# Micropile Bearing Plates:

# Are they Necessary?

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# The Art Gallery of Ontario


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# Post-Transformation – Frank Gehry

# Royal Ontario Museum


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# Post-Transformation - Daniel Libeskind

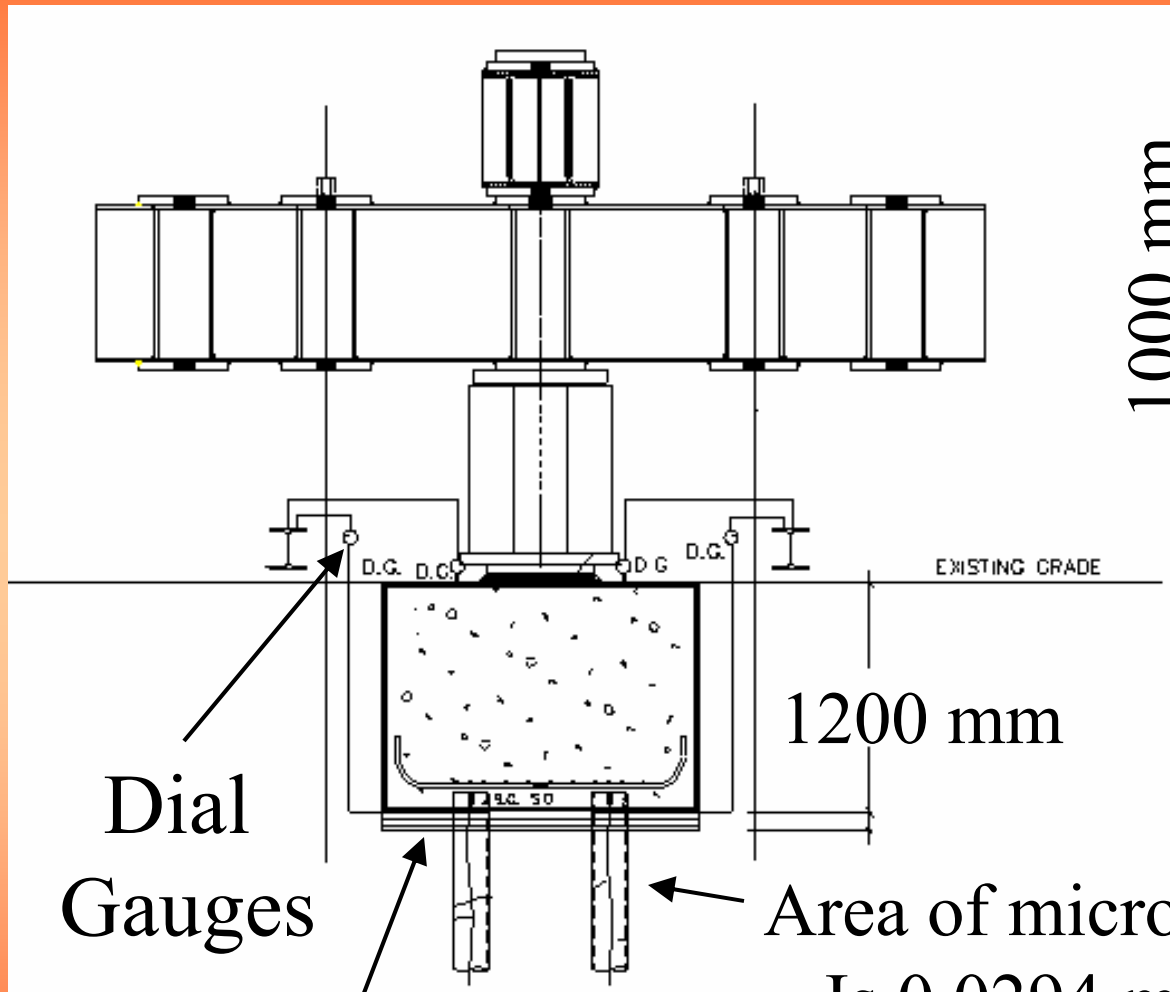
# Outline

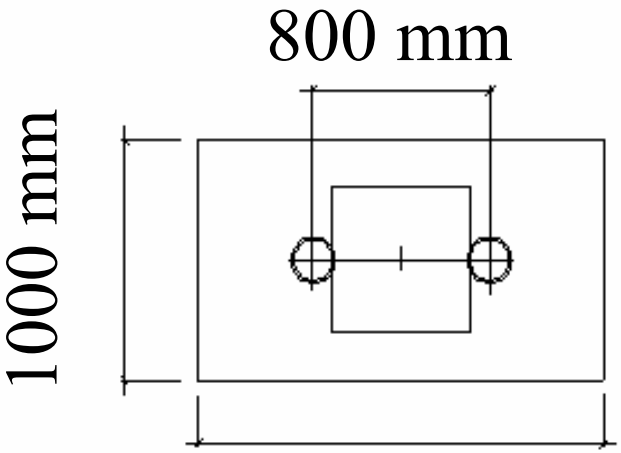
-Reasons for Test
-Test set up
-Instrumentation
-Our Findings

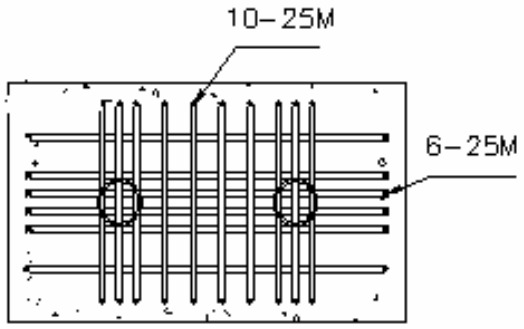
# Reasons for Test and Analysis Program

- Cost
- Time/ Schedule impact
- Difficult to ensure plate to grout contact
- Plates impede concrete placement beneath
- Plates provide smooth interface where cracks may propagate
- Tests by the Ohio DOT in 1947, suggest large plates may weaken pile caps

