IRPO Day Presentation

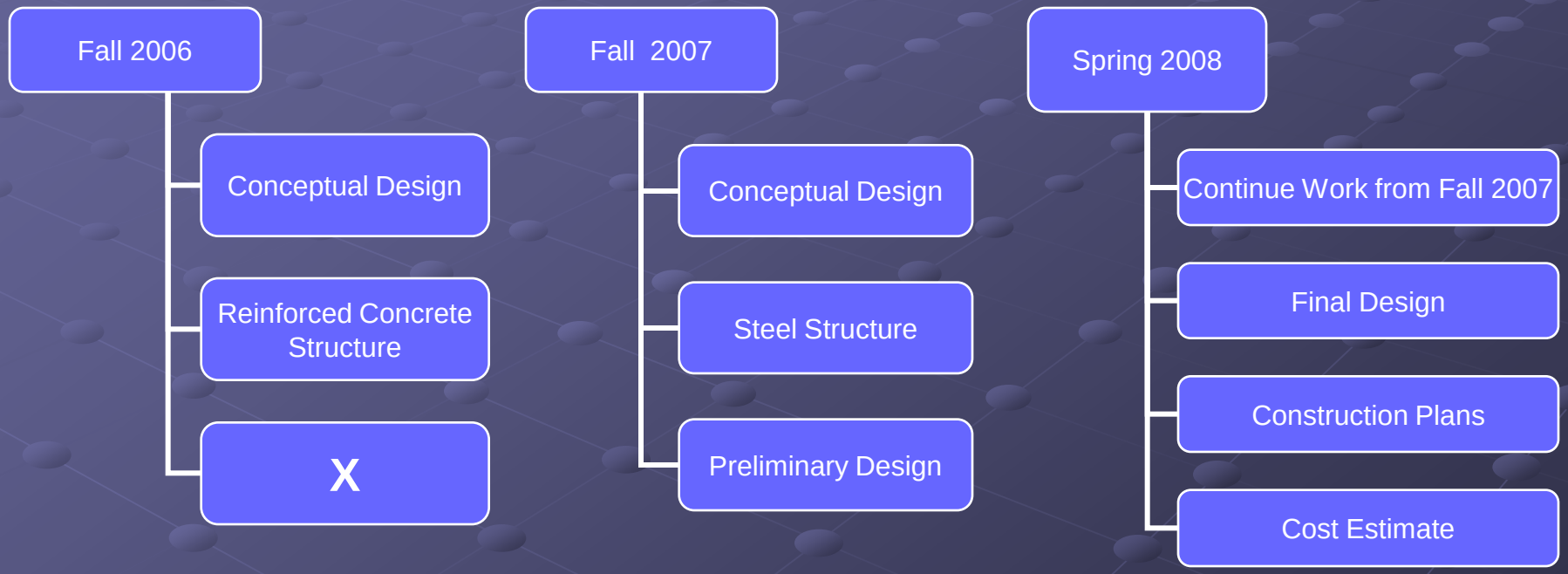
IPRO 315, Spring 2008
Design of Large Scale Structure
Automated Parking Garage

Name	Major
Brady, Brian	**AE**
Butkovich, Paul	**ME**
Chung, Chun	**CE**
Dominikowski*, Marek	**ARCH**
Herbert, Greg	**ME**
Hussaini, Nuddasir	**ARCH**
Magdel, Irina**	**CE**
Mallinger, Nicolle	**ARCE**
Omeralovic, Enis	**ARCH**

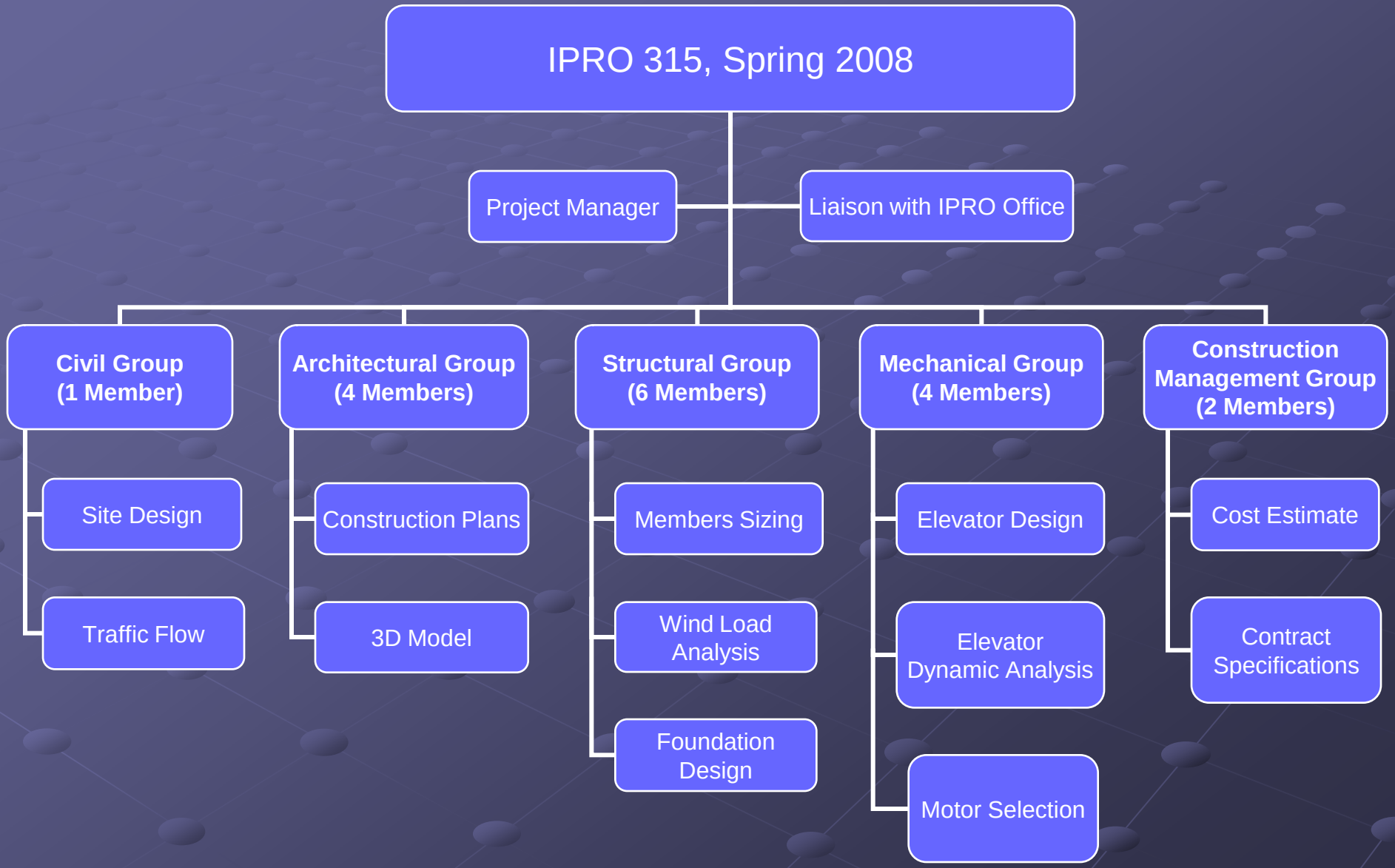
Name	Major
Palma, Jennifer	**CE**
Rathakrishnan*, Malar	**CE**
Ratnani*, Shoaib	**CE**
Russeva, Diyana	**CE**
Russo*, Ben	**CE**
Shim, Mary	**ARCH**
Sisay, Mary	**CE**
Varhegyi*, Aron	**ME**
Velichkov*, Veselin	**CE**

*** Group Leader**
**** Project Record Keeping/Liaison with IPRO Office**

IPRO 315 Development



Organization Chart



Civil Group

- Completed in Fall 2007
  - Preliminary traffic flow
  - Preliminary site plan
- Completed in Spring ‘08
  - Design horizontal curves or intersections for traffic flow conditions
  - Correct/update site plan

