

# Reinforced Concrete Column Joint Strengthening

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*Newark, NJ*

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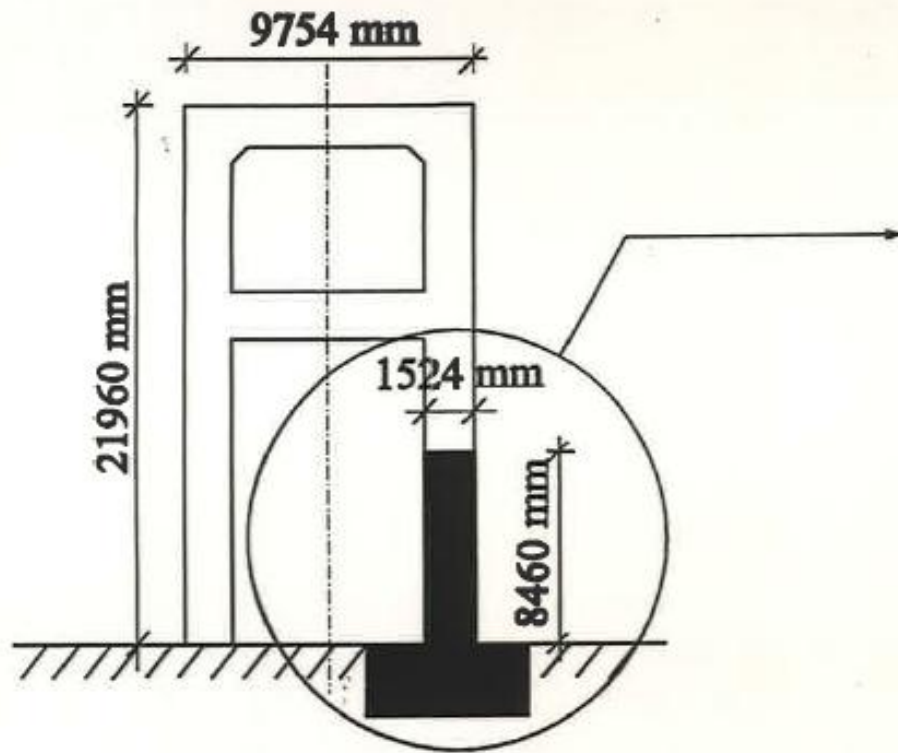
# Presentation Outline

- Introduction
- Objectives and Scope
- Samples Preparation
- Experimental Work and Testing
- Conclusions

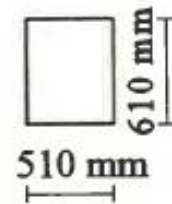
# Introduction

# Nuclear Power Plant, Pickering, Ontario, Canada

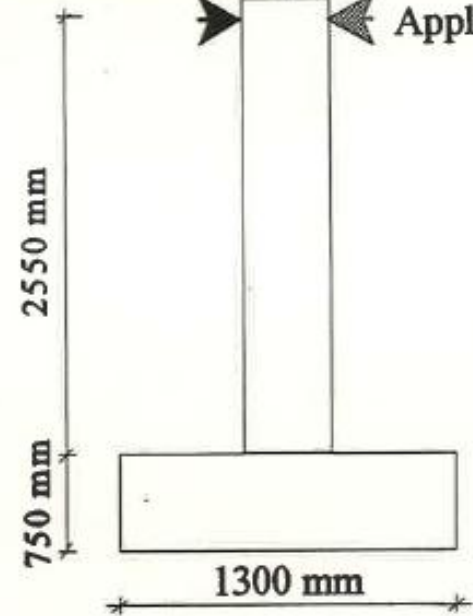




Existing frame



Constant axial load  
Applied load



Test specimen



# Nuclear Power Plant, Pickering, Ontario, Canada

- Construction started 1966
- No Seismic Code Provisions
- Only Gravity Loads considered
- We have been approached to find a solution

# Objectives and Scope

# Objectives and Scope

- Investigate the mode of failure of “as-built” structure
- Build a “code-designed” specimen and test it
- Investigate two innovative retrofitting techniques:
  - (Corrugated steel jacket and flat steel jacket with Hilti bolts)
- Perform nonlinear analysis to study the performance of the “as-built” structure under the three scenarios



