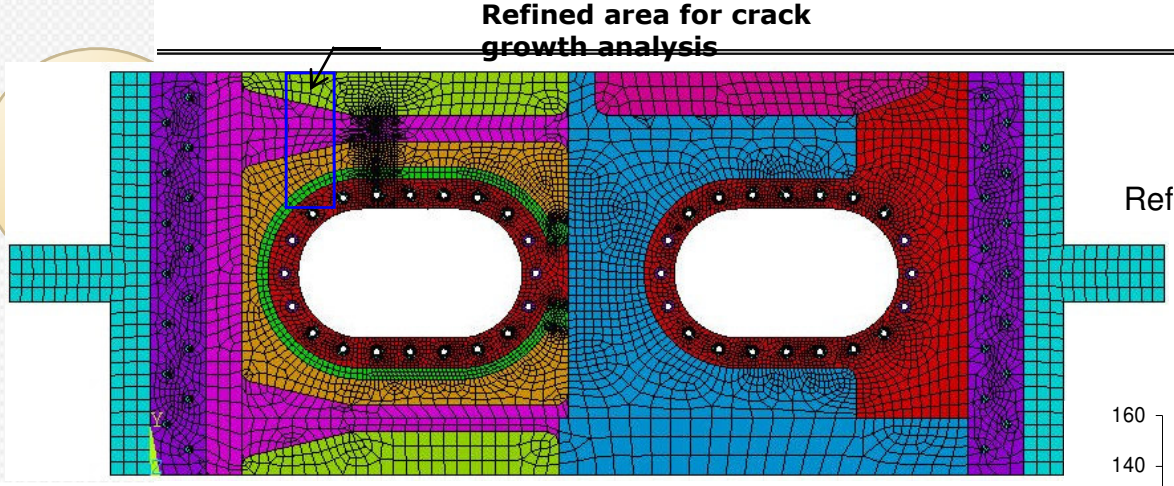




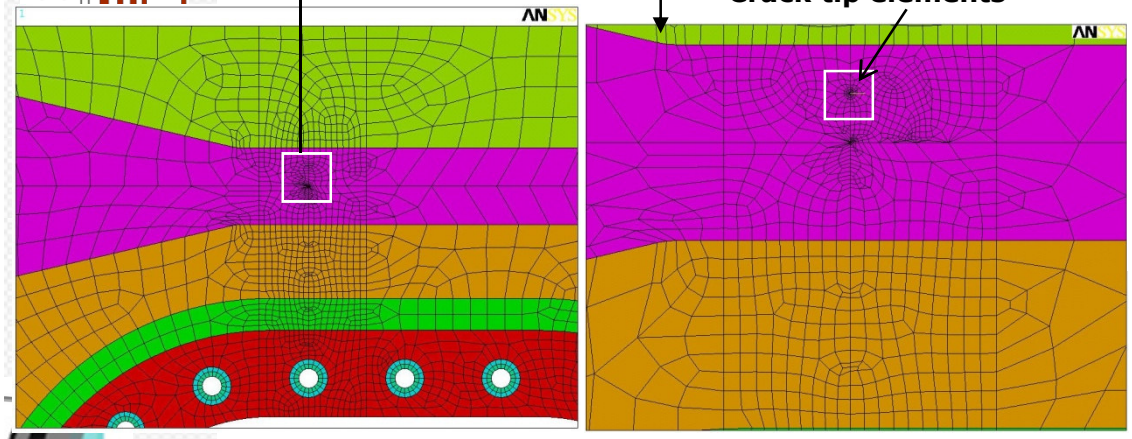
Loco is at P30 (30 m from Pamban End)

For dead load

Damage Tolerant Evaluation of Wing Bottom Skin Panel



No. of elements 9707; No. of nodes 30274;
Plate/Shell elements 9363; No. of Eqns. 181572;
Stiffener Shell elements 344;