# Test Set Up


D.G.
D.G.
D.G.
D.G.
EXISTING GRADE
1200 mm
Dial Gauges
Air Pocket
Area of micropile Is 0.0294 m^2


800 mm
1000 mm
1800 mm


10–25M
6–25M

# Test Set up

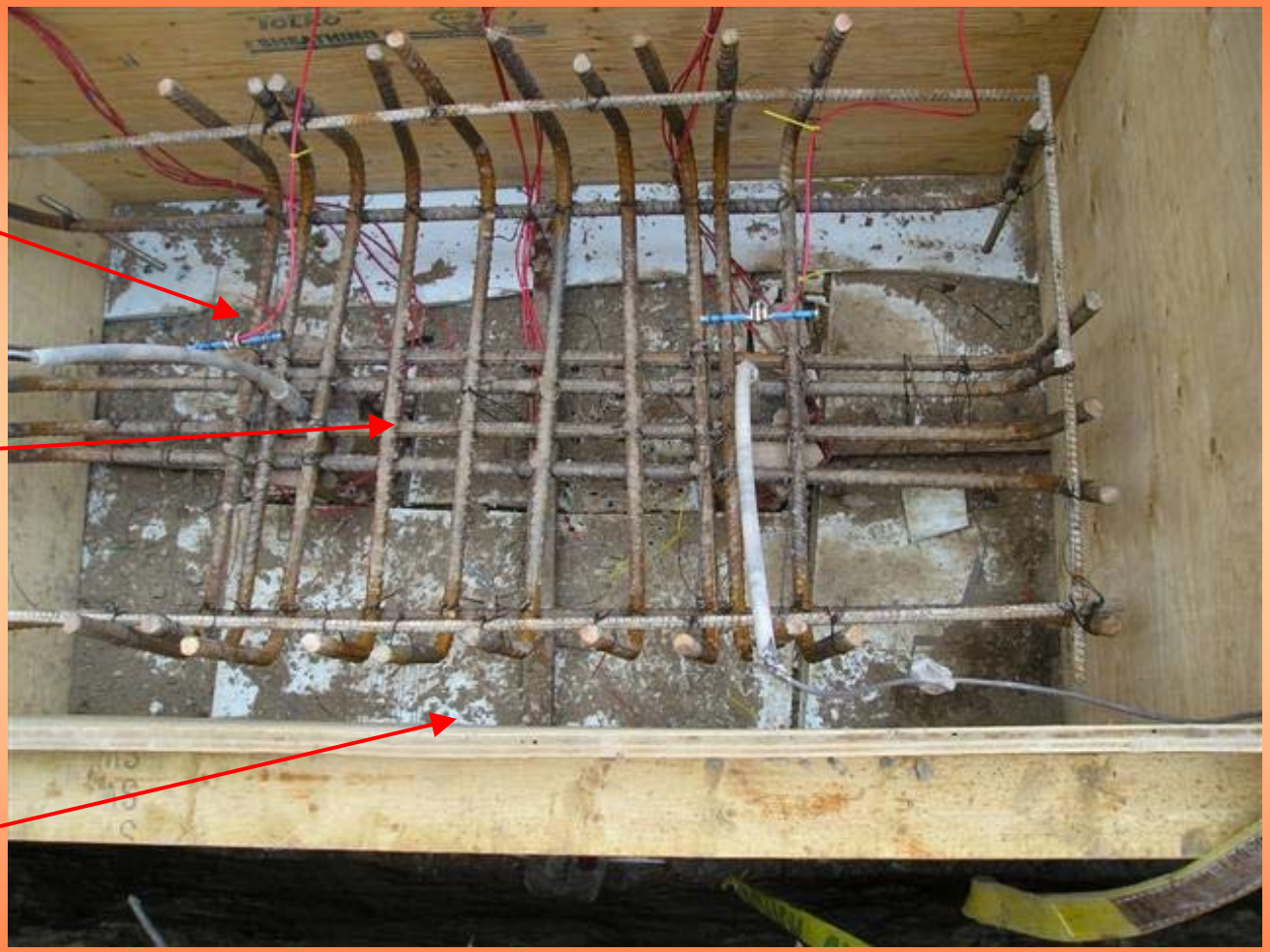
Dial Gauges

# Test Set Up

Concrete Strain Gauge