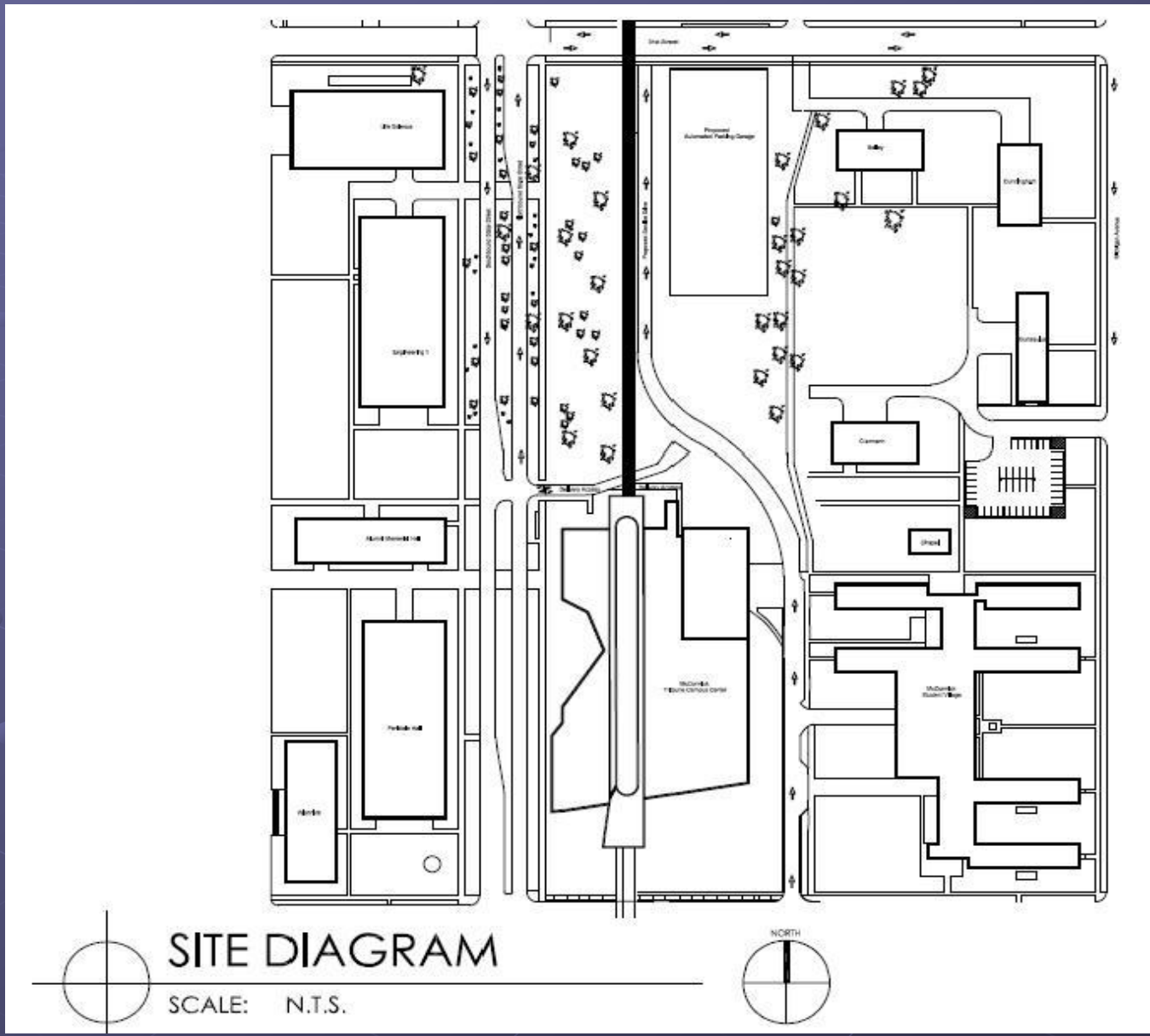
Location and Vicinity

Problem

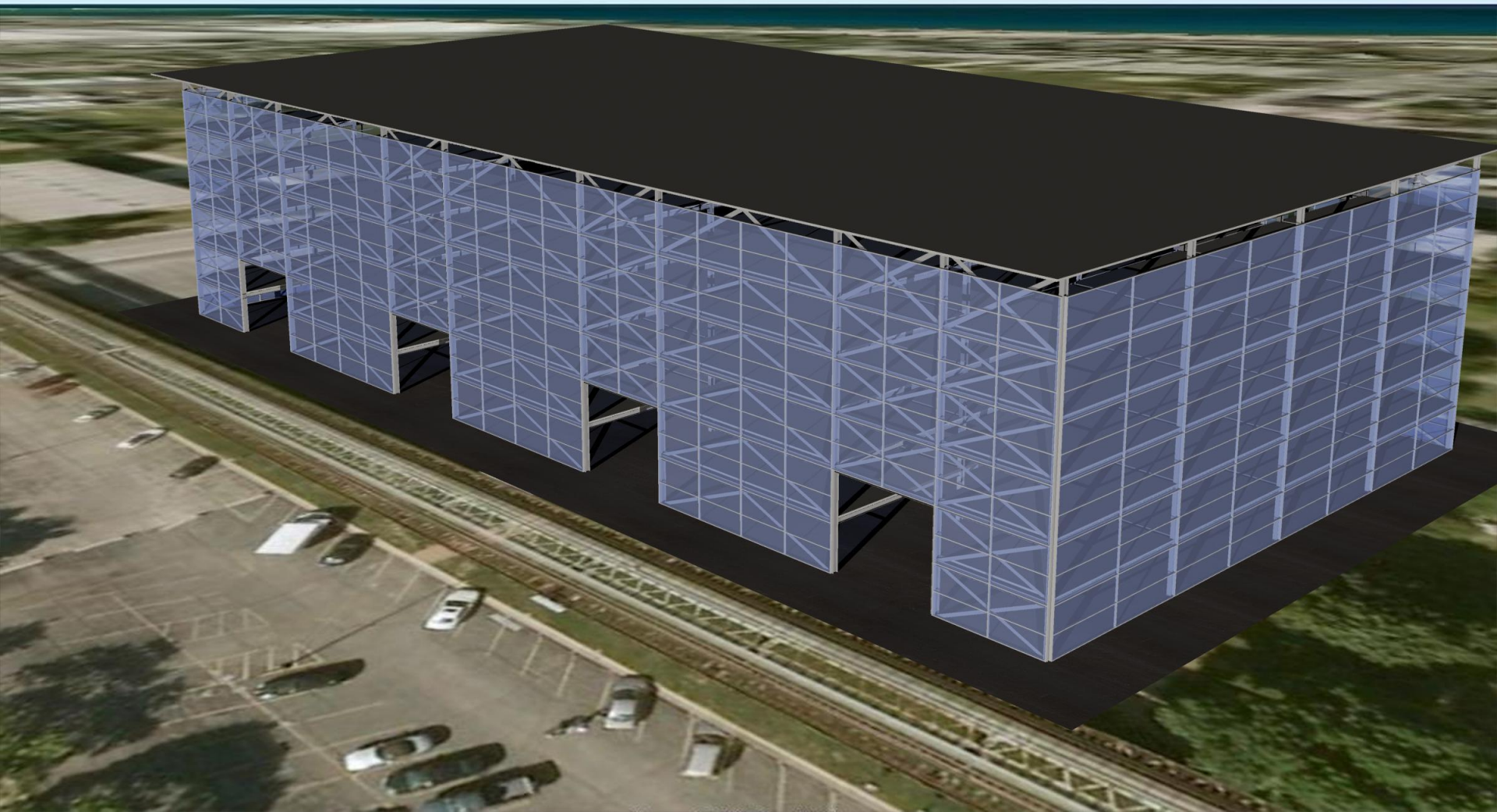
- spillover of cars onto 31st Street due to parking garage