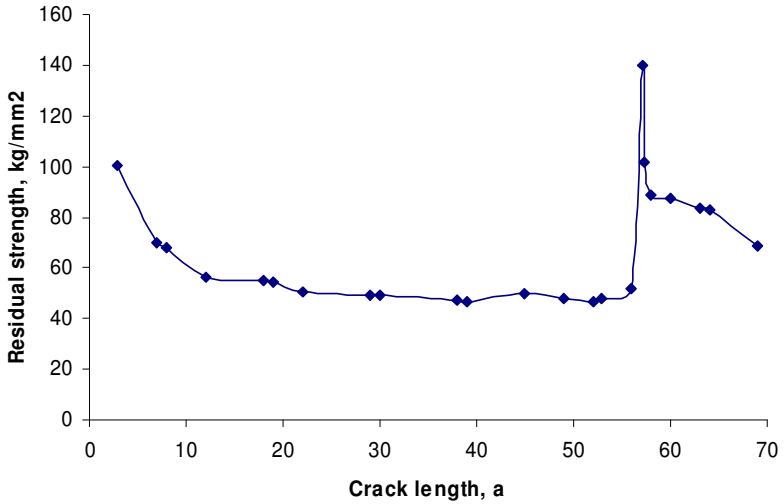


FE idealisation with crack tip elements

Zoomed view indicating crack tip elements

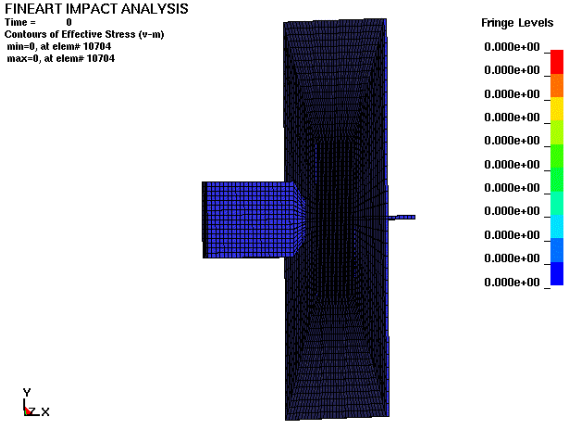
SARAS Aircraft

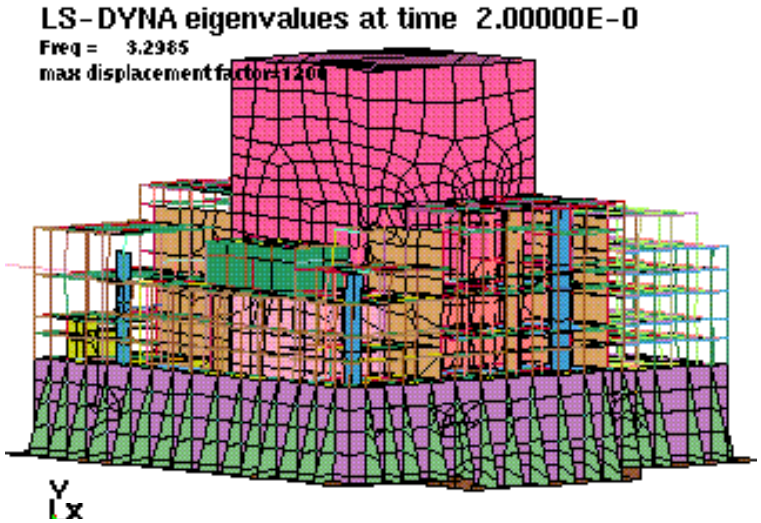
Refined FE Model for SIF Computation

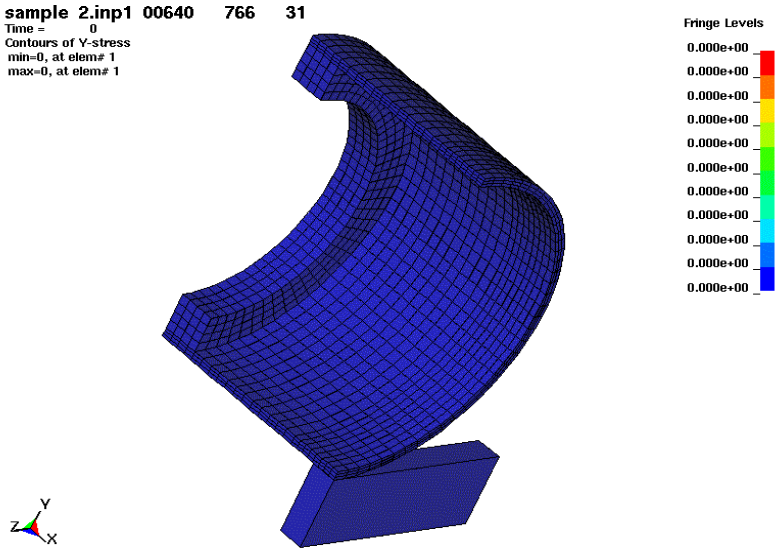


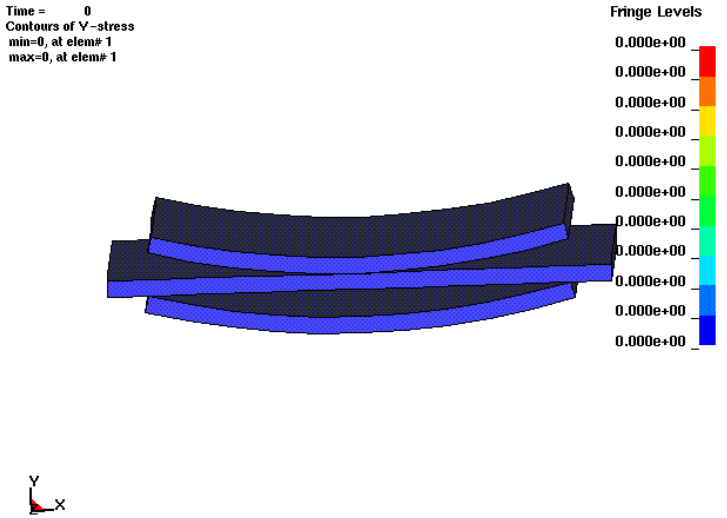
Plot of Crack Length vs Residual Strength

Computational Simulations









Seismic Performance Studies and Construction of 10 Storied Building in 48 Hours in Mohali

Emerging Trends

- **Utilisation of Steel/Concrete ratio is around 0.3 in India**

- **Whereas the ratio is close to or greater than 1.0 in the Western Countries**

- **National initiative to push the Steel utilisation …..**

Emerging Technology

Technology for Mass Housing

One such move towards the National initiative

Technology needs to be assessed for performance .....