# Samples Preparation

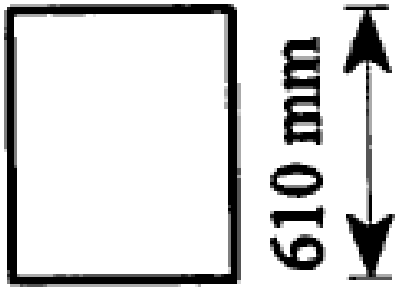










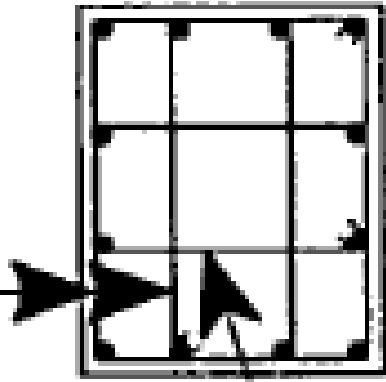


510 mm  
↔

610 mm  
↑  
↓

**Column section**

**6.35 mm diameter  
wires @ 150 mm**



**4 M15  
2 M15  
2 M15  
4 M15**

**4.7 mm diameter  
wires @ 150 mm**





























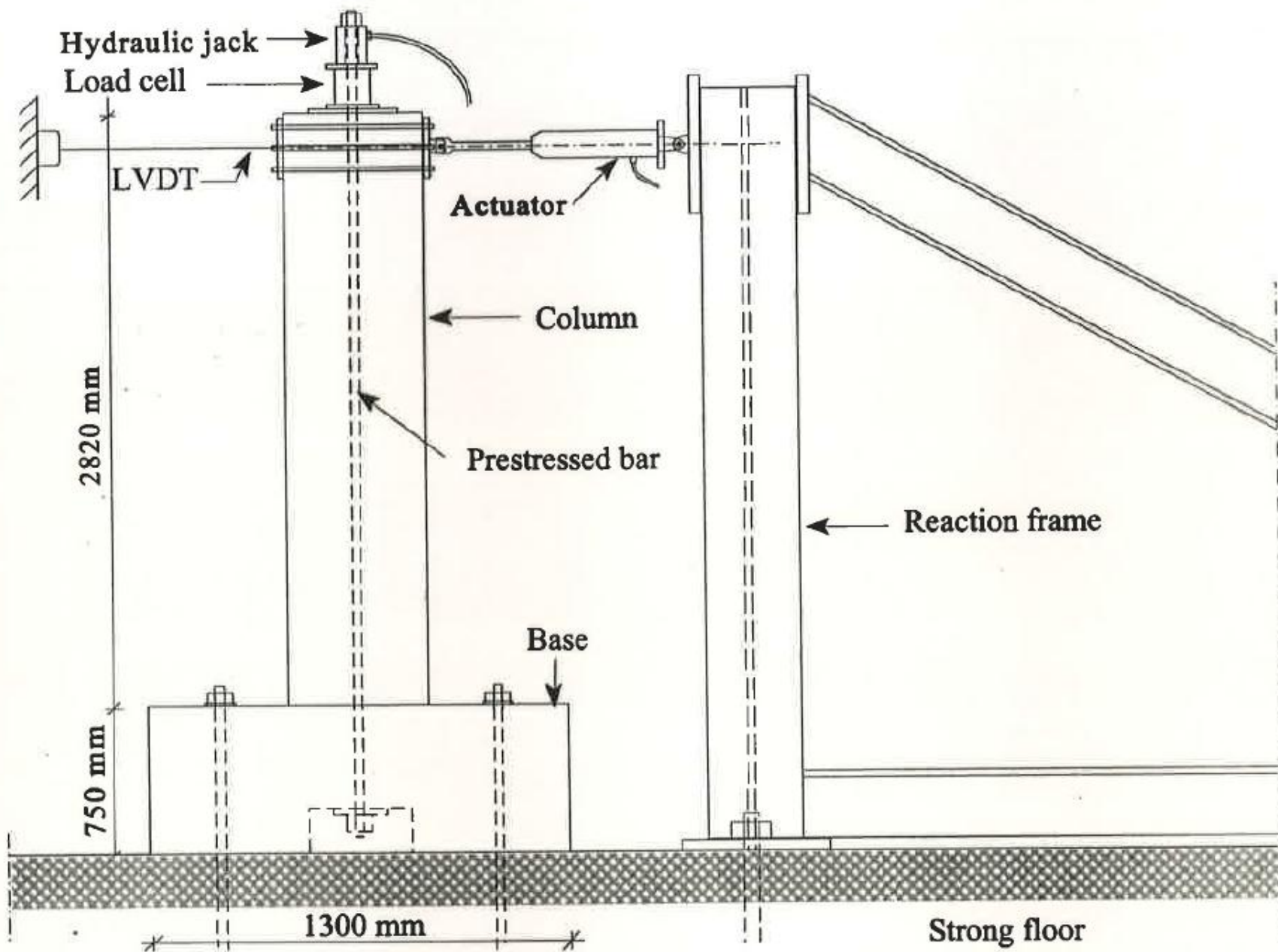


# Experimental Work and Testing

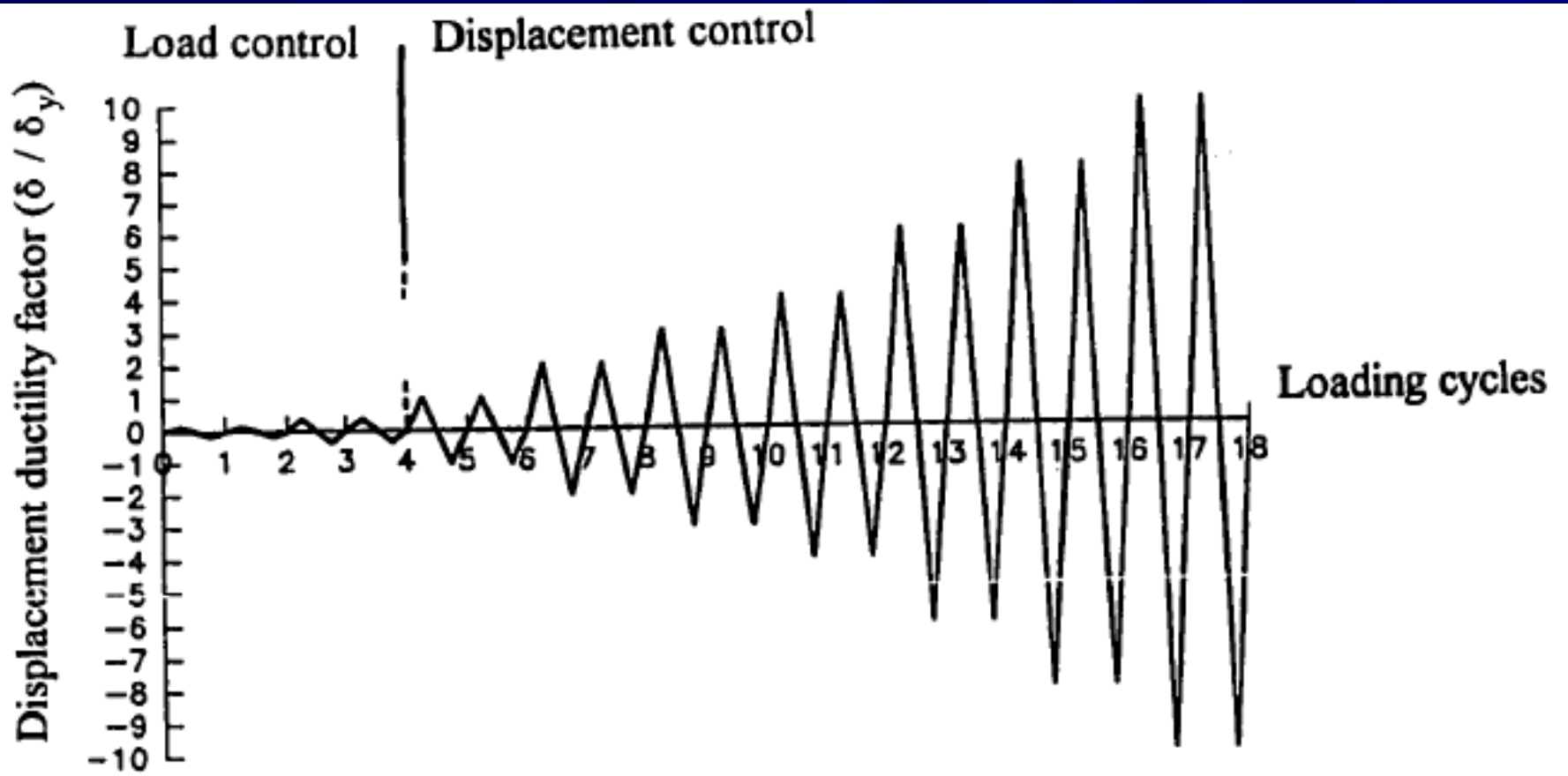
# Specimens

- S1 “As-built” Specimen
- S2 Retrofitted specimen using corrugated steel jacket
- S3 Code designed specimen (NBCC 2010)
- S4 Retrofitted specimen using rectangular flat steel jacket with Hilti expansion anchors