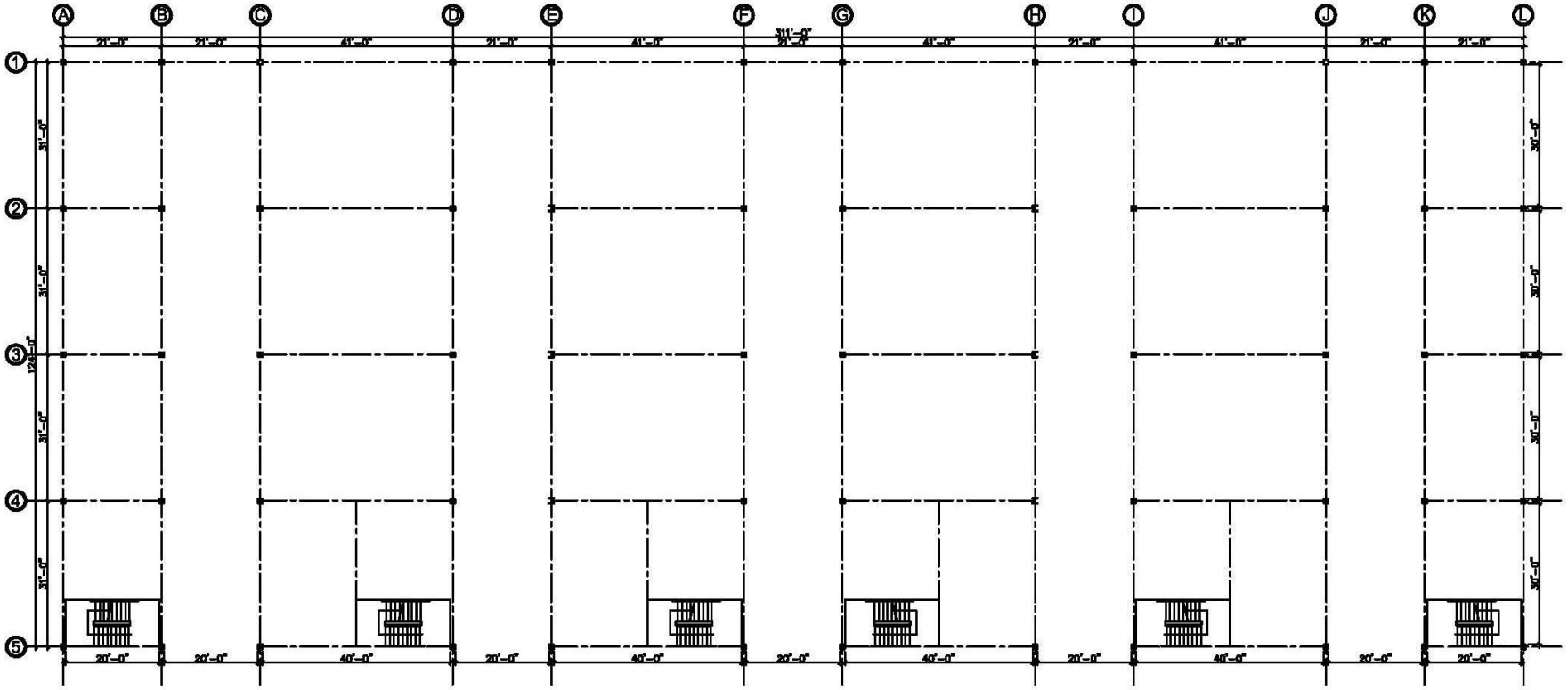
Solution

- Provide access between 31st St. and 33rd St. via Wabash



Architectural Group

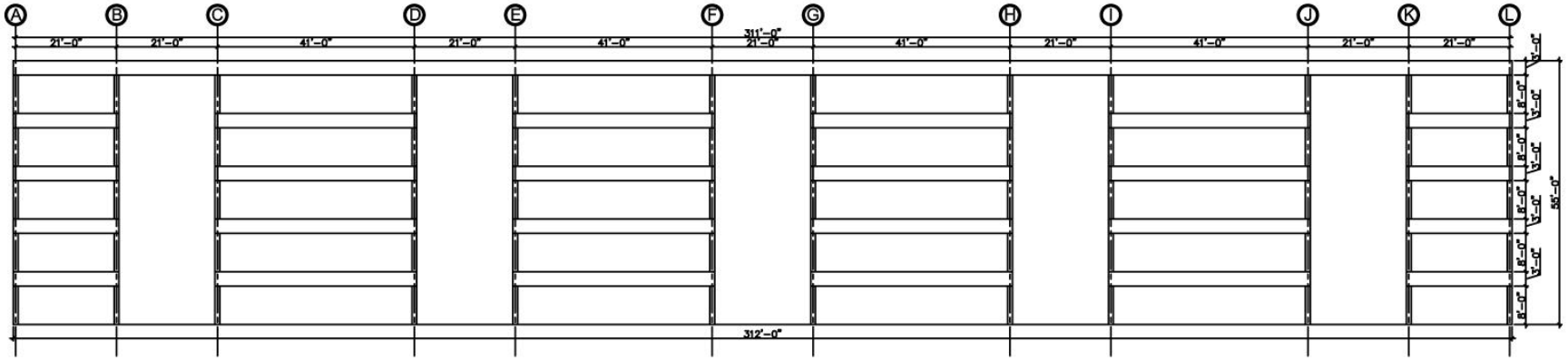




FLOOR PLAN

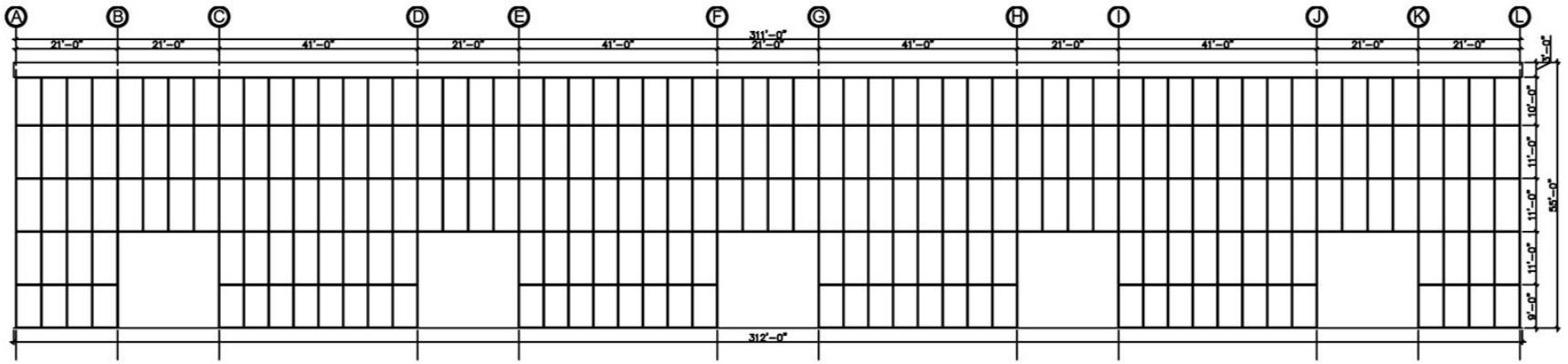
SCALE: 1/32" = 1'-0"

NORTH



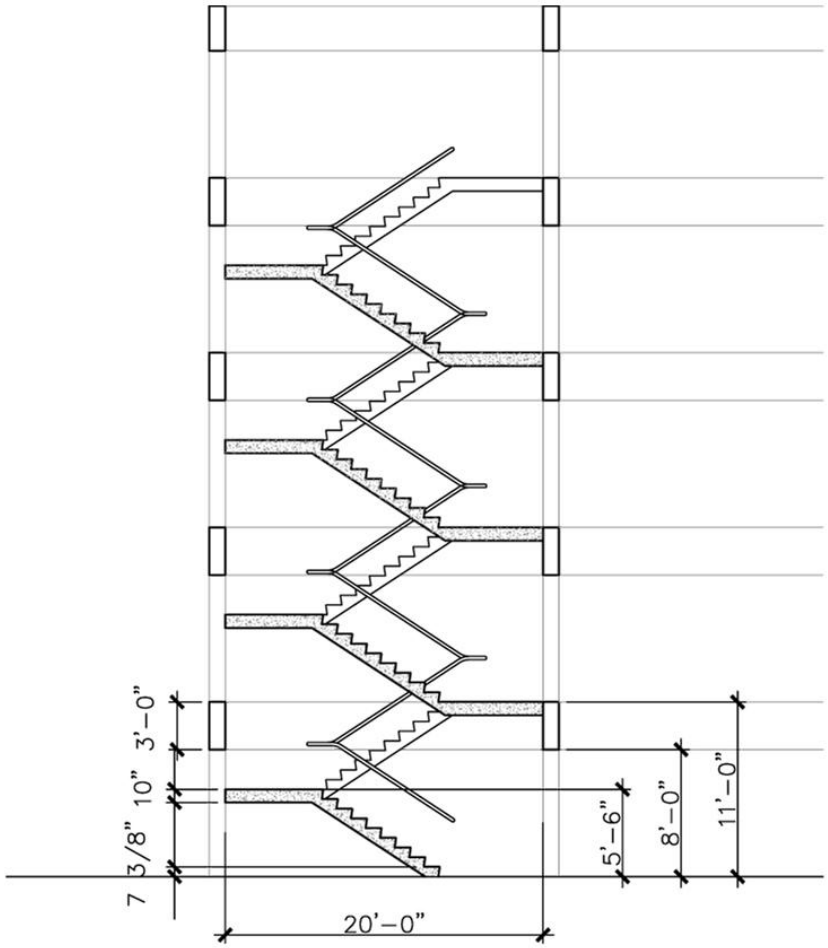
SECTION ELEVATION

SCALE: 1/32" = 1'-0"



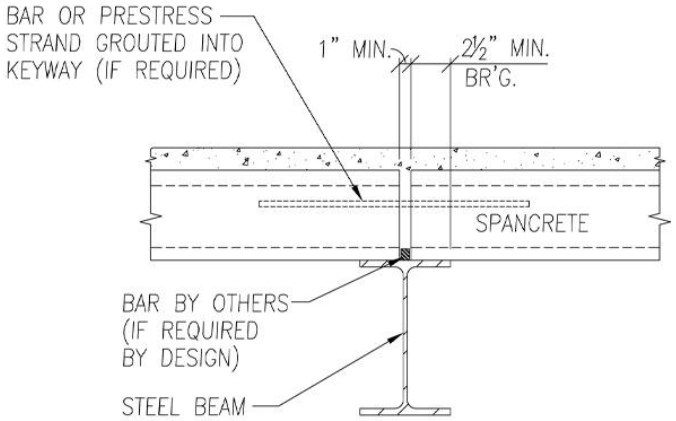
ELEVATION

SCALE: 1/32" = 1'-0"