Rebar with Strain Gauges

Compressible Material



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# Test Set Up

30 MPa Concrete


Cylinders

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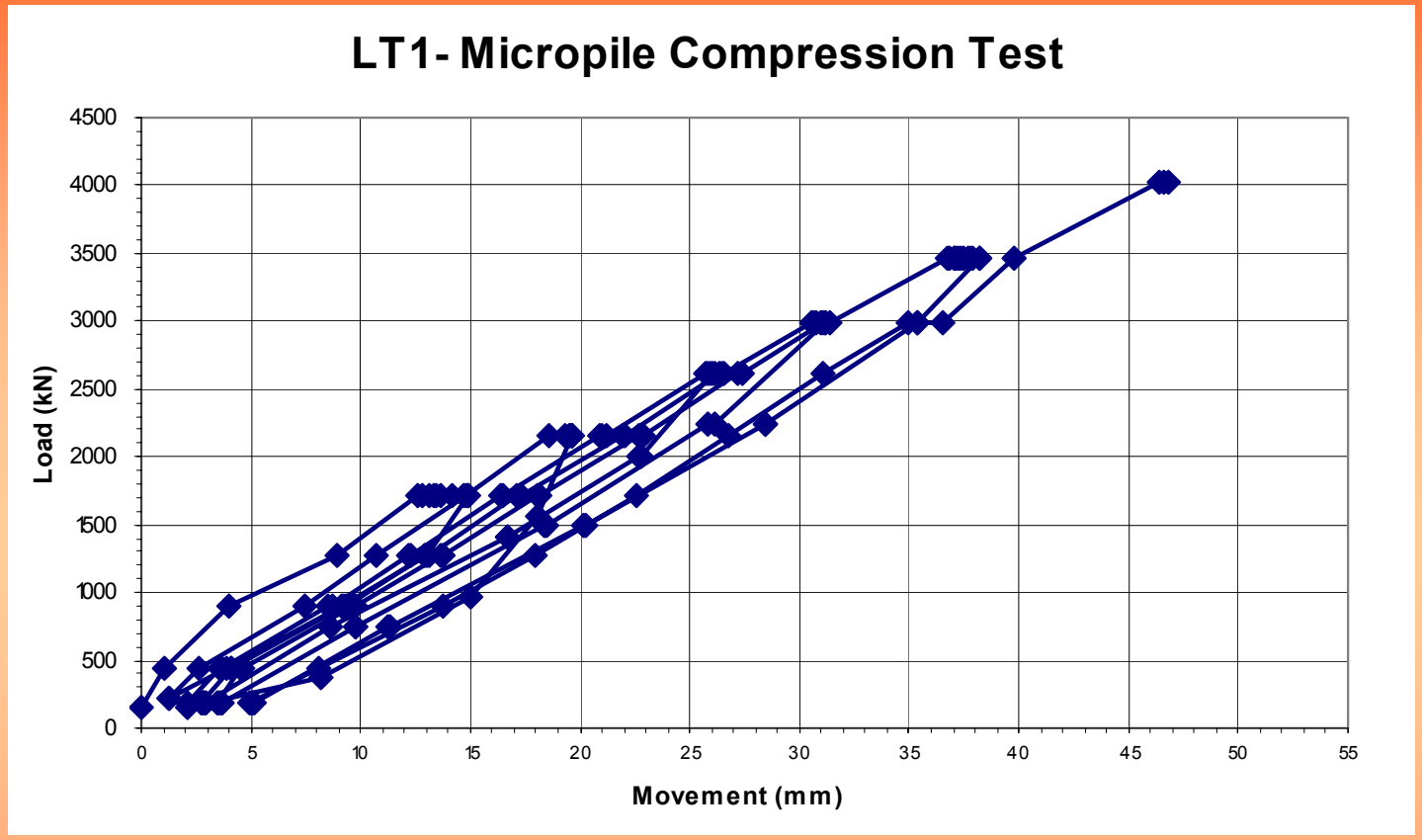
# Cyclic Loading for One Micropile