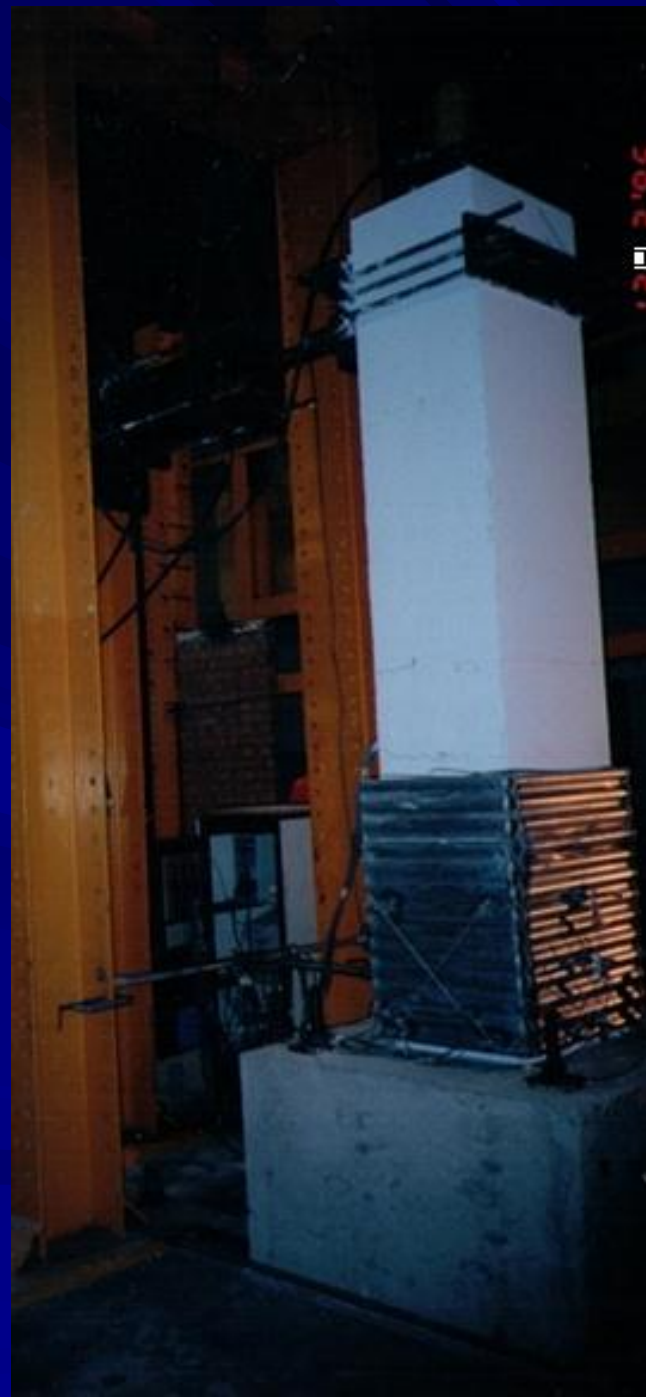






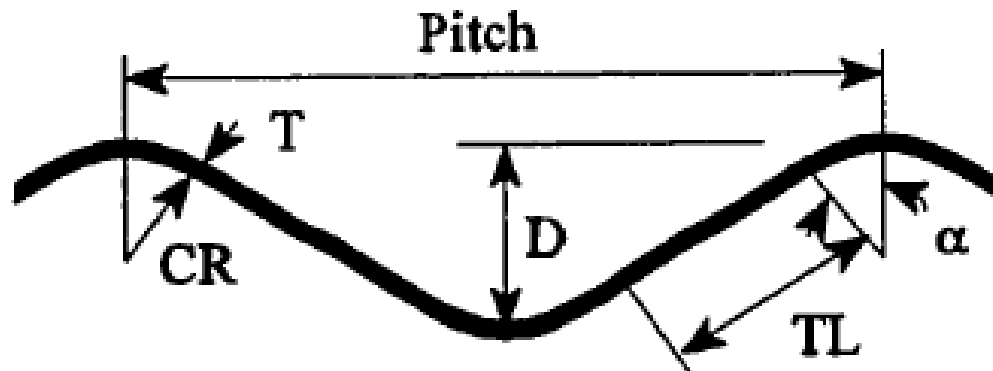








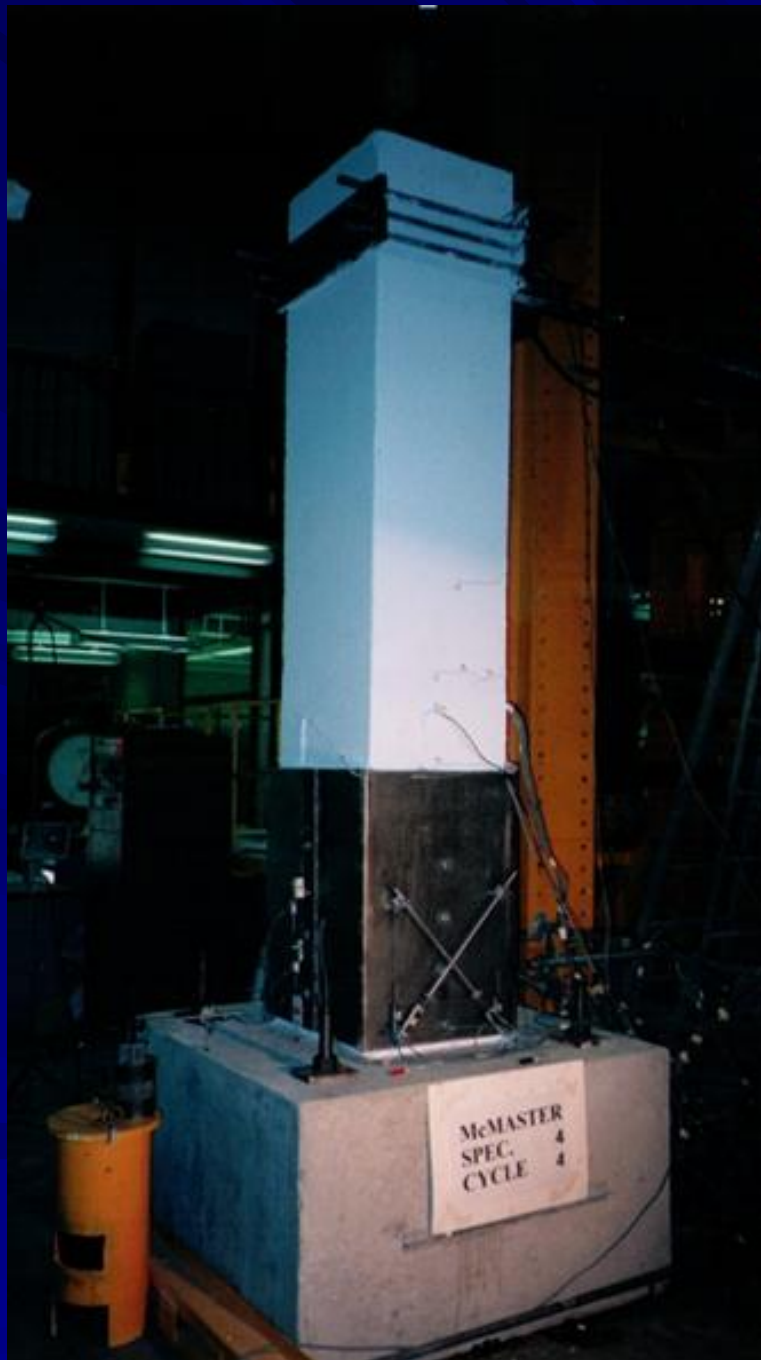
## Corrugation profile 68 x 13 mm

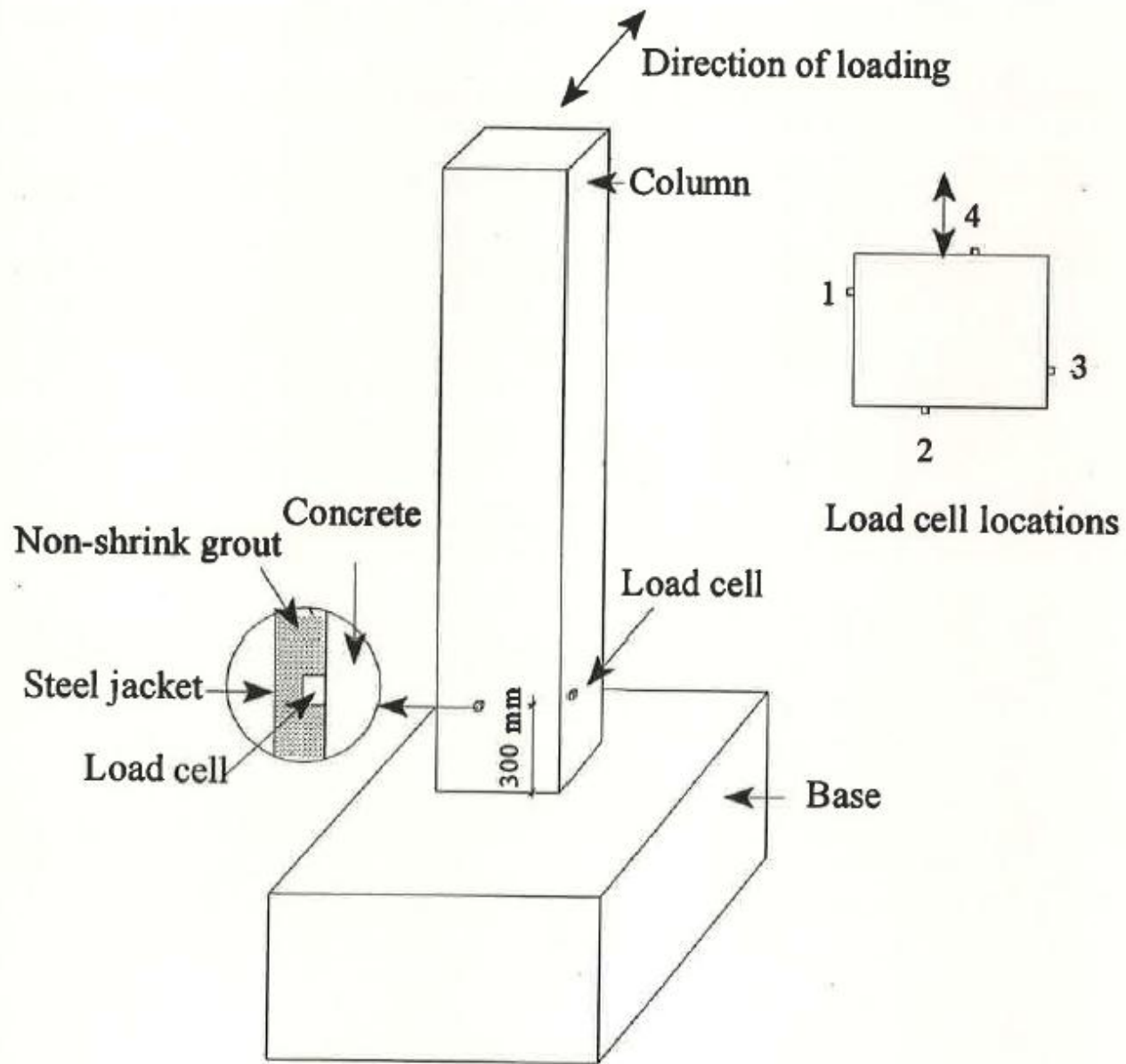


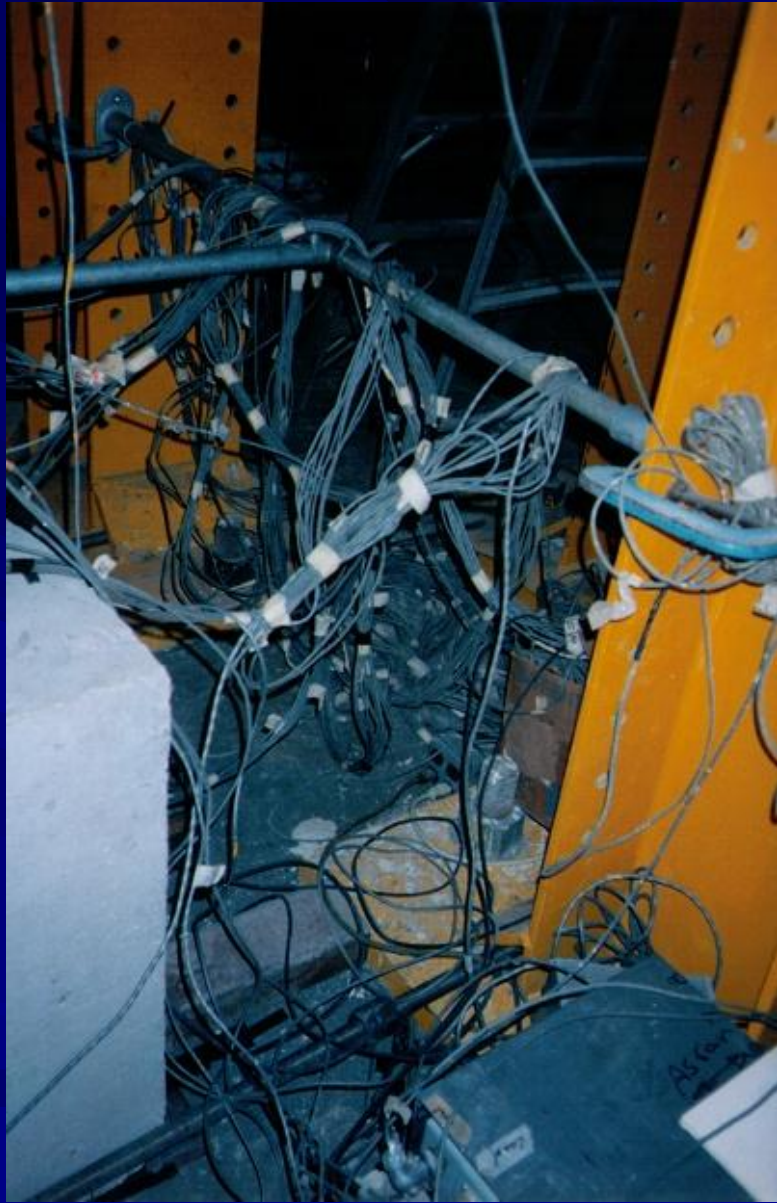