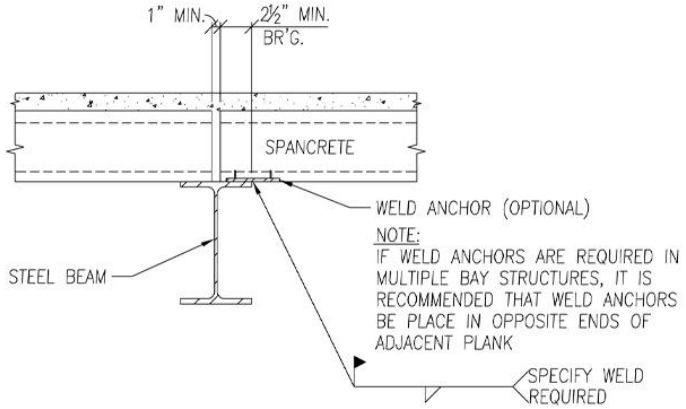


STAIR DETAIL

SCALE: 3/32" = 1'-0"

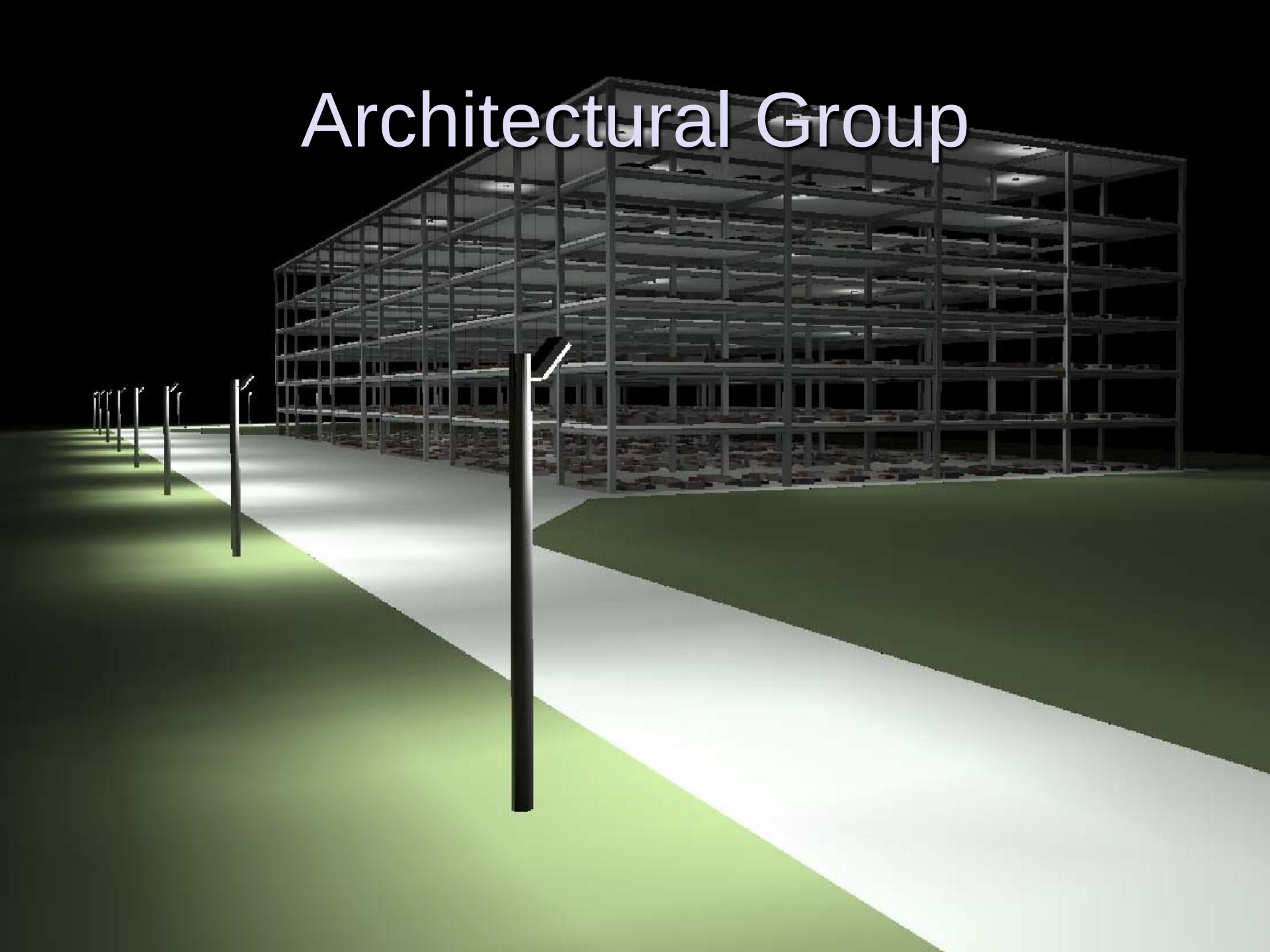


HOLLOWCORE FLOOR PLANK BEARING ON INTERIOR STEEL BEAM



HOLLOWCORE FLOOR PLANK BEARING ON INTERIOR STEEL BEAM

Architectural Group



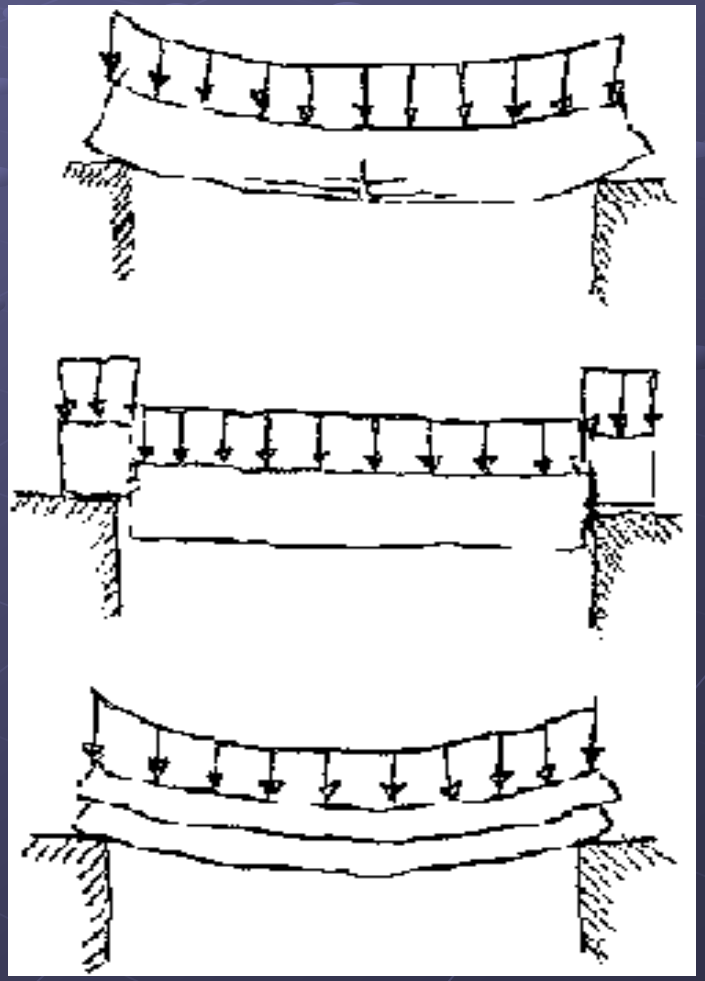
Structural Group - Members

Three Common Failure Modes to Check For :