-8050 kN ultimate load on cap

-50 mm movement

-136 MPa based on MP area

-2.33 Design Load

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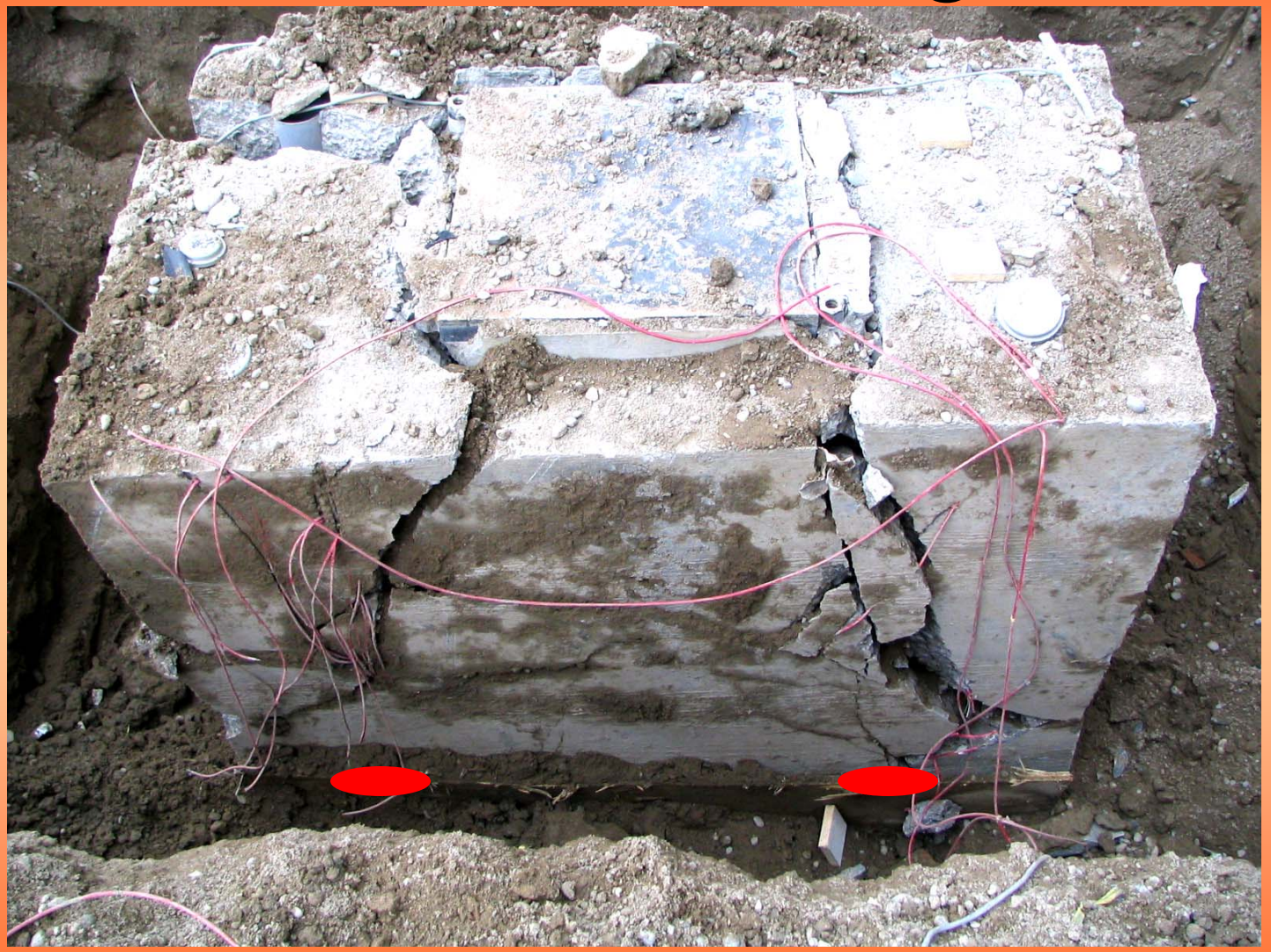
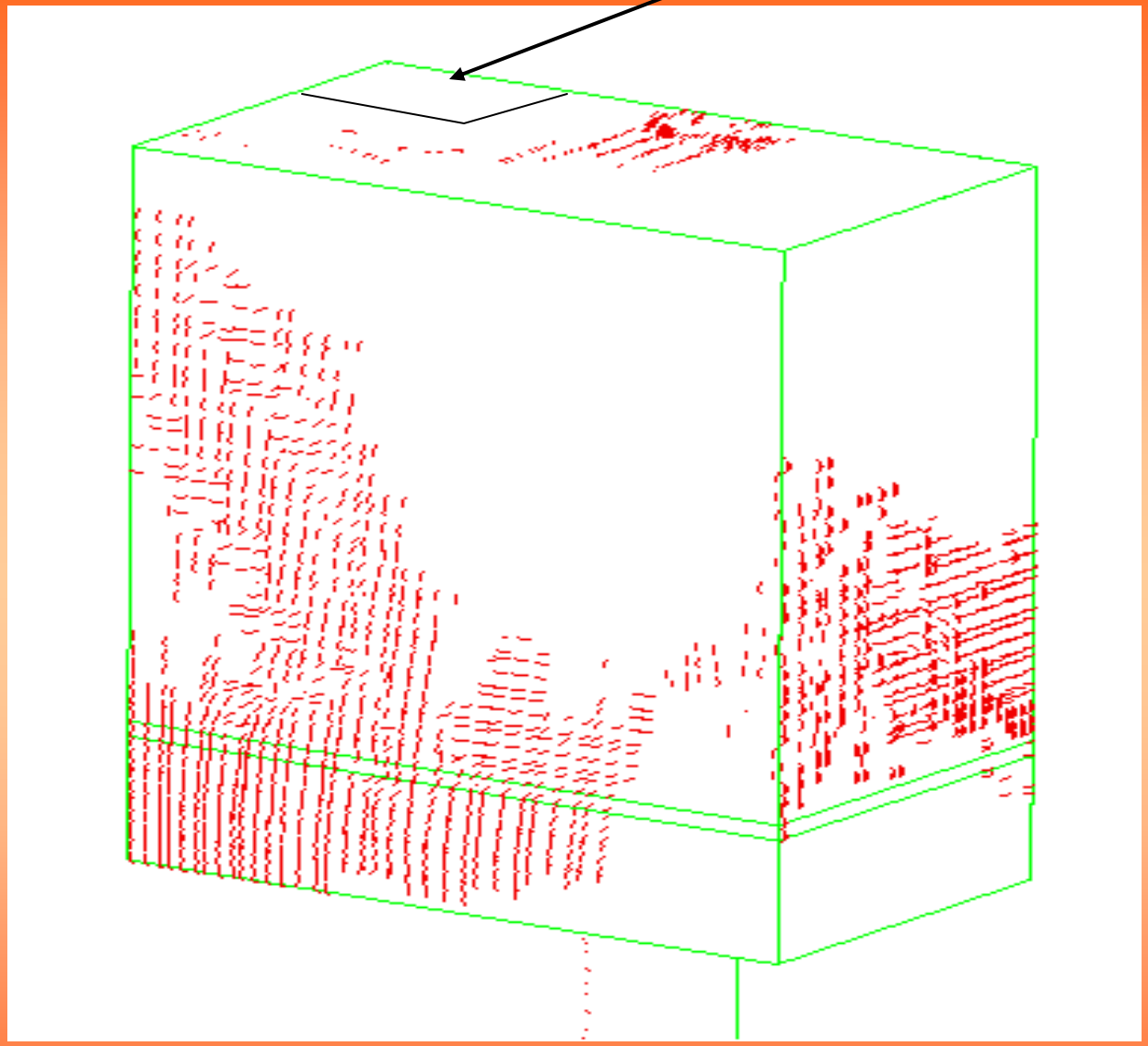
# Results - Actual Cracking Pattern