Mandatory Requirements

Performance of the steel framed structure needs to be assessed for

- **Seismic loads**
- **Wind loads**

As per relevant BIS Codes of practice

Formulation of Problem

M/s Synergy Thrislington approached CSIR-SERC for Seismic Performance Evaluation of Cold Rolled Steel Framed Structures

- **Shake table experimental studies with different spectra**
- **Analytical studies**

Scope & Objectives

- **Analysis of the G+7 CRC framed structure for the seismic load as per IS code**
- **To evaluate the seismic performance of model of a G+7 framed structure for a ground motion compatible to Zone V Spectrum as per IS:1893-2002**
- **Study of the damage pattern and suggestion for improvement**

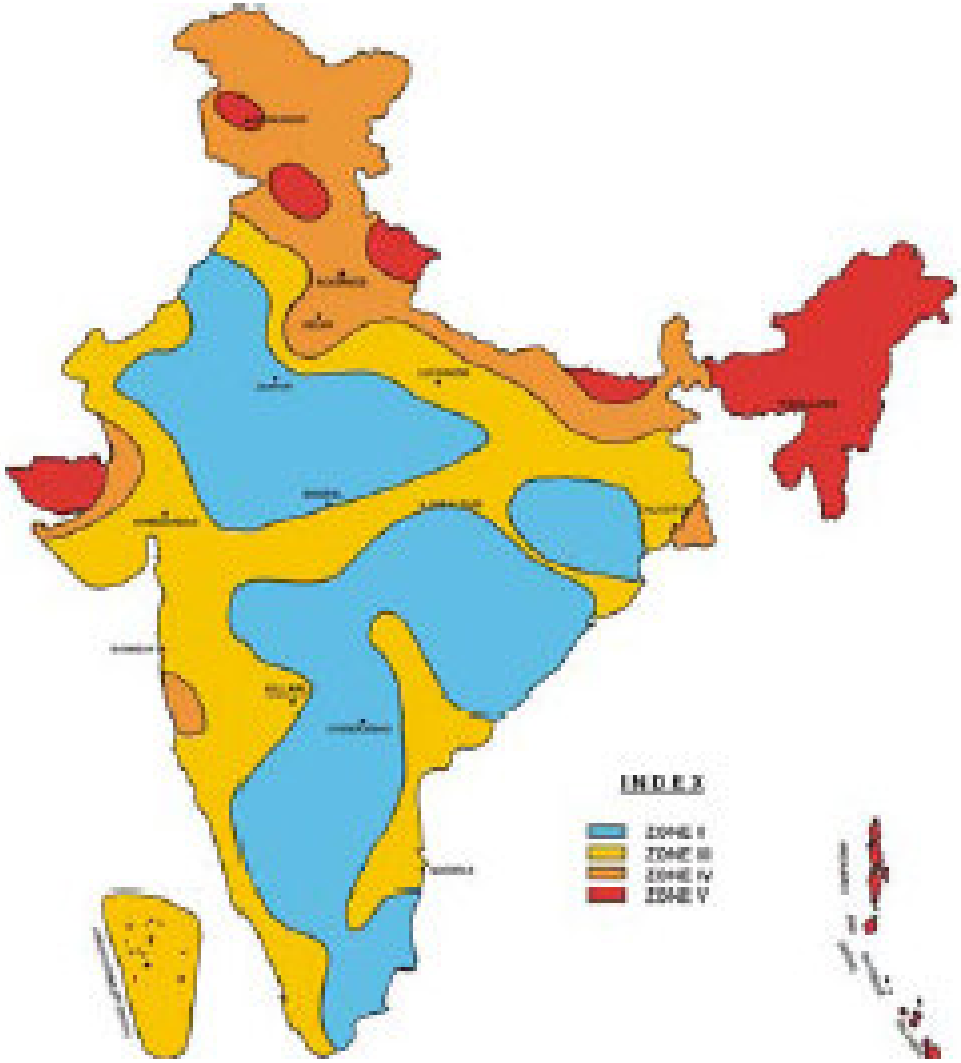
ASTaR Lab.

State-of-the-art 4mx4m tri-axial shake table with 6 DoF

- **4 horizontal and 4 vertical actuators of capacity 250kN each**
- **Acceleration up to 1.0g**

Used in the present investigation for seismic performance evaluation for testing upto Zone V and beyond

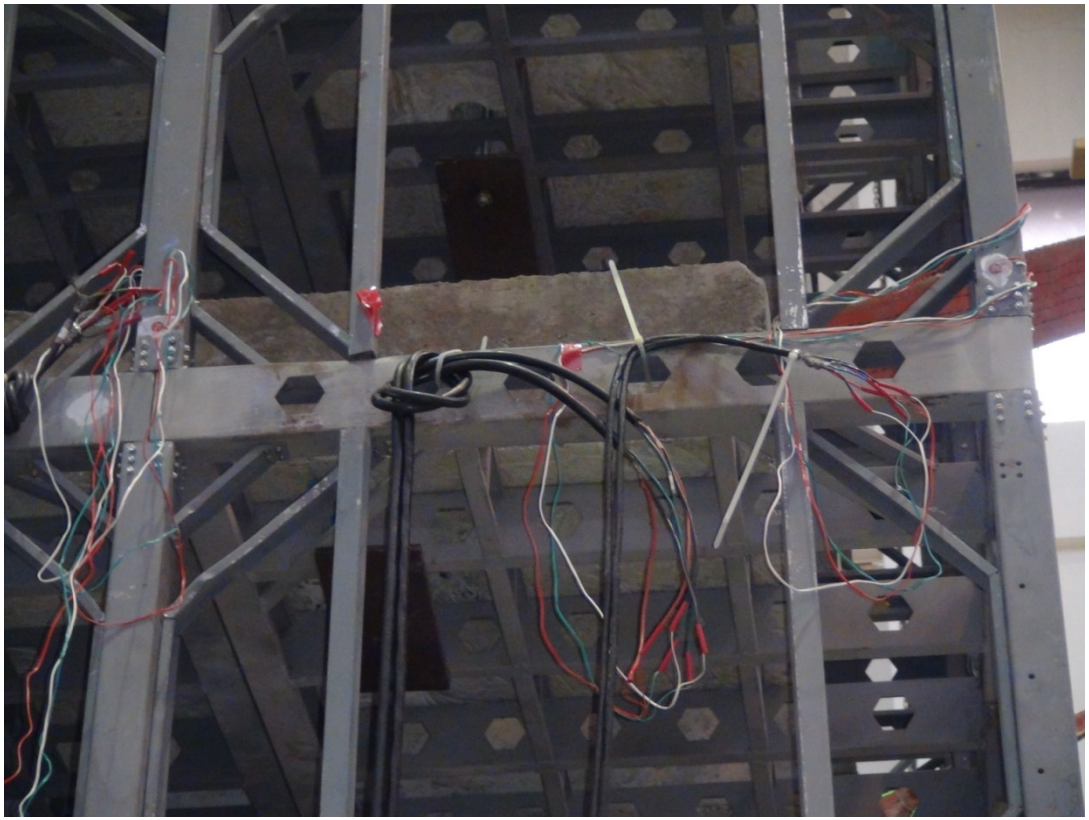
Seismic Zone Map of India [IS:1893-2002]