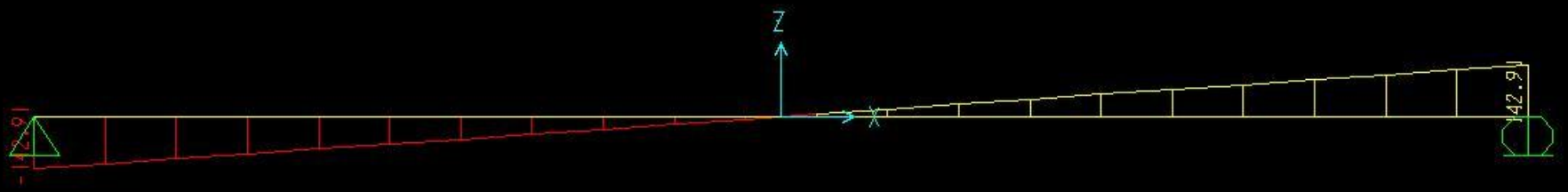
Bending

Vertical Shear

Horizontal Shear

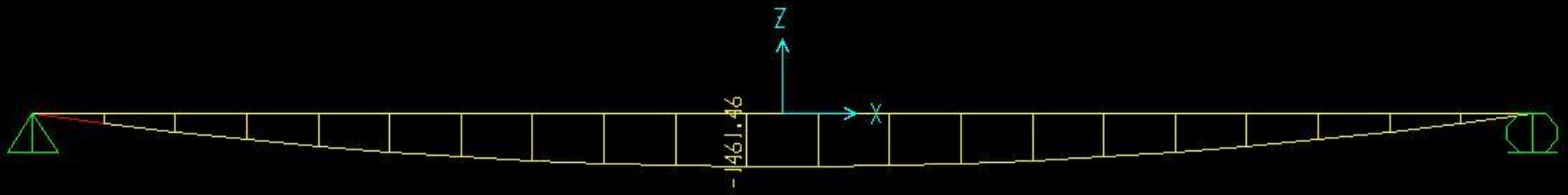


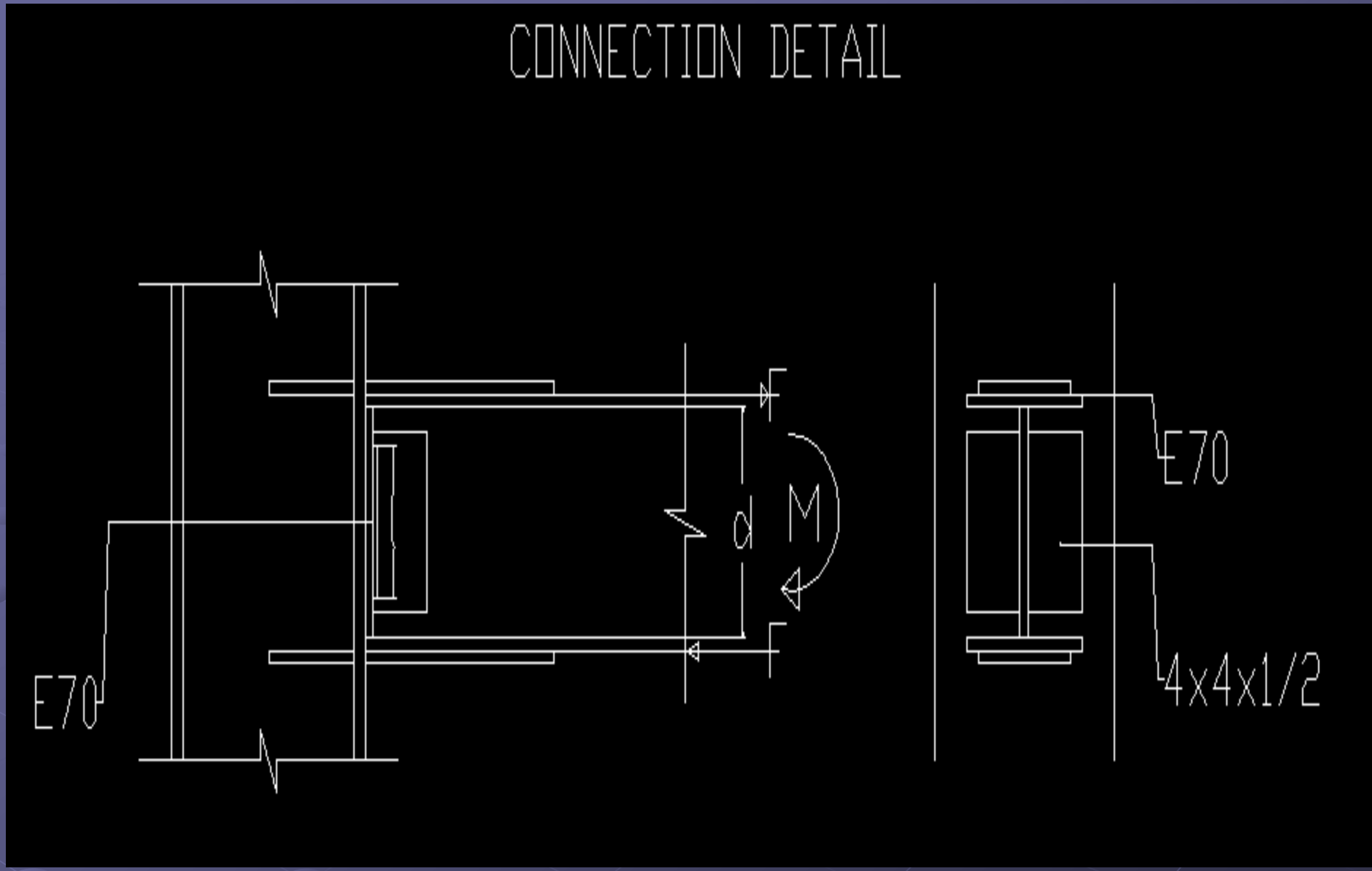
Shear Diagram



Analysis Model

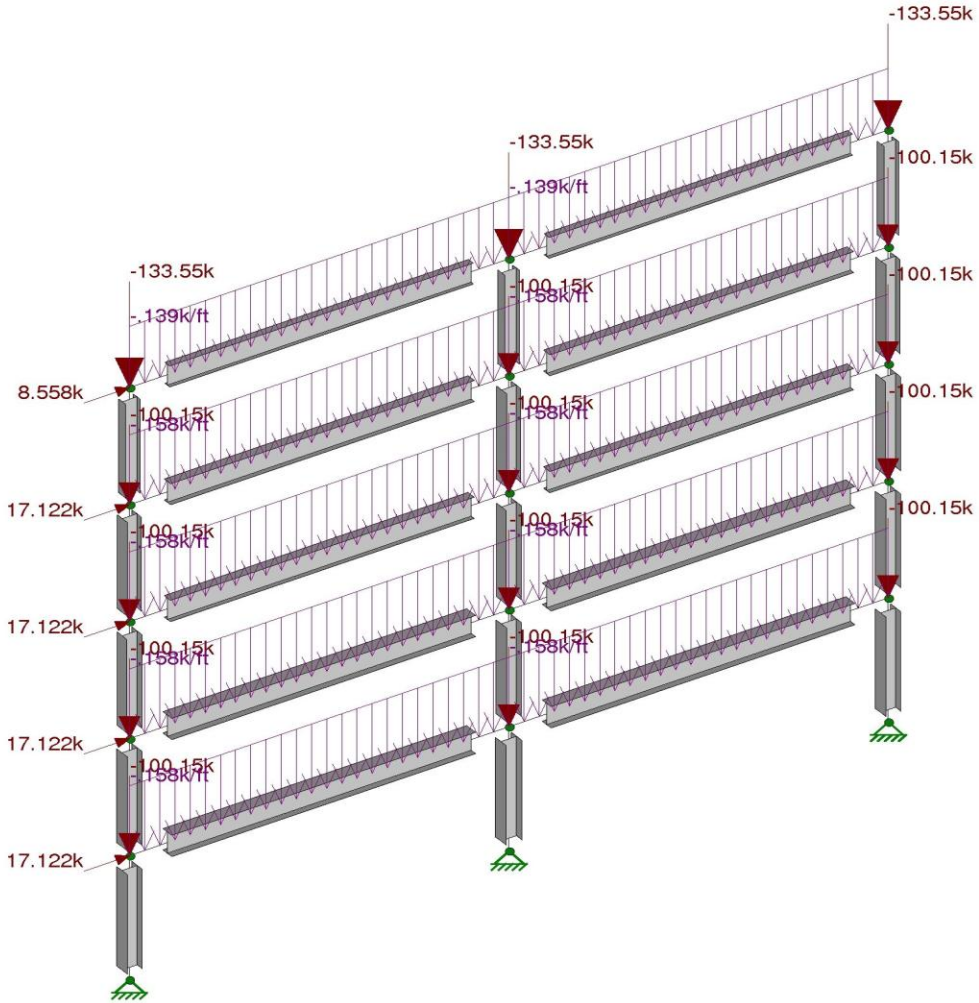
Moment Diagram





Structural Group - Members

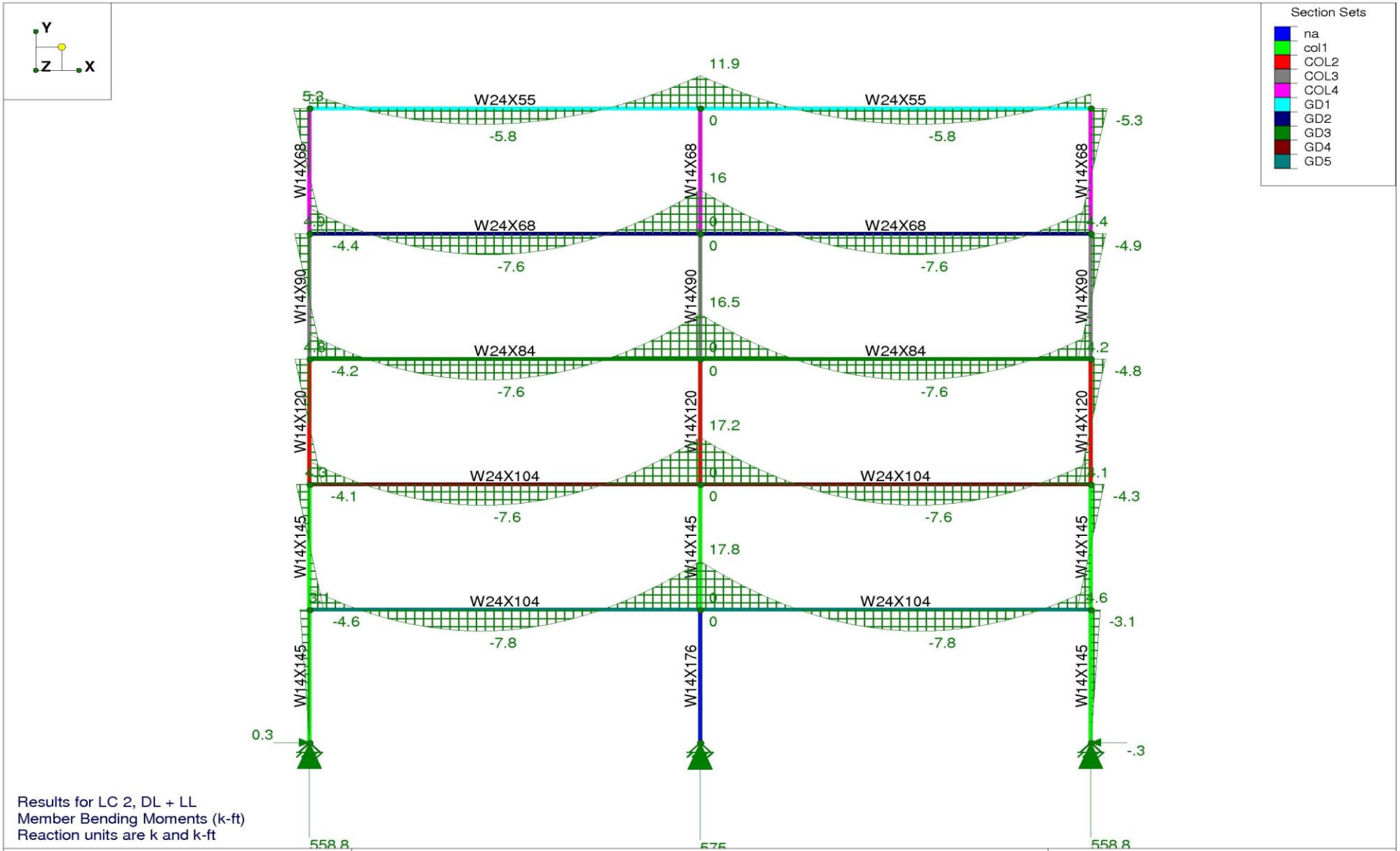
Structural Group – Wind Load



Loads: LC 6, DL + .75LL + .75SL + .75WL