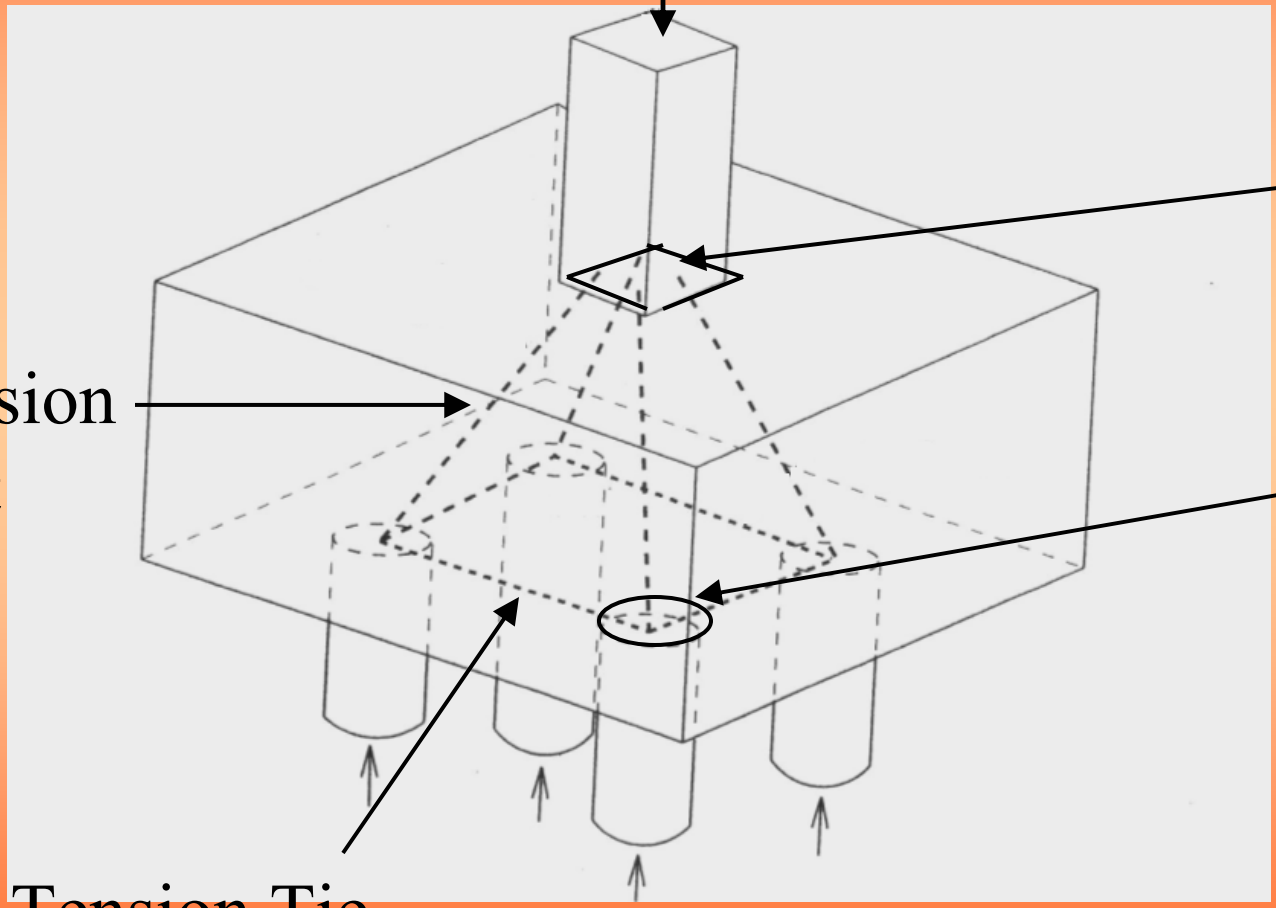


# Actual Cracking Pattern

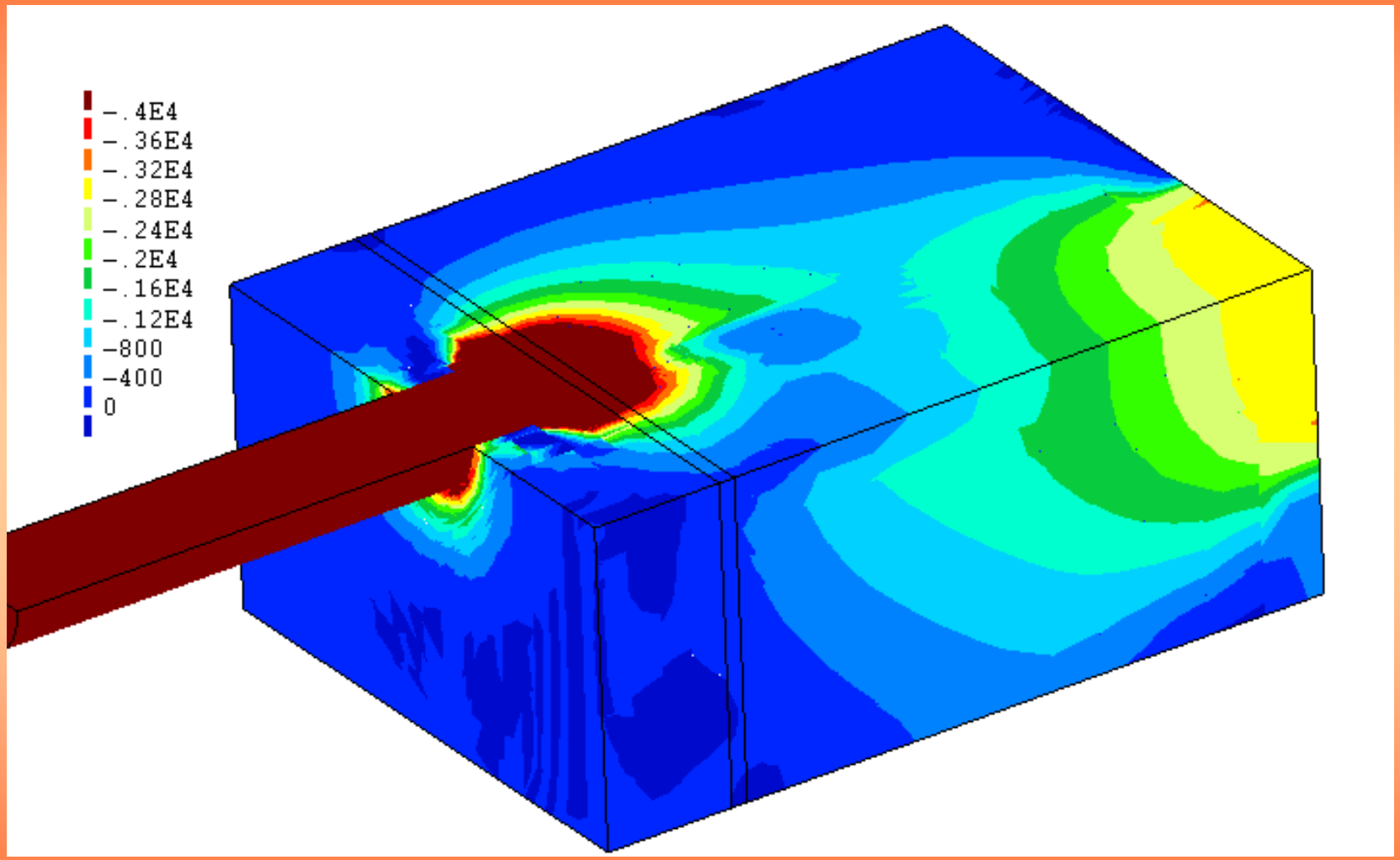