**Pitch = 68 mm**

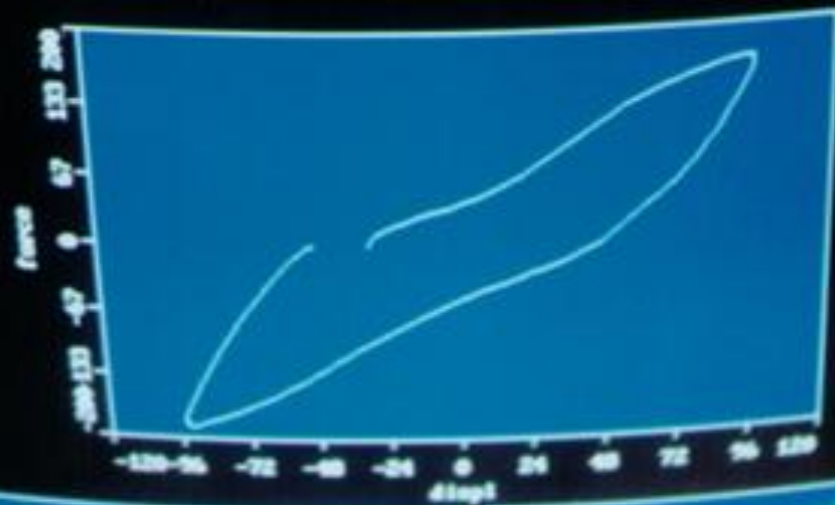








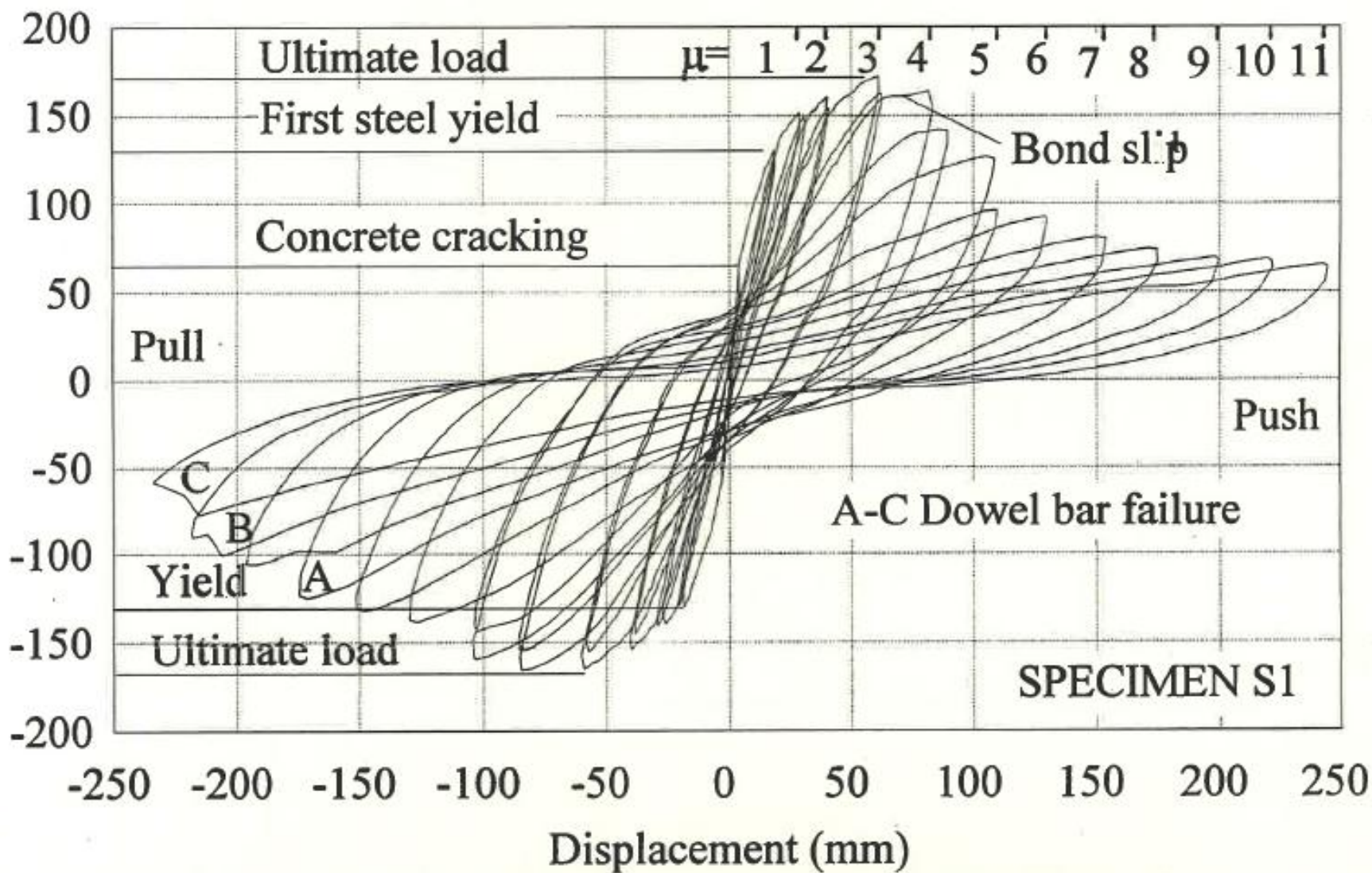


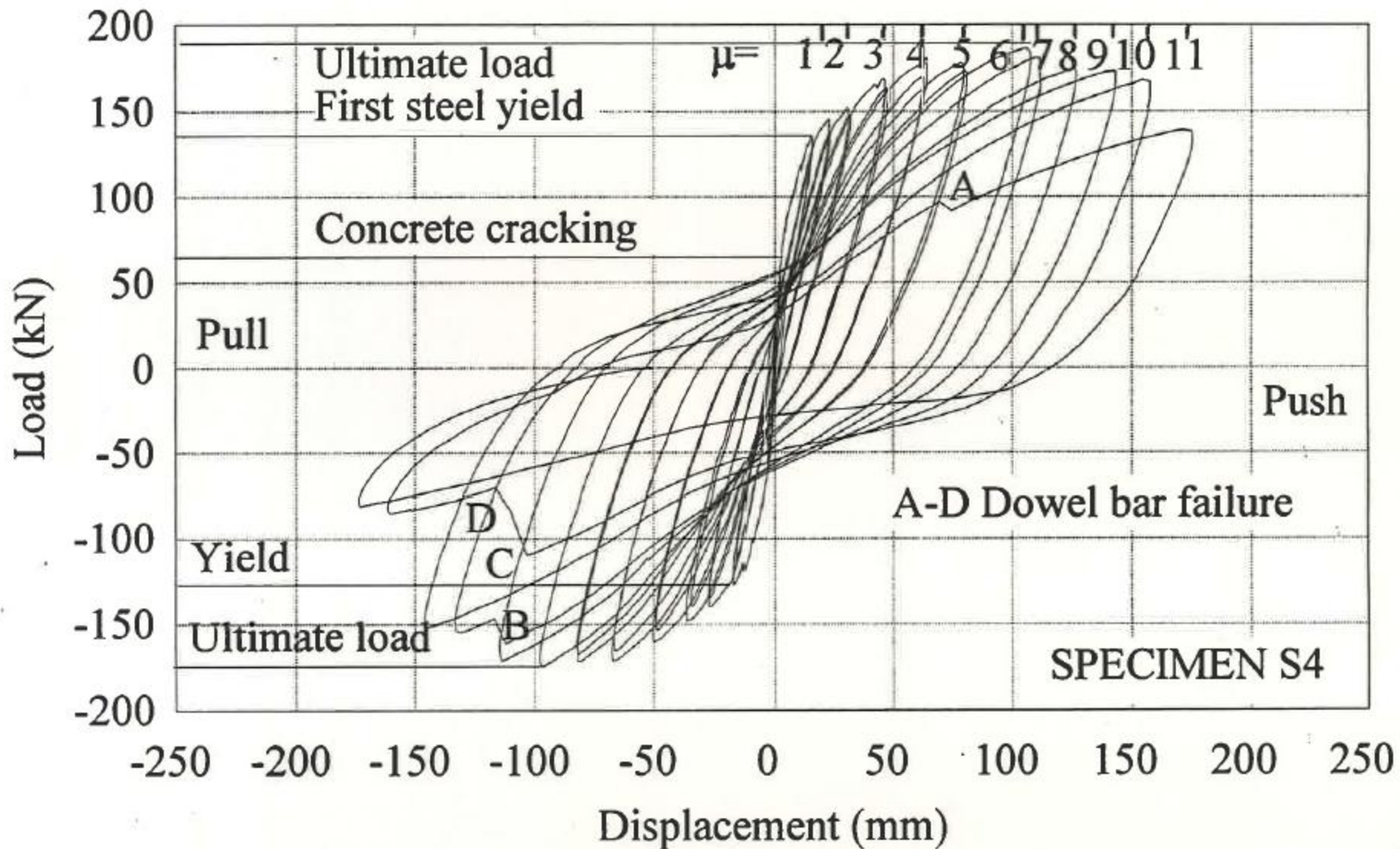


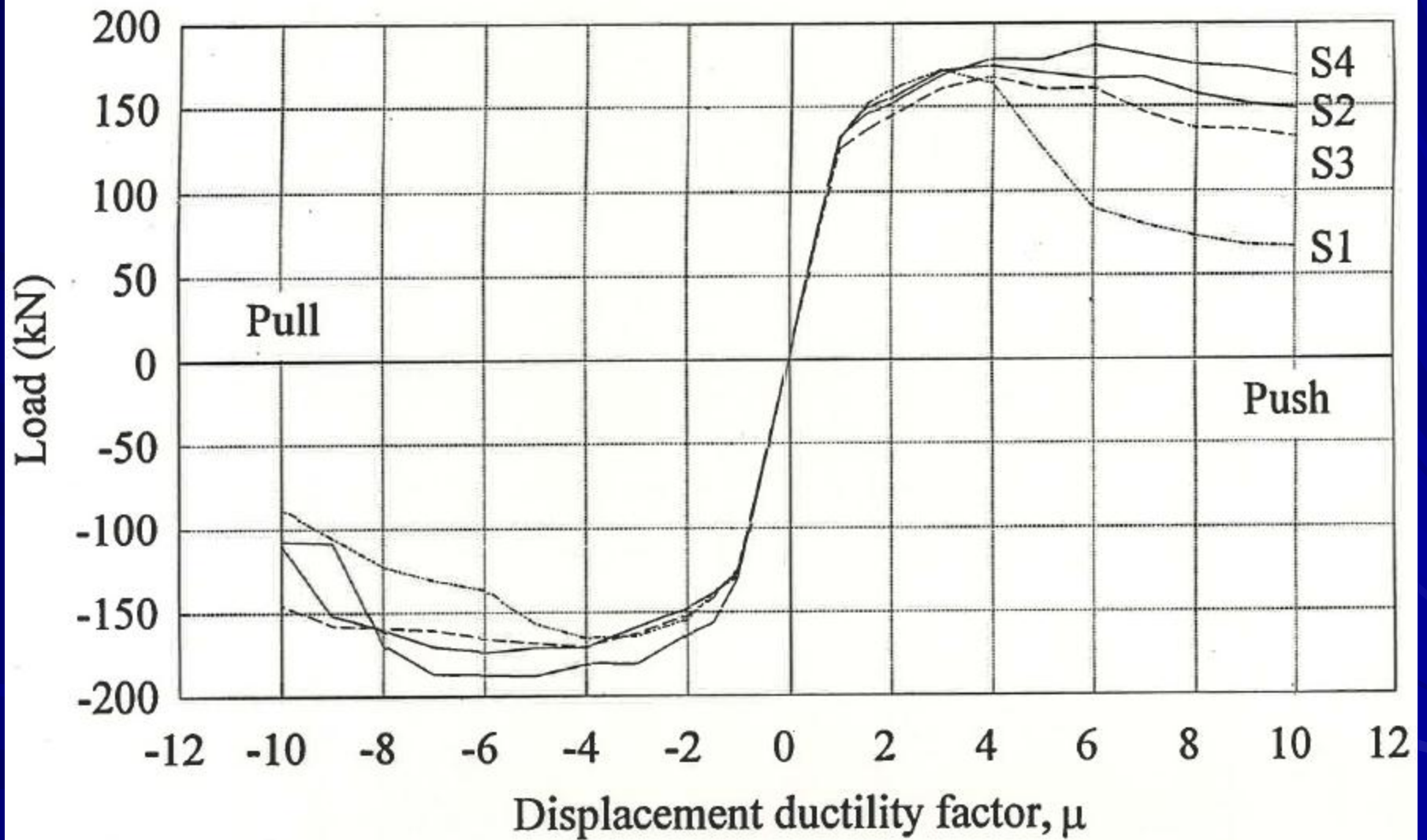
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n	-492.070	Ln	-1.1e+03
		Ns	-8.6e+02