	Moment Frame cl_E	
Diyana Russeva & Veselin Velichkov		Apr 24, 2008 at 5:12 PM
IIT IPRO 315	LOADS	Moment Frame cl_E-04.13.r2d

Moment Diagram – Indicates High Stress Points



Moment Frame cl_E

Diyana Russeva & Veselin Velichkov

Apr 24, 2008 at 5:18 PM

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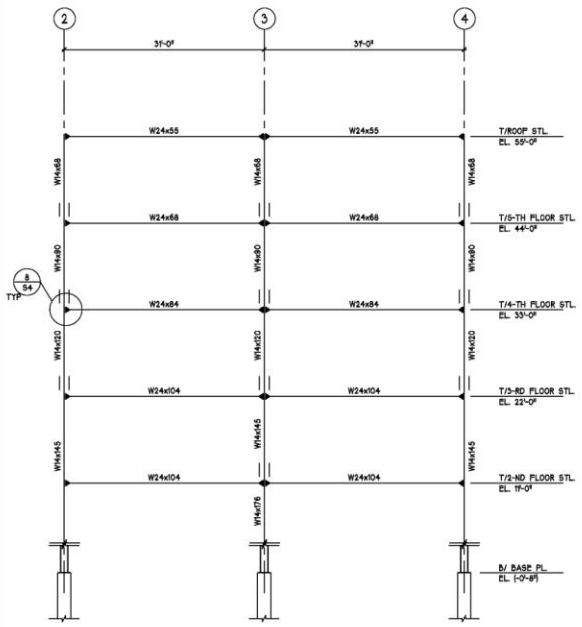
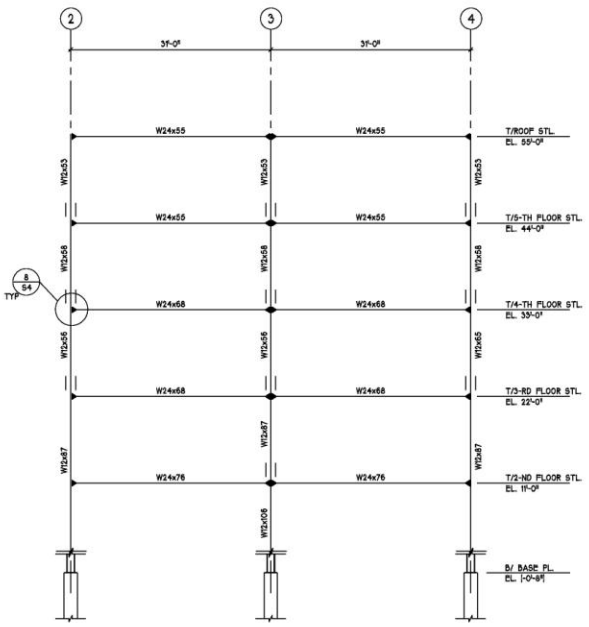
BENDING MOMENTS