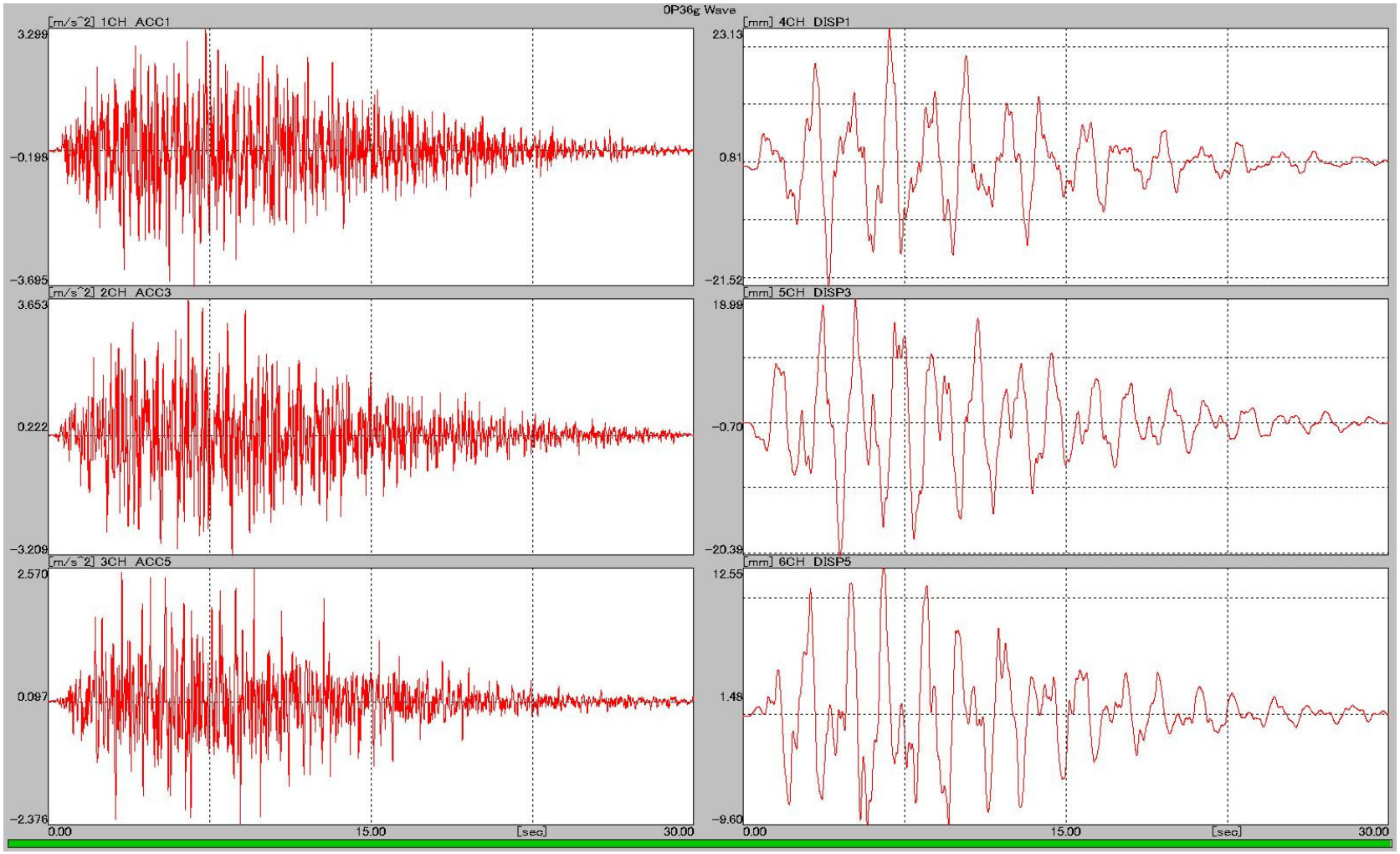
Scaled Model of G+7 Framed Structure on the Shake Table