Trumpet-14

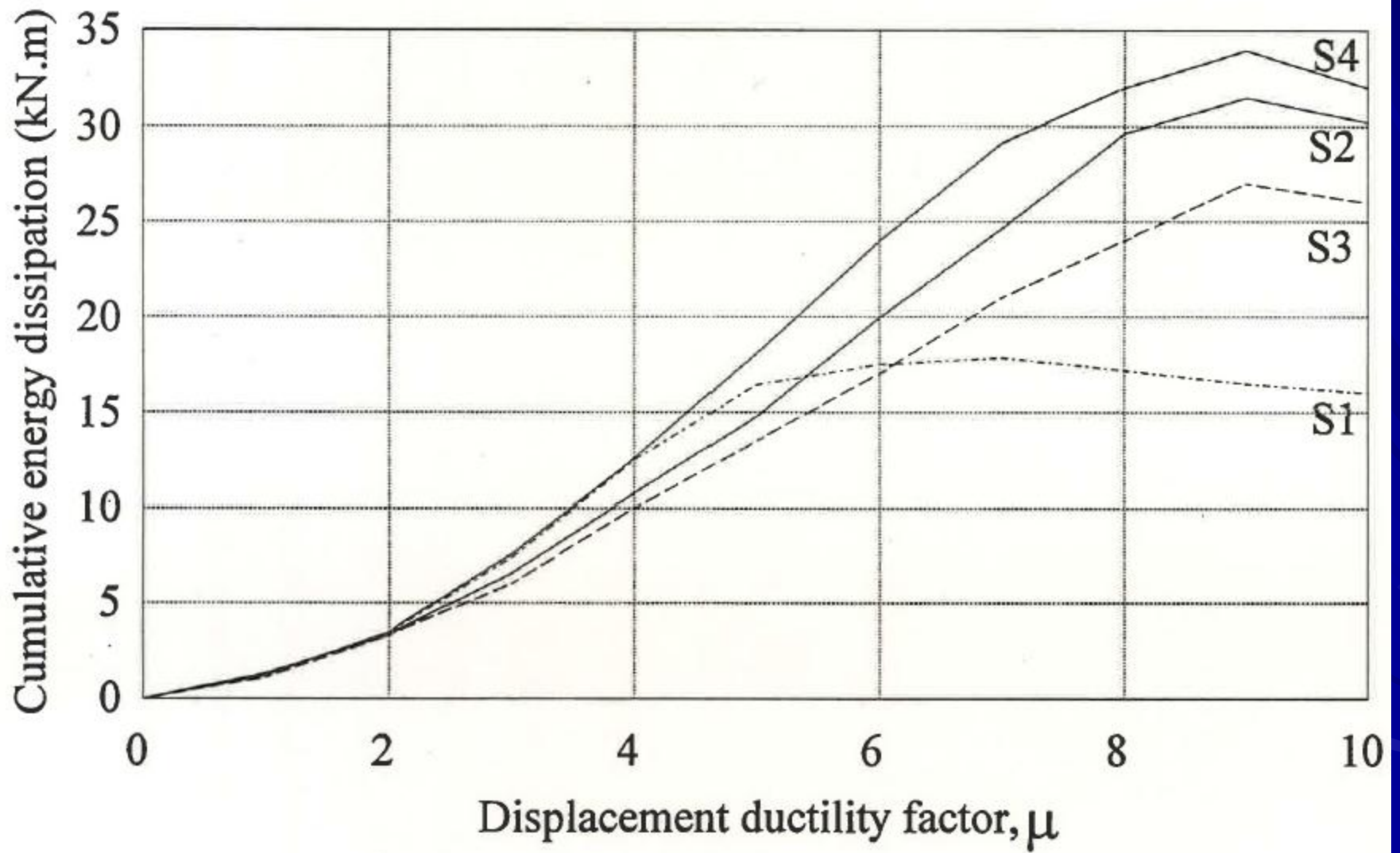




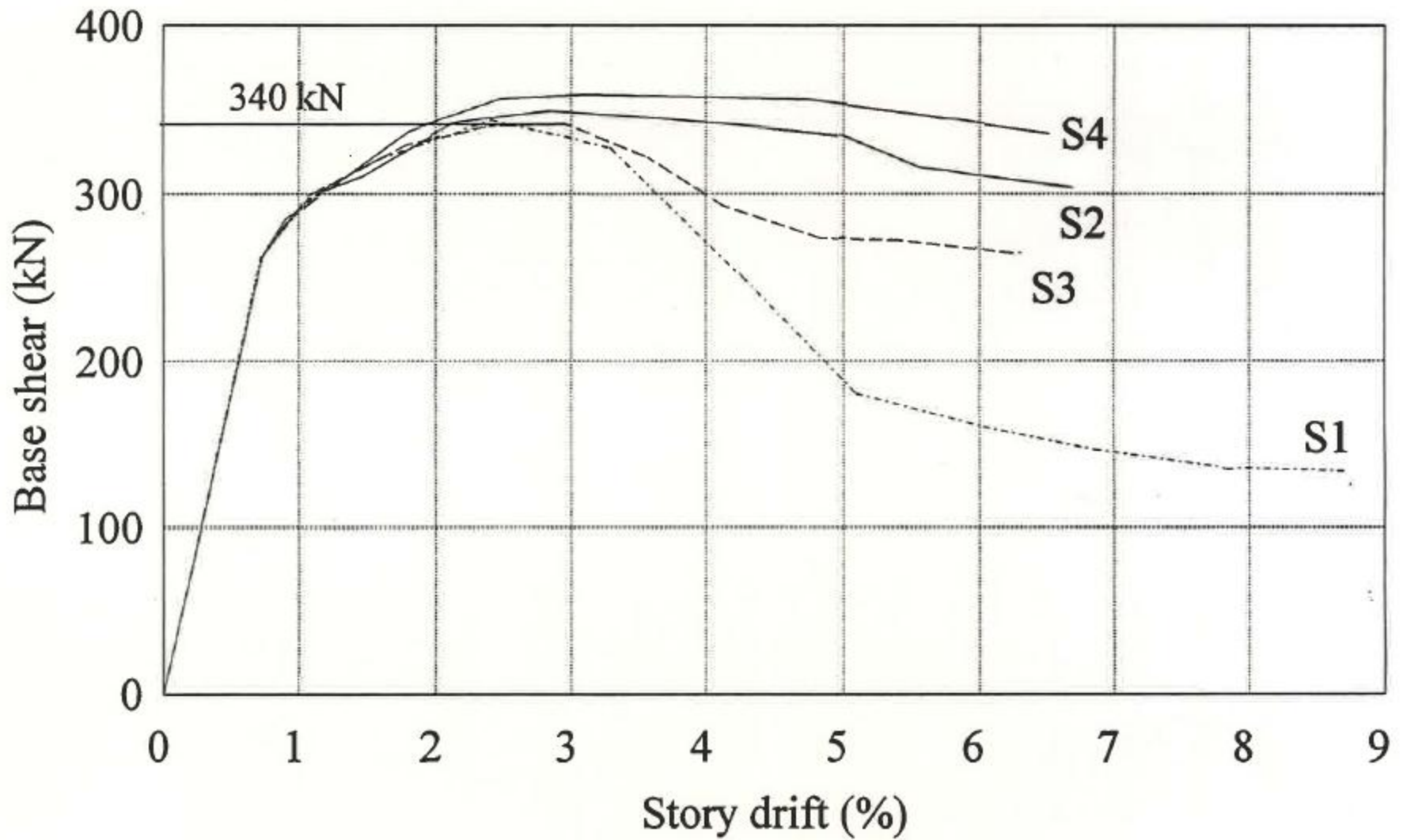


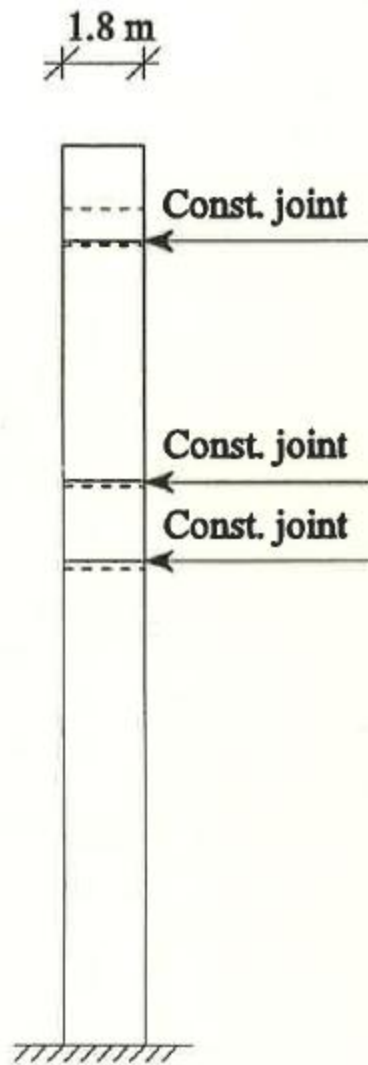




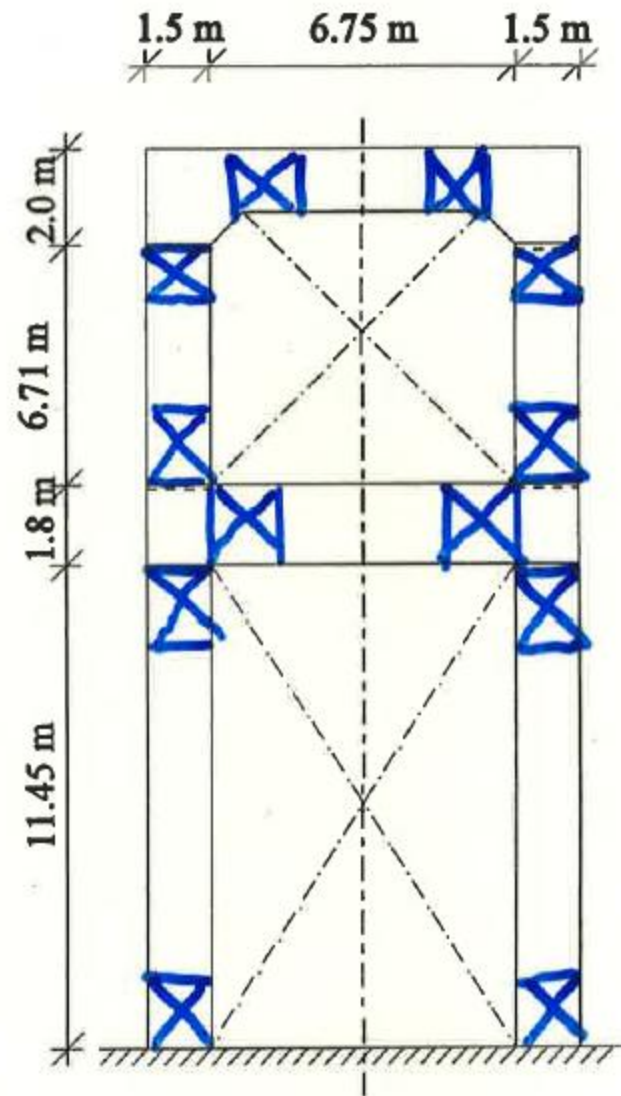




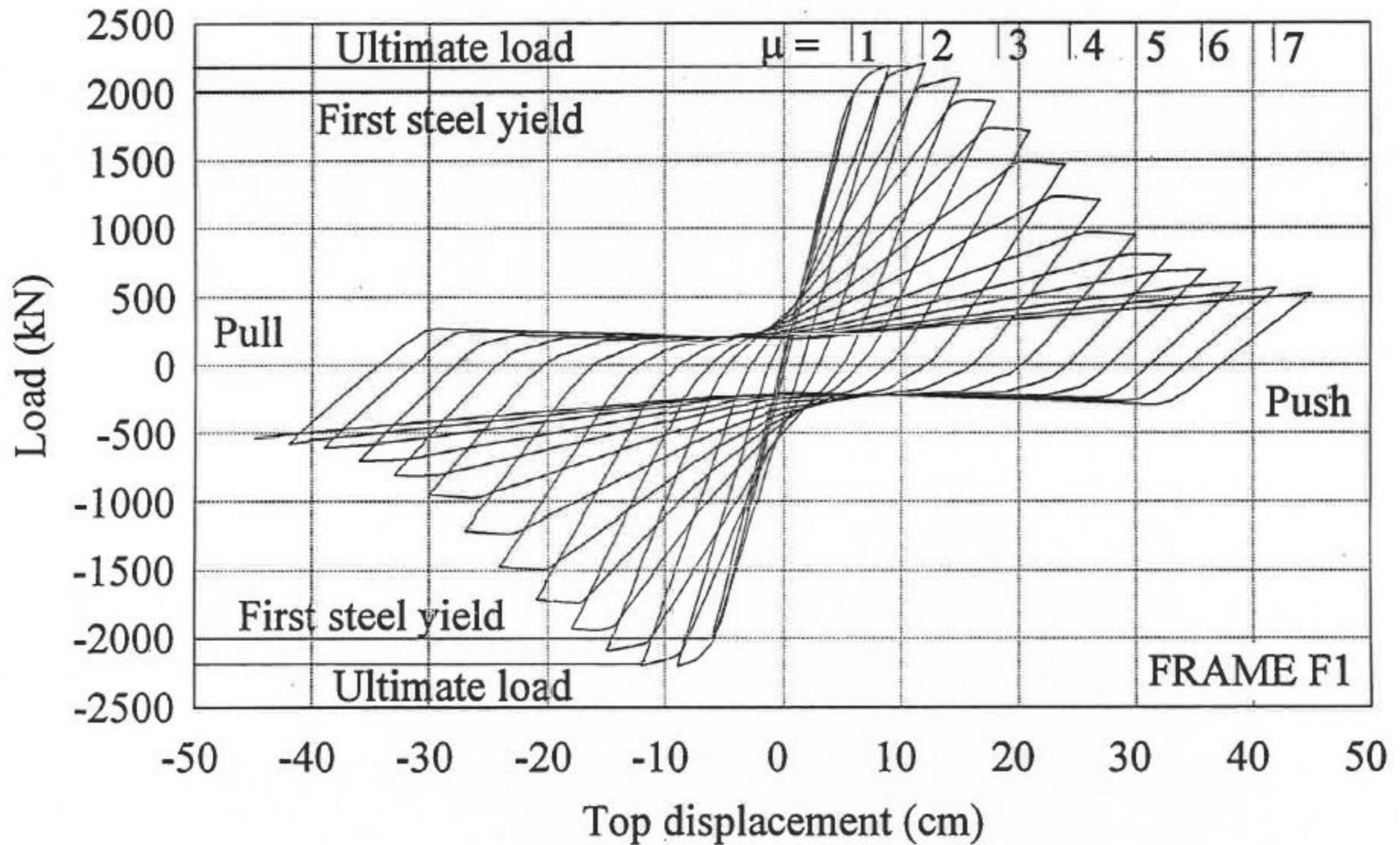




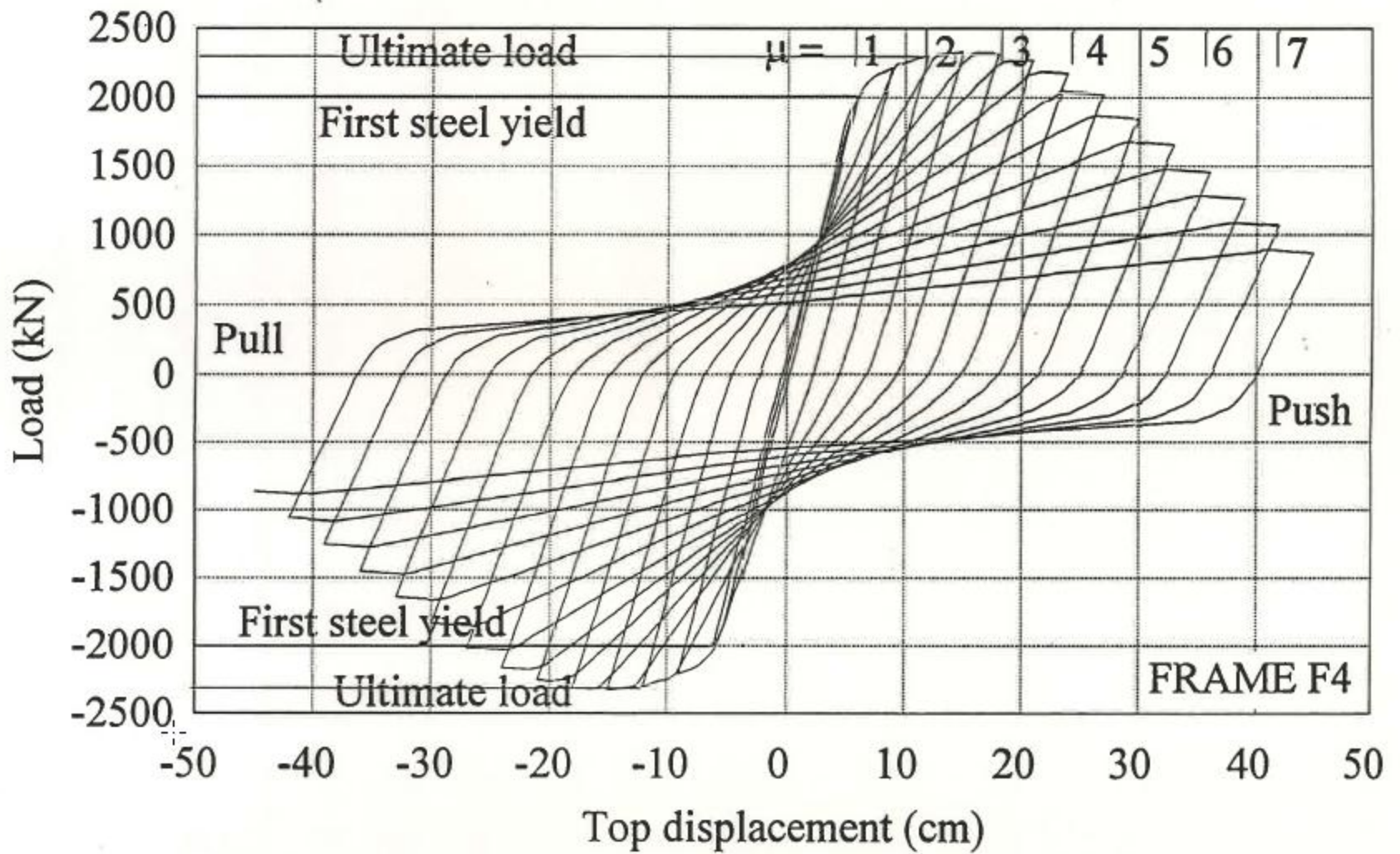
Side-view



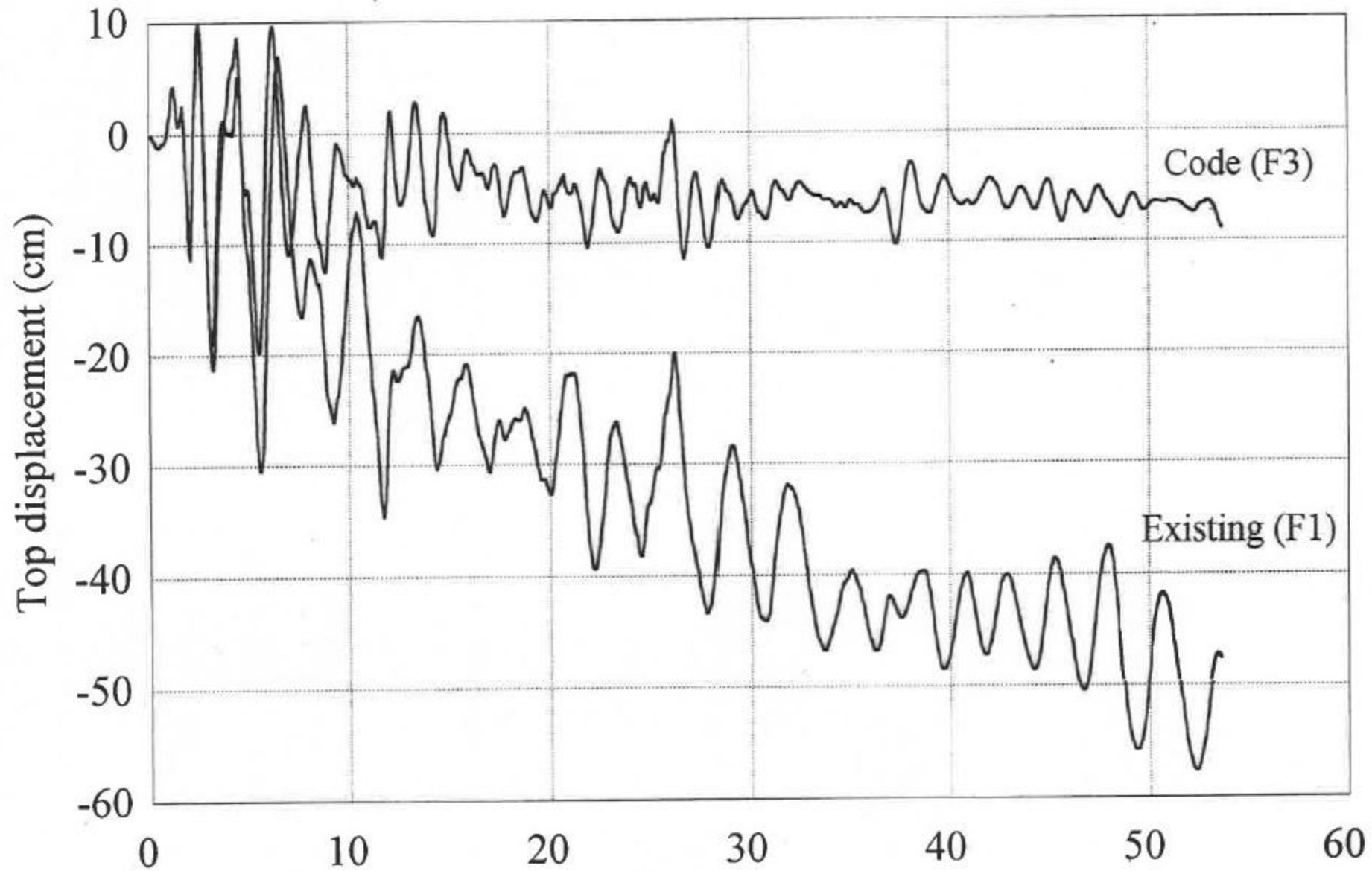
Elevation











# Conclusions

# Conclusions

- The “as-built” specimen was not capable of ductile behavior
- The “code-designed” specimen behaved in a ductile manner
- Both Corrugated steel jacket and flat steel jacket with Hilti bolts provided the columns with adequate confinement
- Nonlinear analyses were capable of predicting the response of both existing and retrofitted structures



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## Concrete Industry Management (CIM)

DEGREE PROGRAM FOR CAREERS IN CONCRETE

The objective of the Concrete Industry Management (CIM) Program is to produce graduates grounded in the basics of concrete's production techniques and its use in a multitude of construction applications. In addition, graduates acquire a minor in business administration. A CIM degree is designed to provide the graduate with a broad array of initial opportunities within the industry that include sales, operations, technical services, project, production and concrete construction management. CIM students gain both theoretical and practical knowledge of the concrete industry, its production techniques and construction applications through typical classroom-style learning, as well as hands-on experience through an array of internship opportunities.