Moment Frame cl_E-04.13.r2d

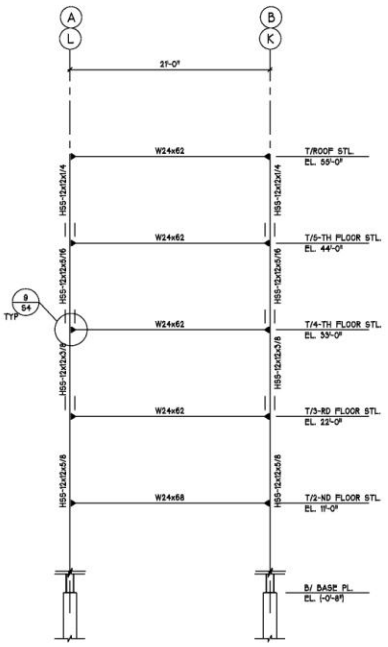
Structural Group – Wind Load



LINE Ⓔ AND Ⓗ - MOMENT FRAMES
SCALE: 1/8" = 1'-0"
1
S4



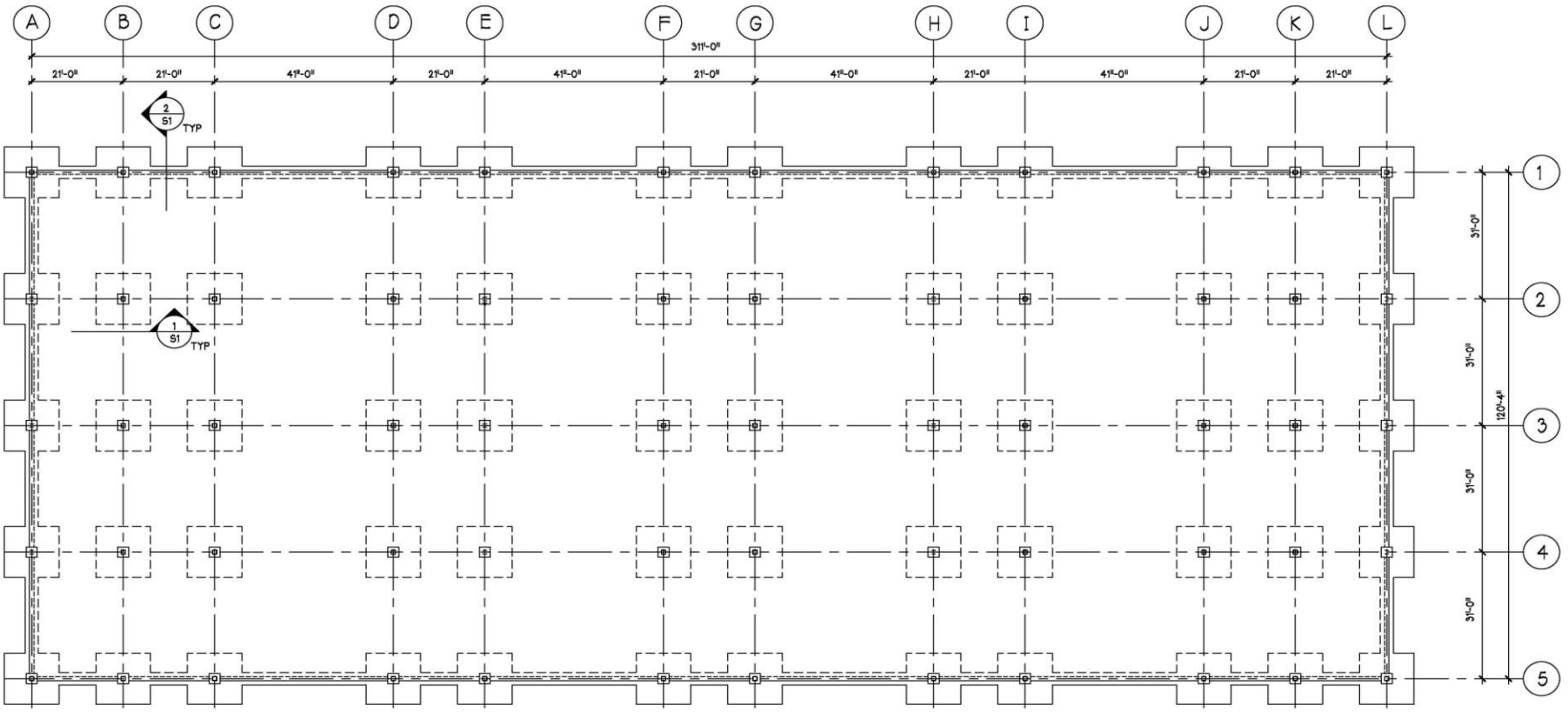
LINE Ⓐ AND Ⓛ - MOMENT FRAMES
SCALE: 1/8" = 1'-0"
2
S4



LINE ① AND ⑤ - MOMENT FRAMES
SCALE: 1/8" = 1'-0"
3
S4

PROJECT NAME	IPRO 315 - SPRING 2008	DATE: 04-22-2008
DRAWING TITLE	DETAILS AND SECTIONS	SHEET NO. S-4
DRAWN BY	DIYANA RUSSEVA & VESELIN VELICHKOV	OF 4

Structural Group - Foundation

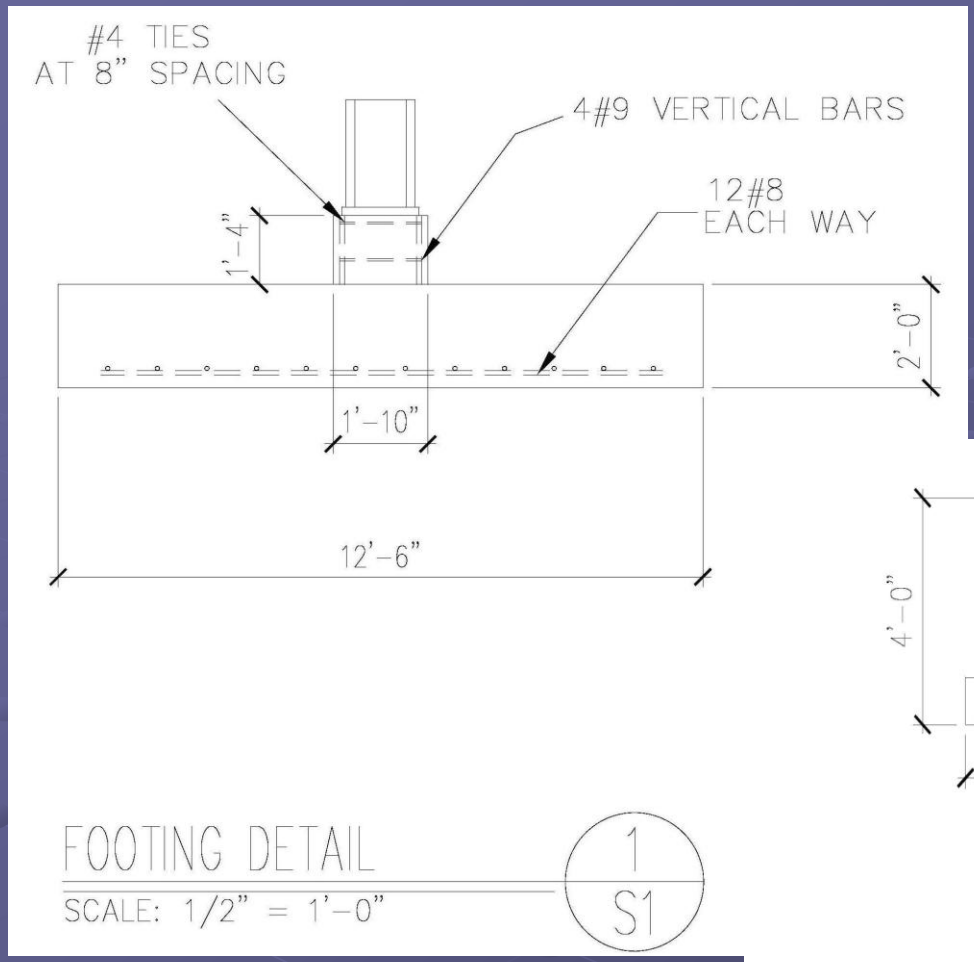


FOUNDATION PLAN

SCALE: 1/16"=1'-0"

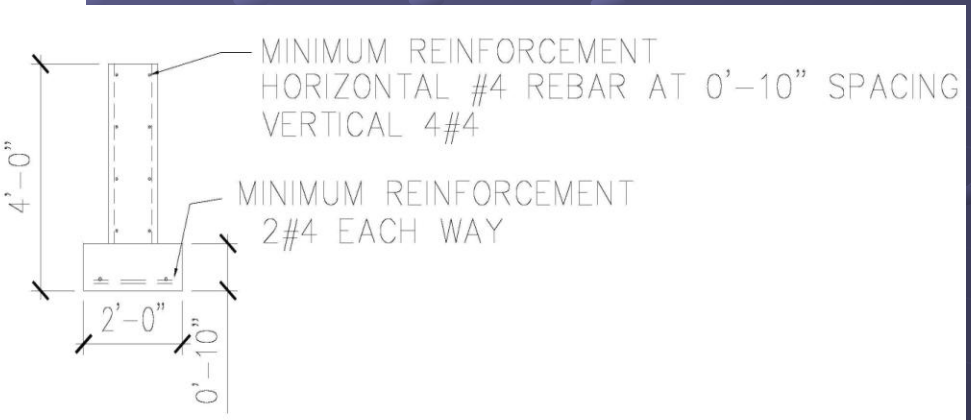
N

Sp = 4000 PSF
B/FTG. EL. (-4'-0) U.N.O.
FOOTING SIZE 12'-6"x12'-6"x2'-0"
PIER SIZE - 22x22



FOOTING DETAIL 1/S1

SCALE: 1/2" = 1'-0"