Simulation of Dead and Imposed on the Model

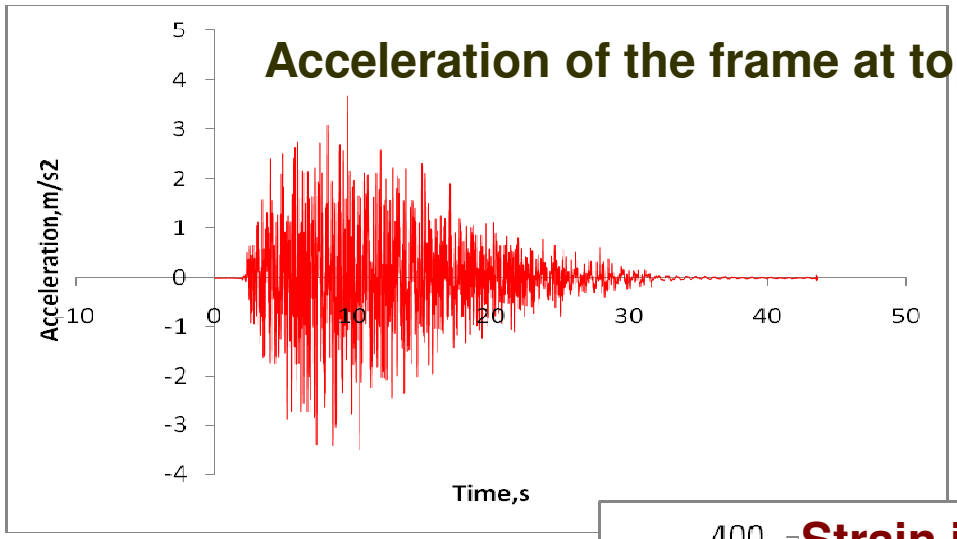
Instrumentations on the Model

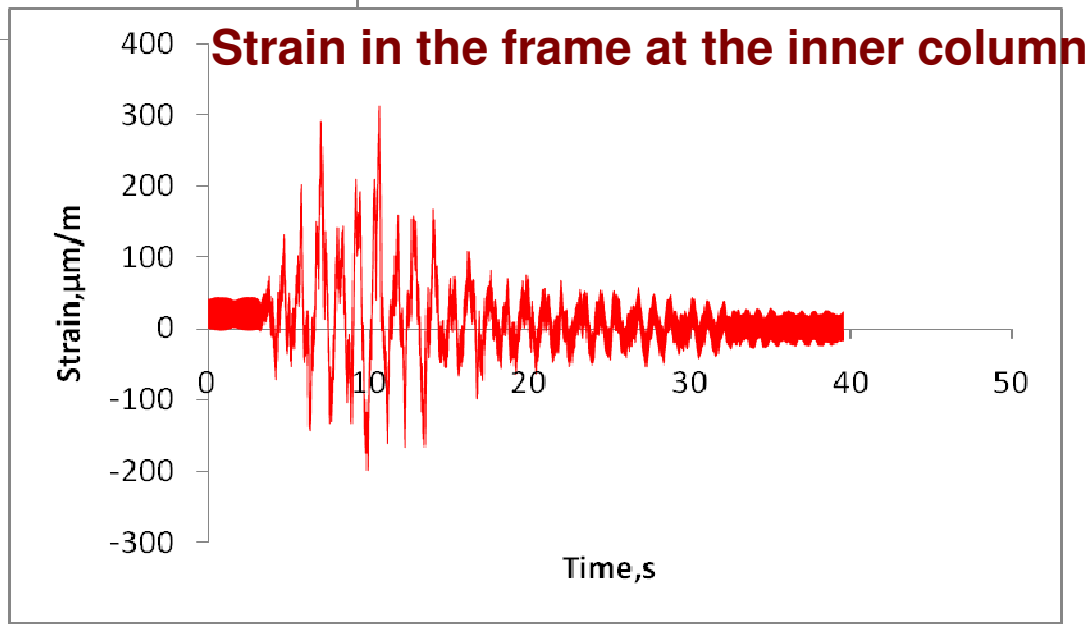


Input Time History for 0.36g



Plot of Responses for 0.36g





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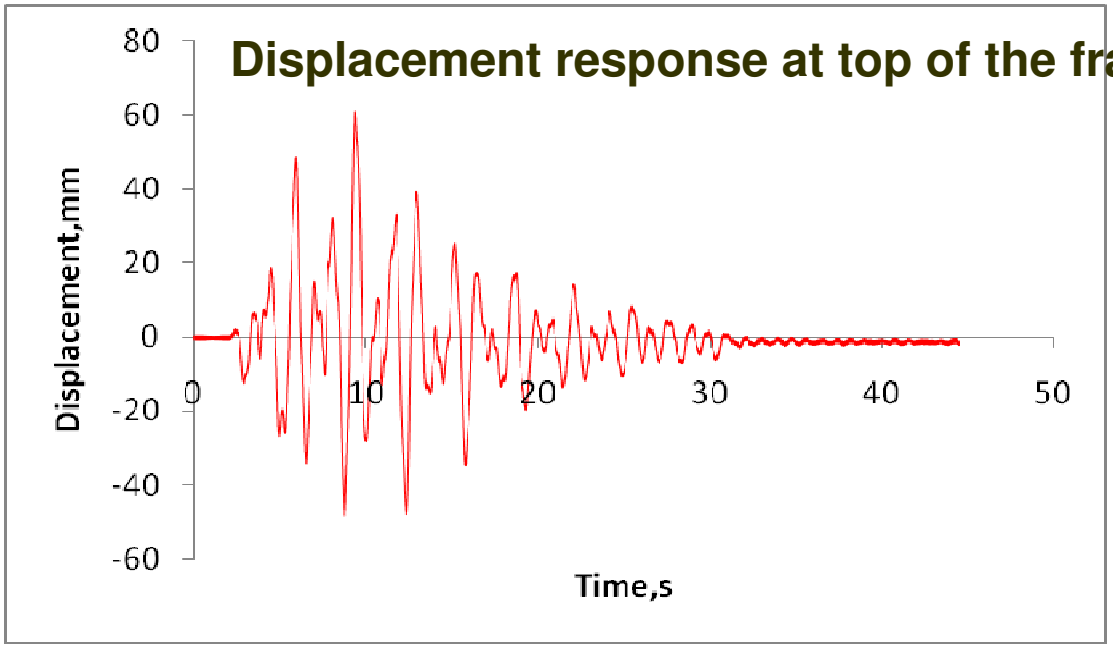