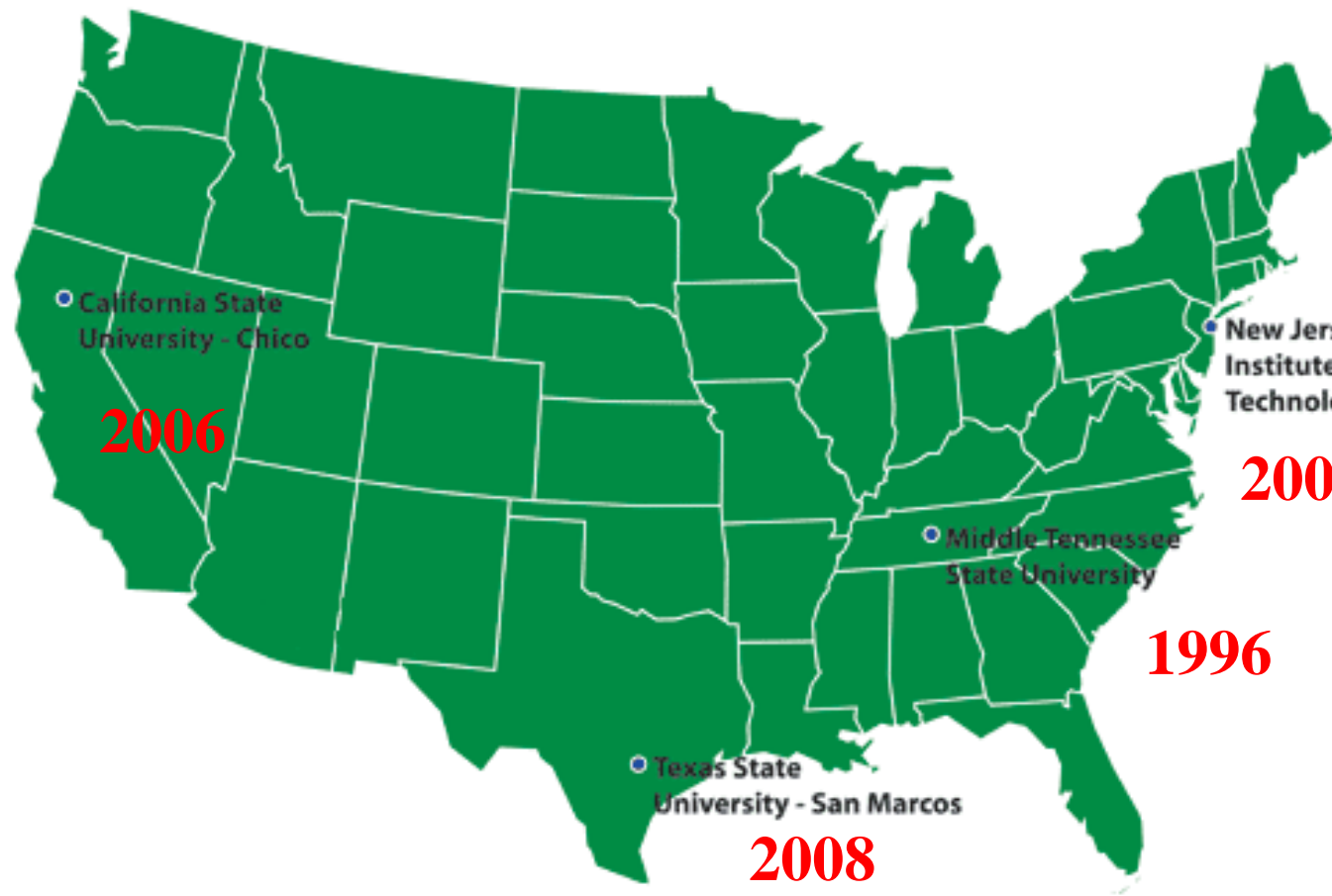
The CIM Program was originally founded at Middle Tennessee State University in 1996. Since then, more than 200 people have graduated from the program. The CIM Program has expanded to Arizona State University, the New Jersey Institute of Technology, California State University - Chico and Texas State University - San Marcos.



CIM RELEASES  
2011-2012  
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# CIM Sponsoring Organizations



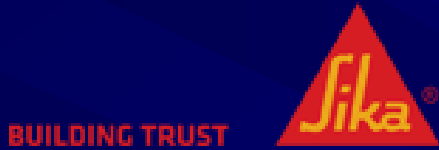
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PCA Portland Cement Association



# CIM Patrons (Local & National)



**\$200,000 Annually**  
**(\$100,000 national and 100,000 local patrons)**

- (1) Travel Seminars/Conferences
- (2) Scholarships
- (3) Field Visits
- (4) Laboratory Equipments and Supplies
- (5) Research
- (6) Salaries