# Cracking Pattern in one quarter of the cap

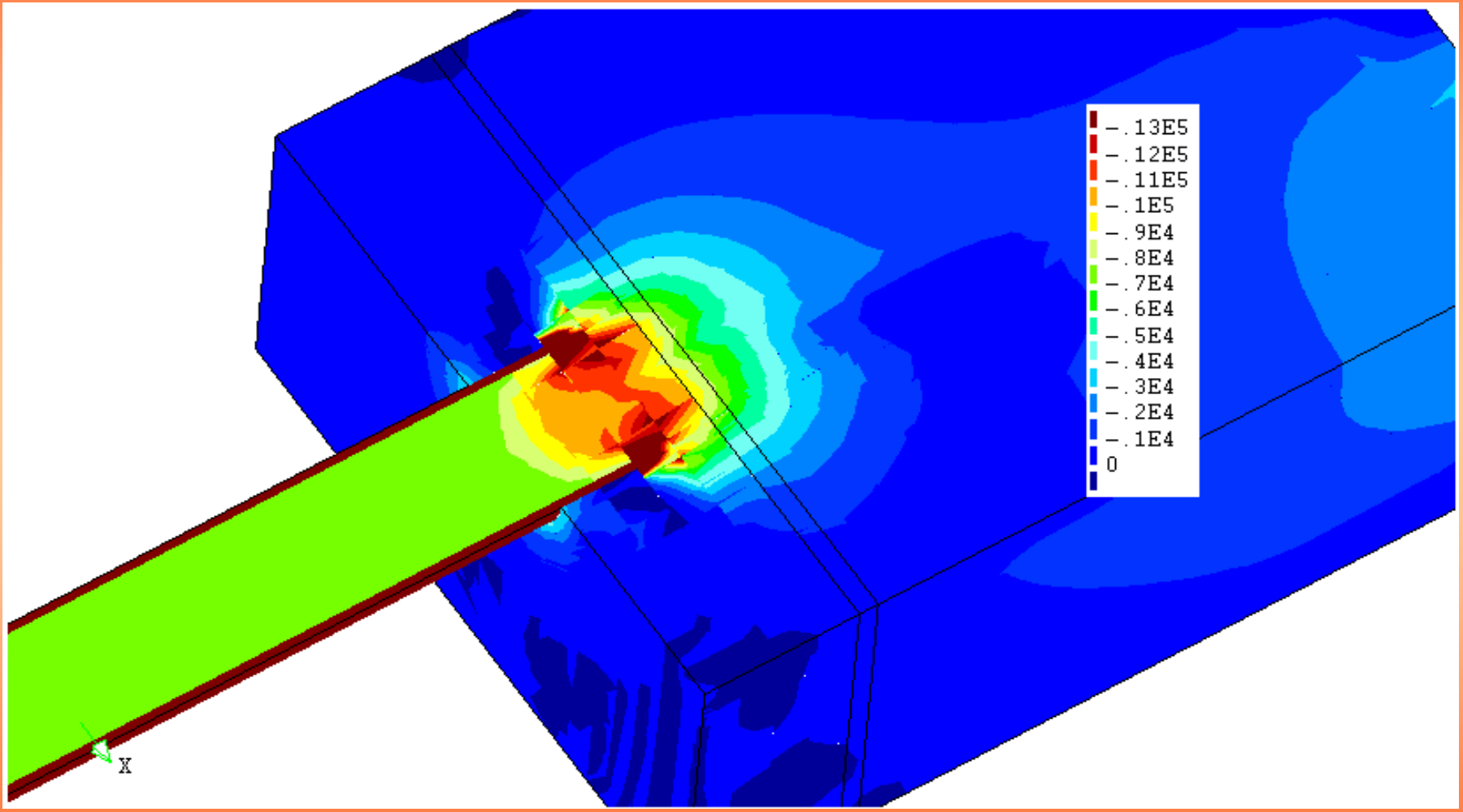
# Strut and Tie Model Used to Determine Required Reinforcement