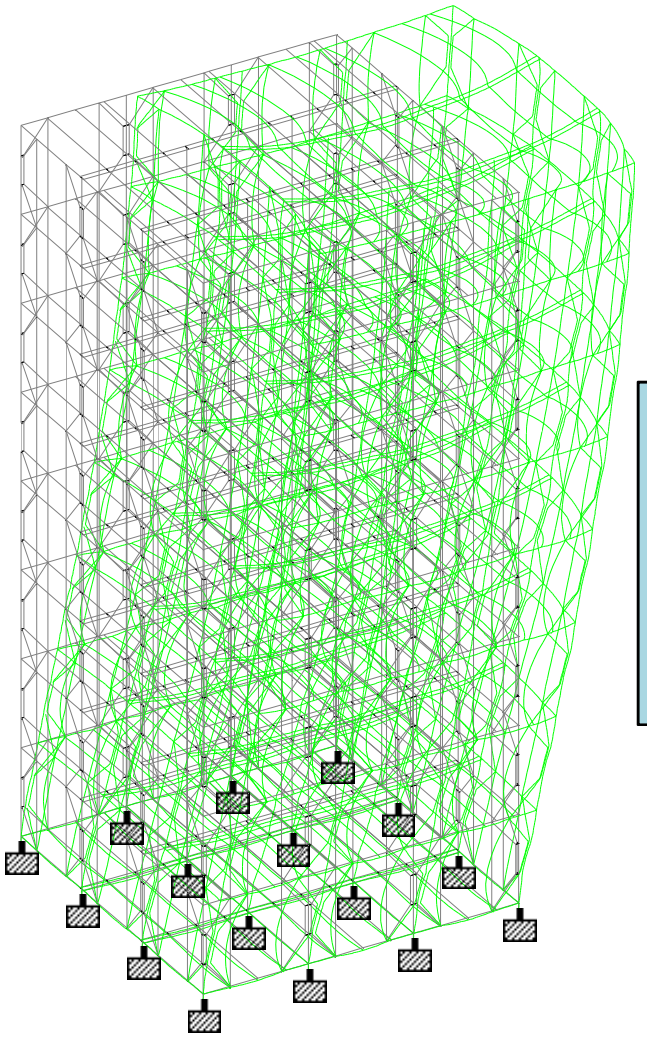
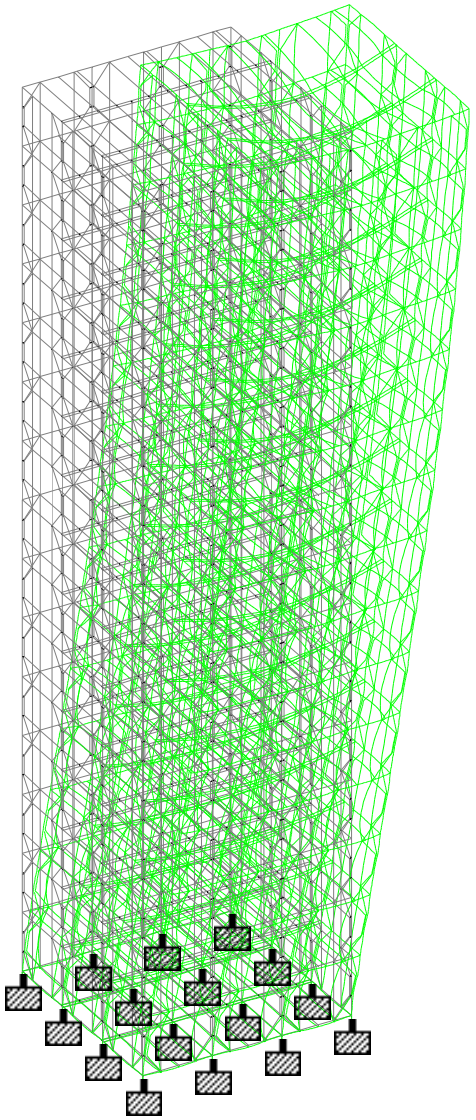


Zone	Maximum Displacement, mm	Maximum Acceleration, m/s^2
II (0.08g)	14.24	1.5
III (0.16g)	30.94	2.59
IV (0.24g)	29.55	2.45
V (0.36g)	61.26	3.68
0.48g	80.10	7.14

Analytical Simulations - Seismic Response Spectrum Analysis (Zone V)