# National Patrons



**\$ 800,000**



# **Exclusive Dinner & Wine Tasting**

## **Celebrate the CIM Program at NJIT**

**Valbella Restaurant  
421 West 13th Street  
Manhattan**

**Saturday, February 22, 2014  
7 pm Cocktails / 8 pm Dinner**

**\$ 100,000**



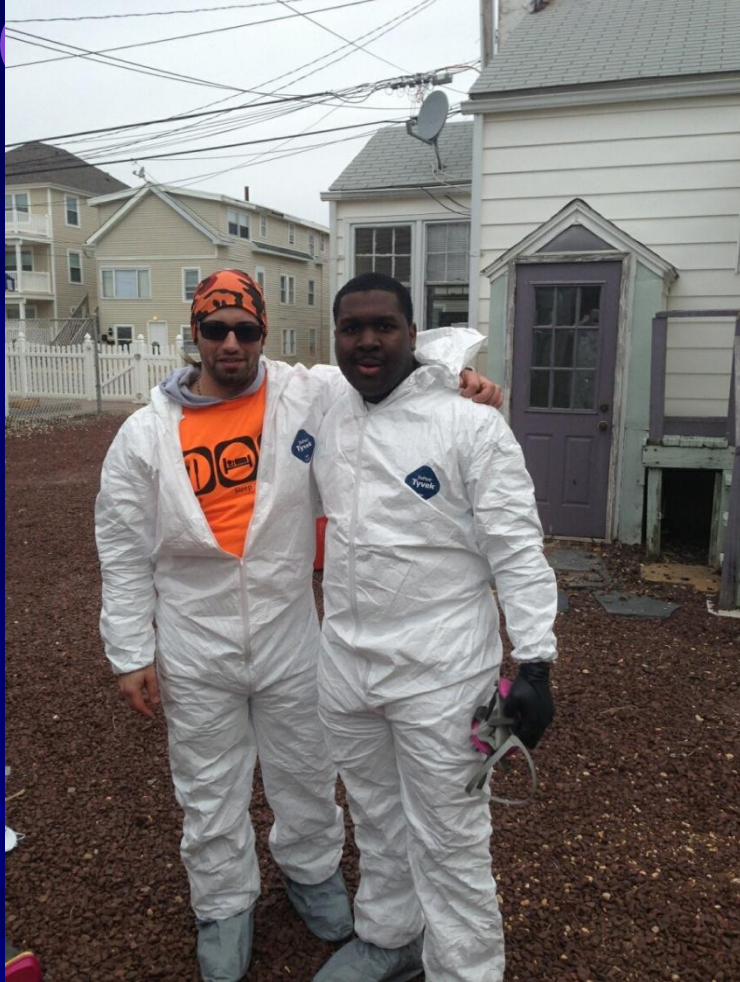






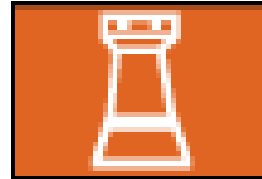


# Hurricane Sandy Relief Effort, ACI Student Chapter, Jersey Shore, NJ, Mar 18, 2012





# CIM Students Activities

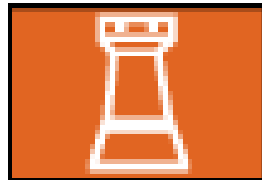


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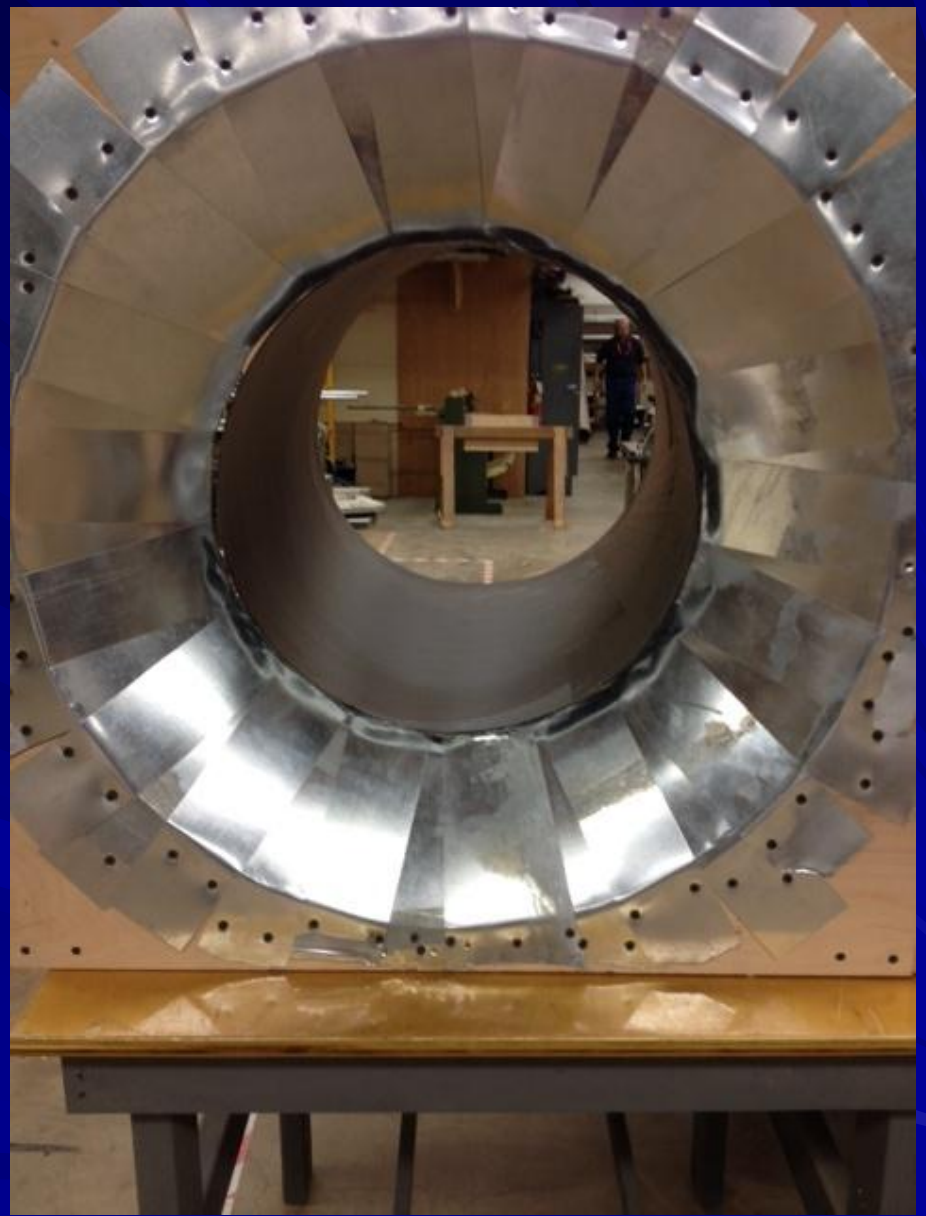
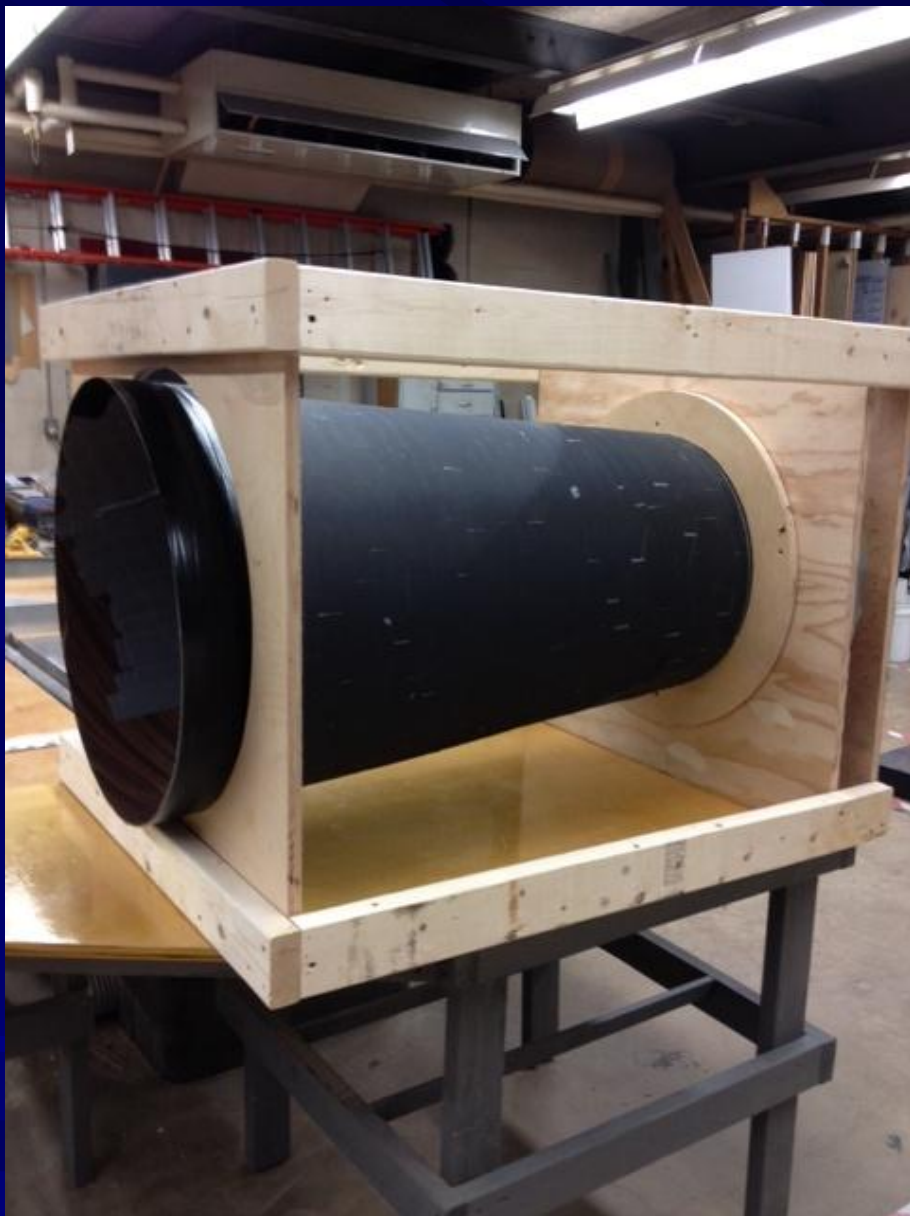


# CIM Students Activities

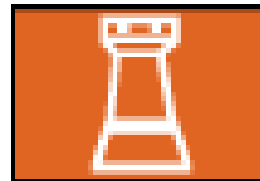












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# CIM Students Activities (December 23)

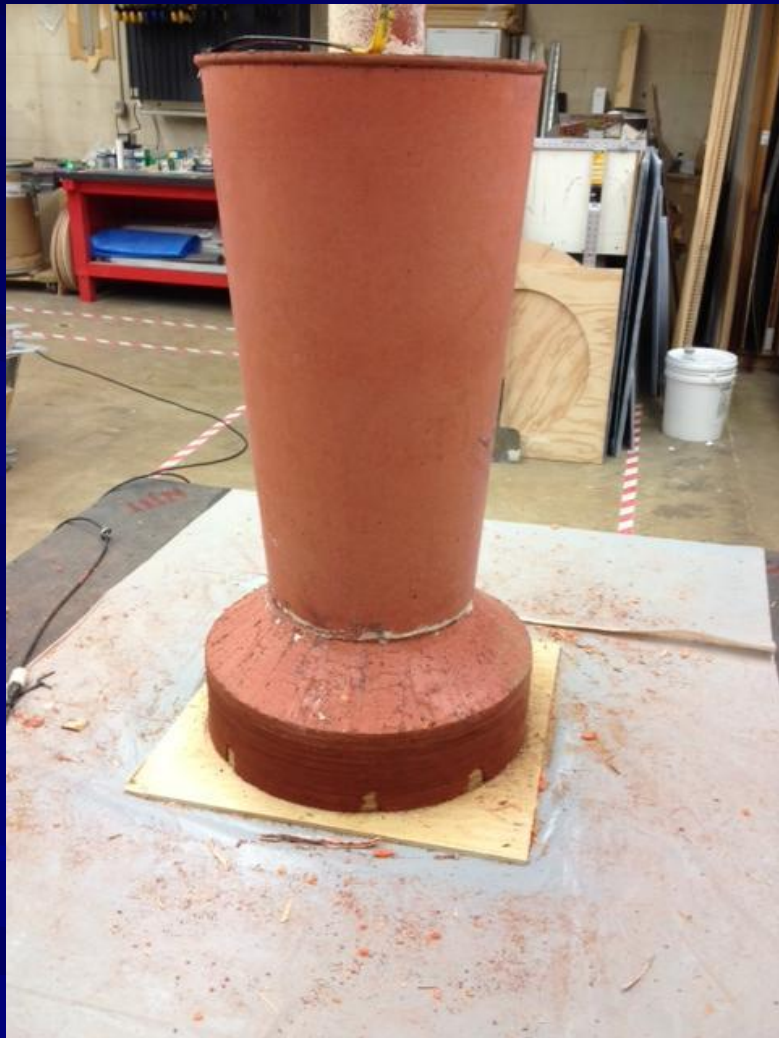




# CIM Students Activities (December 23)




# CIM Students Activities (January 13)






# CIM Students Activities (January 13)



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# CIM Students Place Second and Third at ACI Competition

NEWARK, Nov 21 2013

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Two Concrete Industry Management (CIM) students were winners in the recent American Concrete Institute (ACI) Art of Concrete Competition. Of the thirty-three teams that participated, Disan Katumba, of Linden, placed second and Narguis Benyamin, of Garfield, placed third. Both students, also NJIT ACI student chapter members, spent months designing and working on their models. The international competition, held this year in Phoenix, Arizona, challenges students to explore the artistic nature of concrete and display its many varieties of form, function, and beauty.





# Concrete Association Meetings



**ACI New Jersey**

**ICRI Metro New York**

# ICRI Metro NY Chapter Golf Outing September 19, 2013





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## ICRI NEWS ARCHIVES

### ICRI ANNOUNCES FORMATION OF FIRST STUDENT CHAPTER

Rosemont, IL - October 21, 2011 - The International Concrete Repair Institute (ICRI) announces the formation of the California State University, Chico Student Chapter. The ICRI Board of Directors approved its 34th chapter and first student chapter during the ICRI 2011 Fall Convention in Cincinnati, Ohio.

The ICRI Chapters Committee worked diligently with the Director/Program Coordinator of the Concrete





INTERNATIONAL  
**CONCRETE REPAIR**  
INSTITUTE



**ICRI 2014 SPRING CONVENTION**  
MARCH 19-21, 2014  
PEPPERMILL RENO RESORT • SPA • CASINO  
RENO, NV



**ICRI Student Chapter President and Vice P resident for California State and NJIT**

Thank You

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