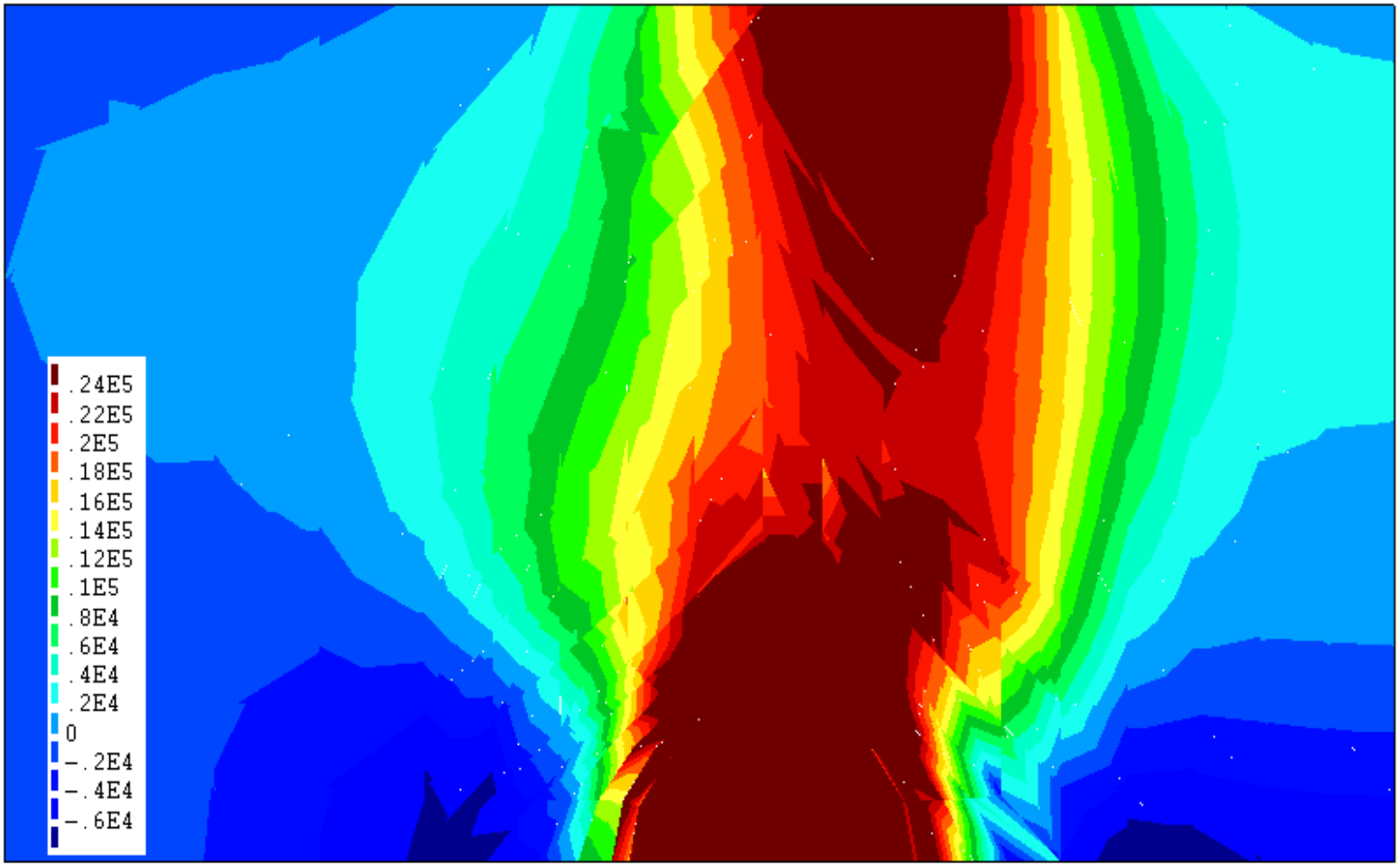
# Vertical Stress



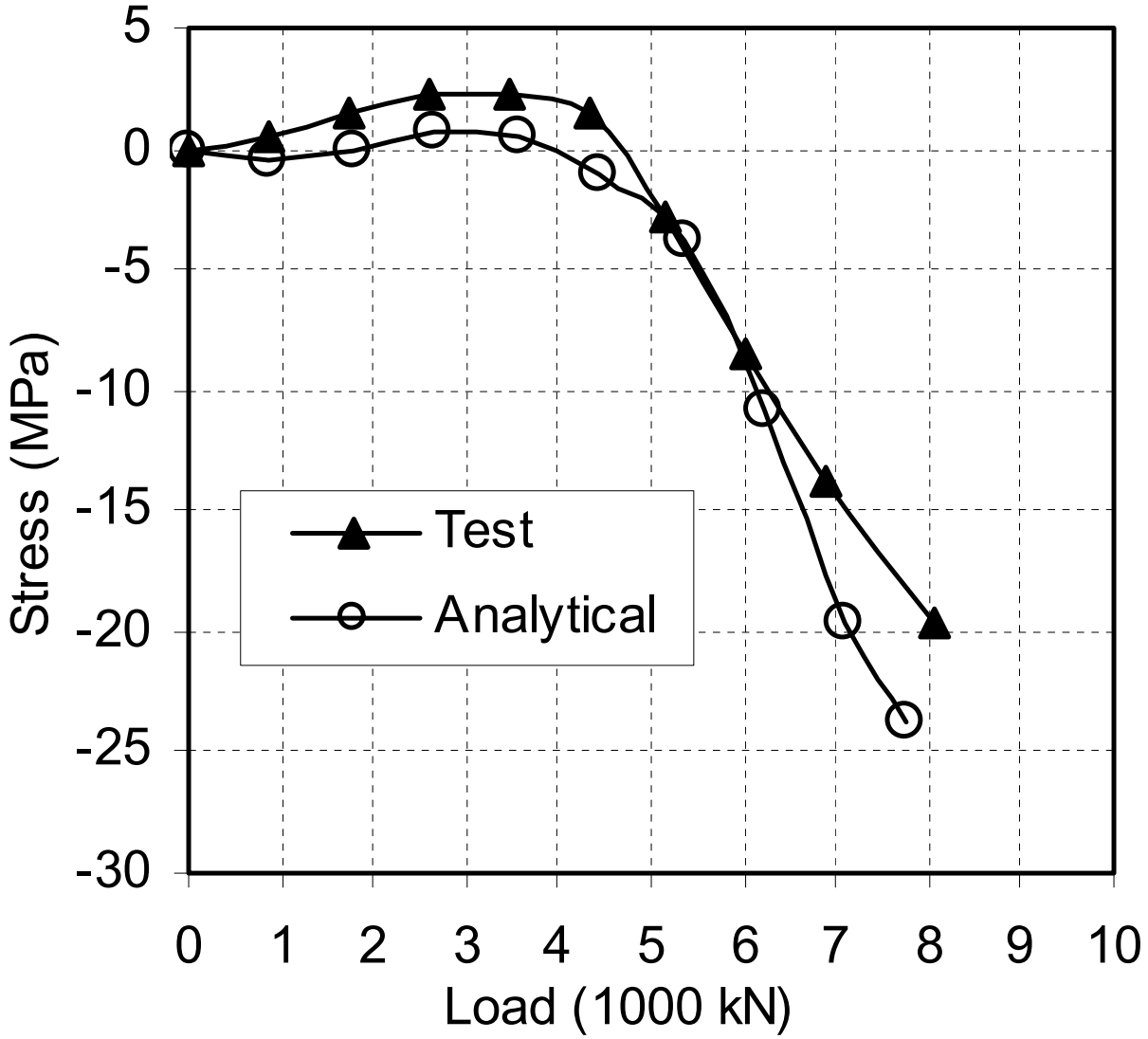
# Vertical Stress



# Horizontal Stress in Reinforcement Plane



# Results- Rebar Stress

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# Our Findings

-Bearing plates were not necessary

-Based on area the bearing strength was 4.5 times the concrete compressive strength much higher than allowed by codes