Lateral displacement of G+7 and G+14 storey frames

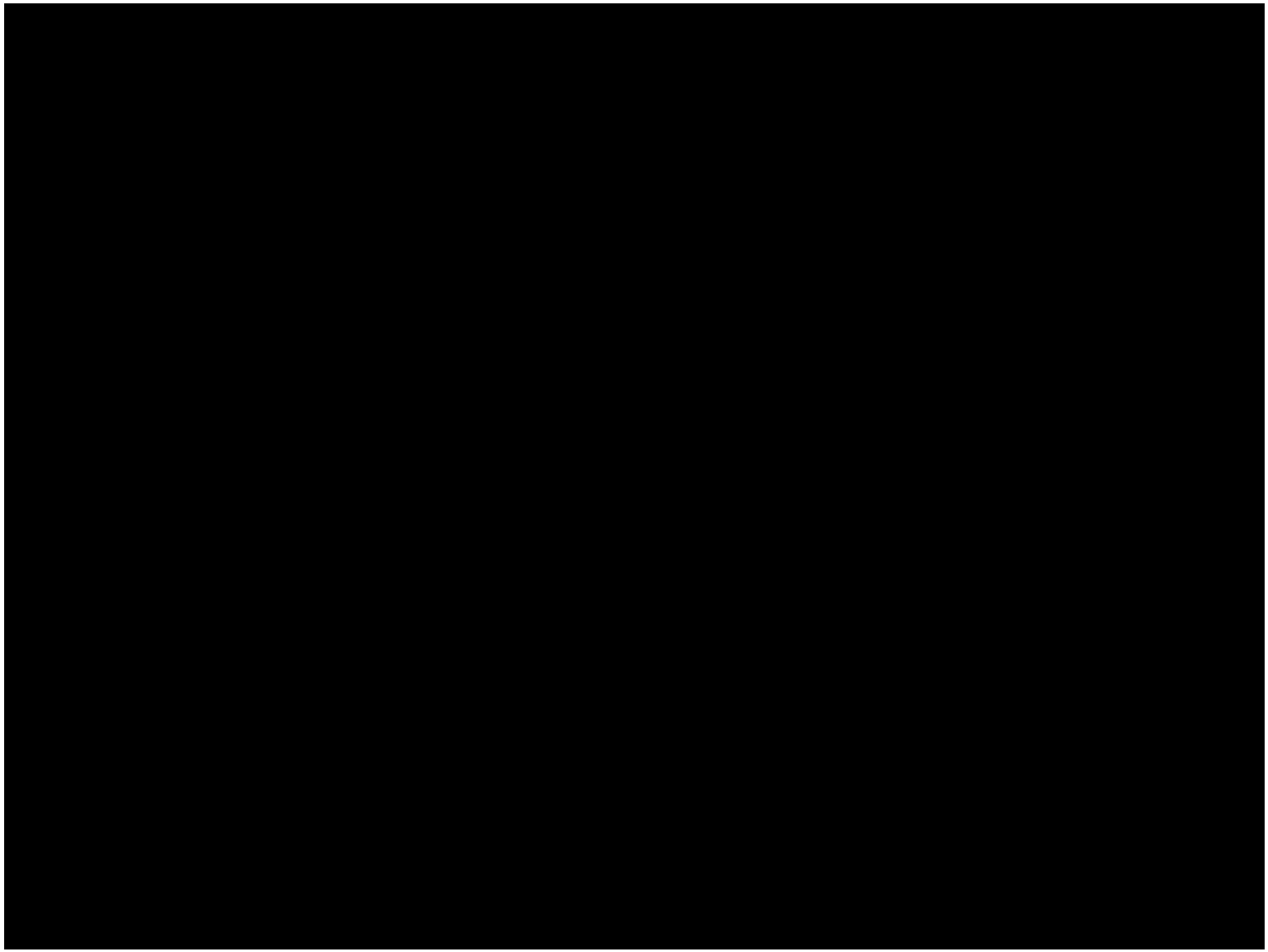


Video on Shake Table Studies

- **Highlights of the shake table experimental studies**

- **Spectra applied progressively by increasing earthquake motions quantified by peak ground accelerations corresponding to Zones II, III, IV & V as per IS:1893-2002**

Video on Shake Table Studies



Launch of the Building at Mohali

- **Punjab Deputy Chief Minister Honorable Sukhbir Singh Badal had laid the foundation stone at Mohali, 10 km from Chandigarh**

- **Construction of the 10-storied building, located in an industrial area in the city of Mohali, began on 29th Nov. 2012, Thursday afternoon at 4.30 pm local time**

- **Target in assembling 200 tonne building having an area of over 25,000 square meters**

- **Three cranes and over 200 workers, including technicians, worked “round the clock"**

Salient Construction Details at Site

- All the components of the building were manufactured in the factory and pre-fitted with floors
- Concrete has been used only in the foundations and three inch deck floorings in the nut and bolt structure
- More than 80 %of the work is done in the factory
- Ultrafast technology of construction with less than 20% of work at the site
- Minimal emission of flying dust and less pollution of water at the site
- Facade of the building is double skinned PUF panel that ensures thermal insulation
- Other essentials including provisions for water supply, wiring, sanitation and air conditioning ducts

Photos on Construction Details

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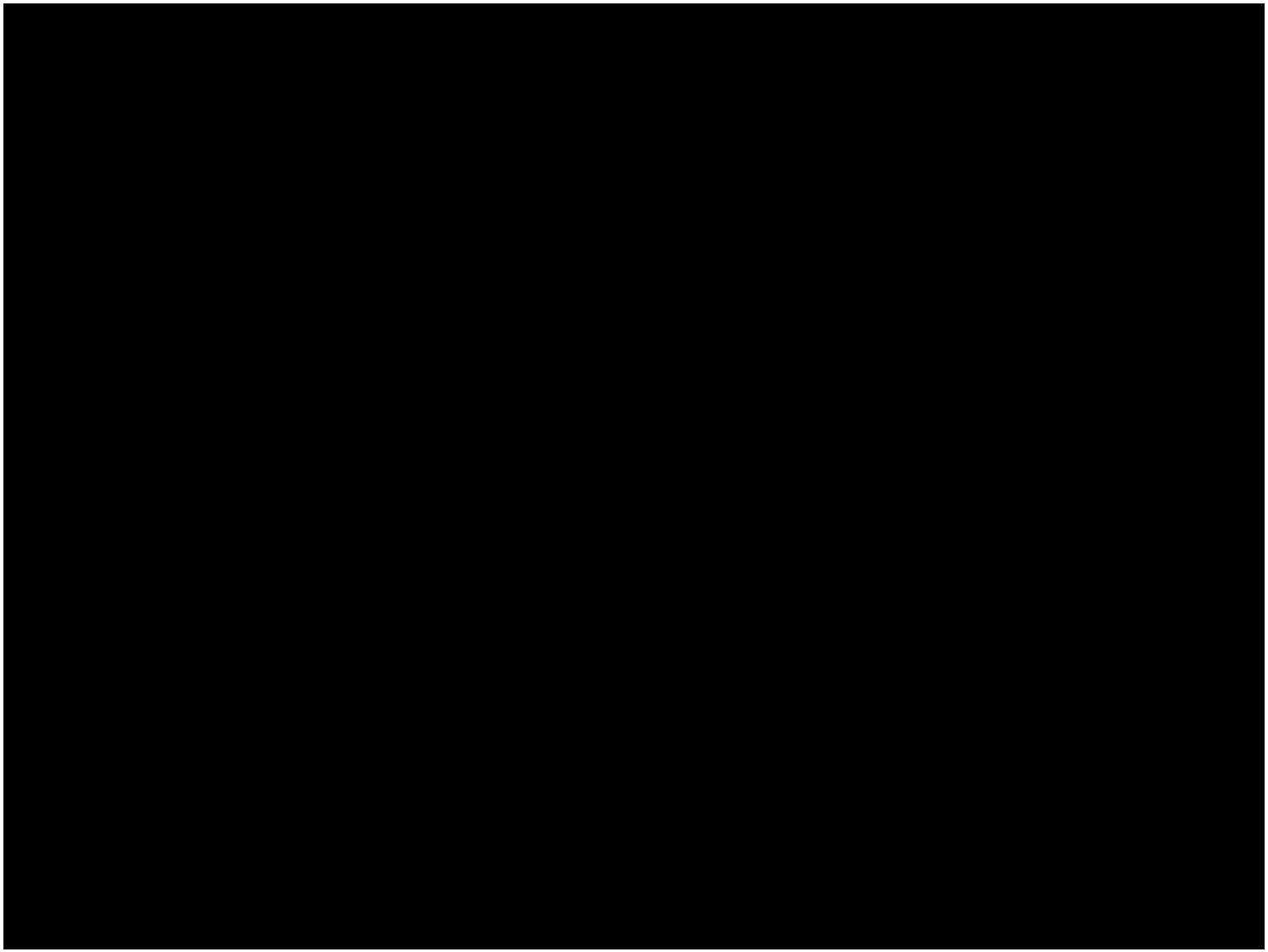
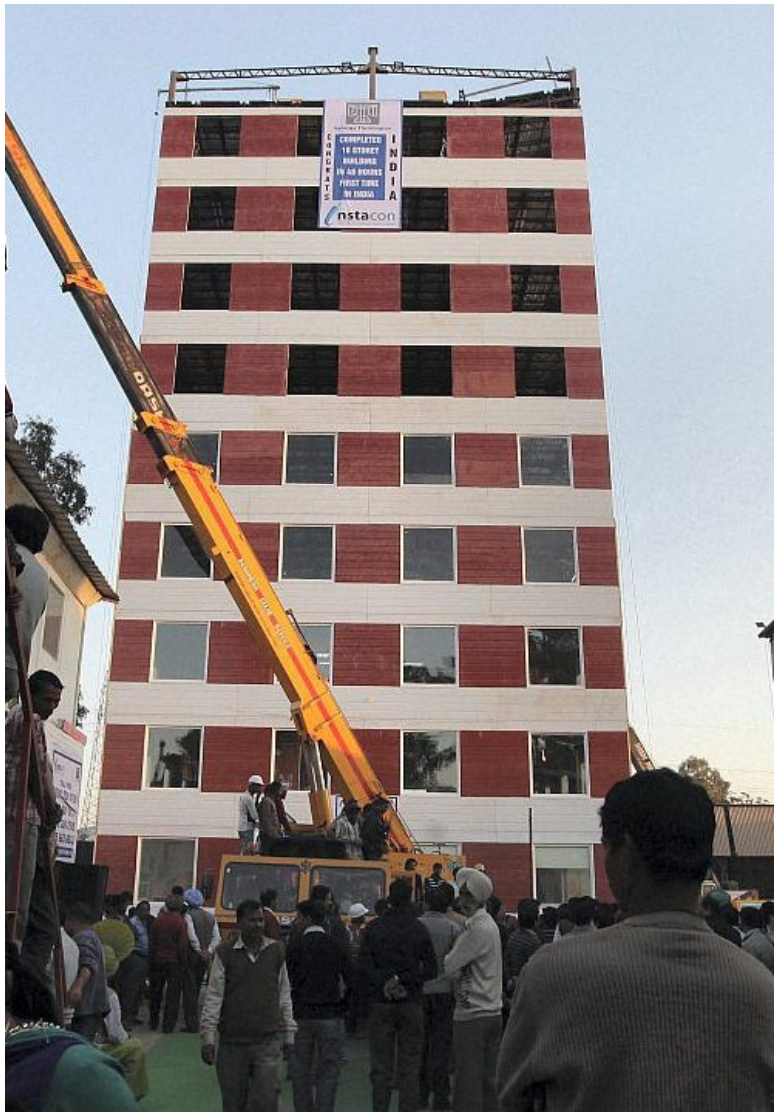
Video on Launch and Start of the Project

Video at 24hrs after Launch



Completed Building



- First building of its kind in the country – Limca book of records
- Completed on 1st Dec, Saturday at 4.30 pm
- Better, energy efficient construction technology that will enable builders and owners to generate revenue within days, instead of waiting for months

Well Coordinated Team Effort

Tough challenges …

Thank You

…thrilling opportunities