-Class A analysis predicted failure within 5%

-The concrete strut was parabolic, not linear

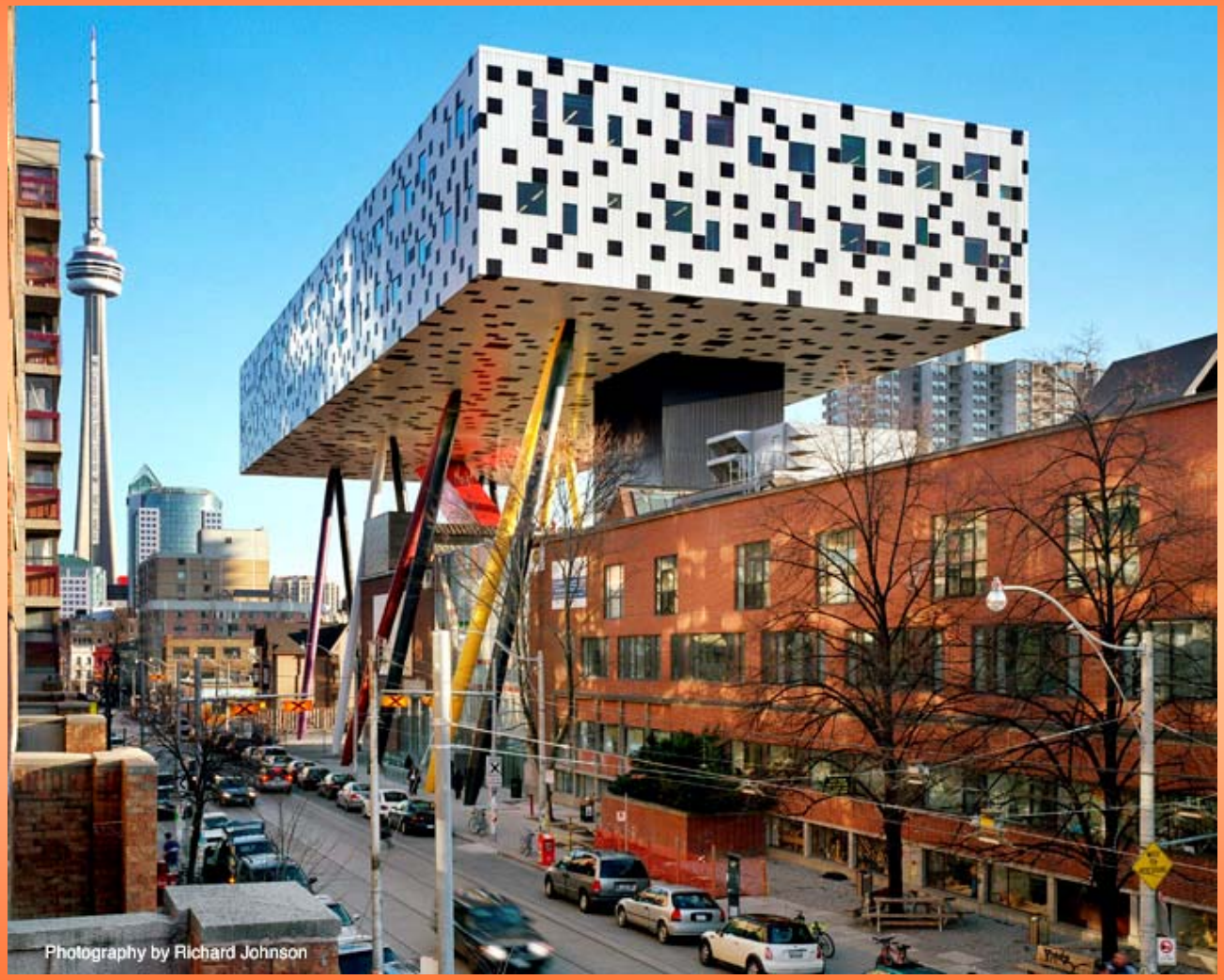
# Findings Continued

-Longitudinal rebar was in Compression in the middle of the pile cap

-Rebar can be spaced evenly across pile cap

-Further research for other geometries is necessary

# Ontario College of Art and Design

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