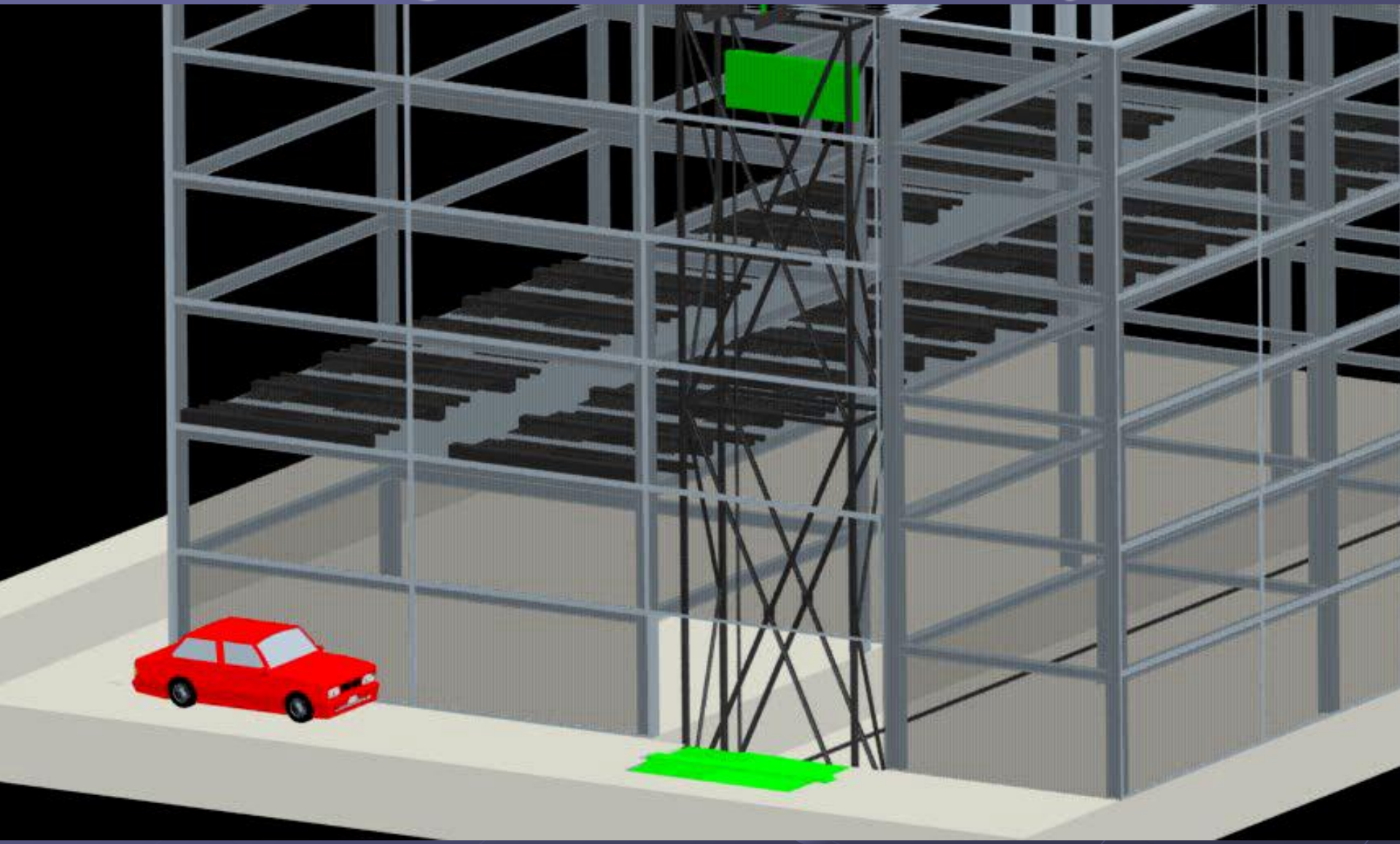


FOUNDATION WALL DETAIL 2/S1

SCALE: 1/2" = 1'-0"

Structural Group - Foundation

Placing Cars via Comb System

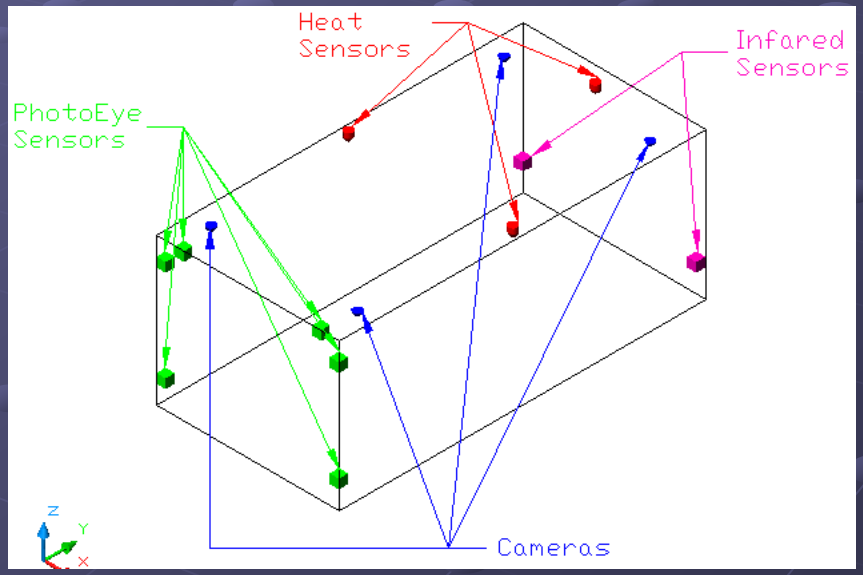


Logistics

- # Cars Parked vs. Time
- Time to park a car:
  Max: 1 min 27 sec
  Min: 40 sec
- Time to fill up garage:
  2 hr 10 min

Sensors

- Photo-Eye & Infrared
- Heat sensors
- Cameras



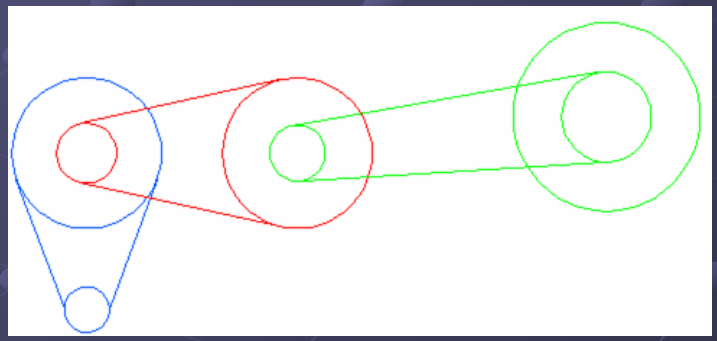
Engine / Gearbox Selection

High Torque GE Motor

- Vertical
- Horizontal

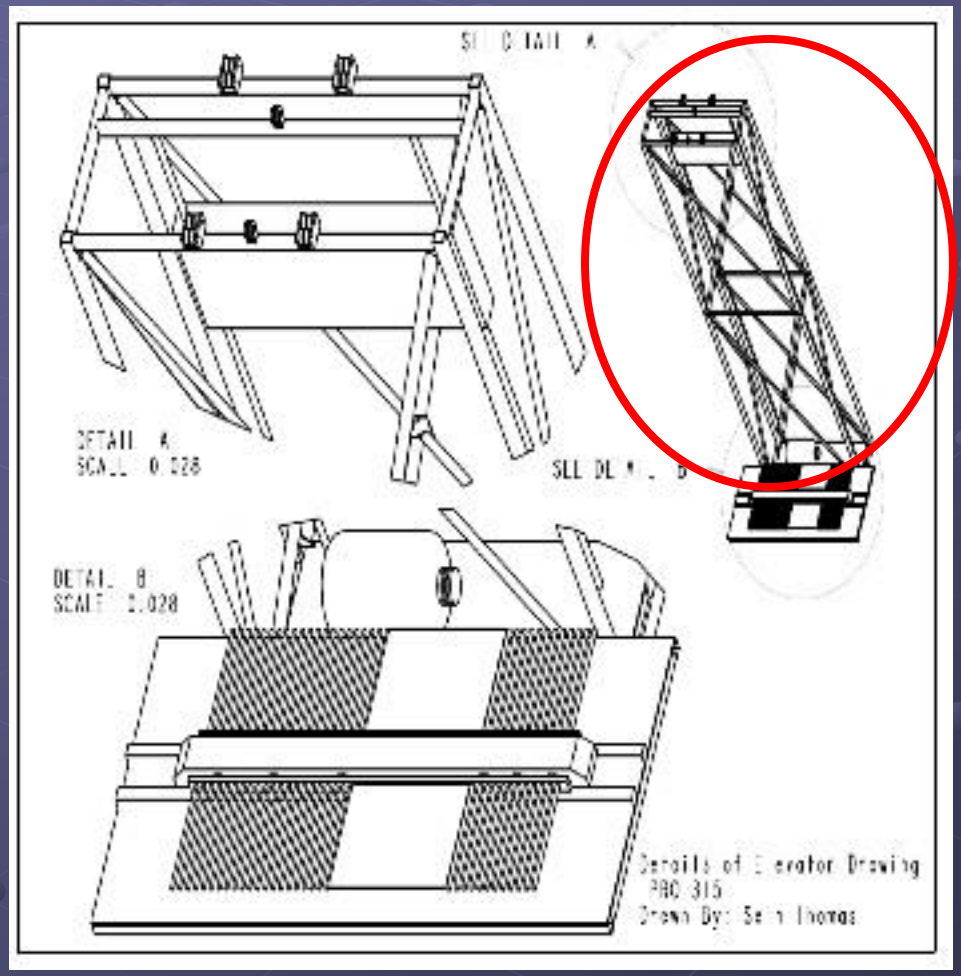
Optimization

- Created excel spreadsheet
- Designed gearbox
- Reduced est. cost by 1751%



1800 RPM → 100 RPM

Elevator Structure

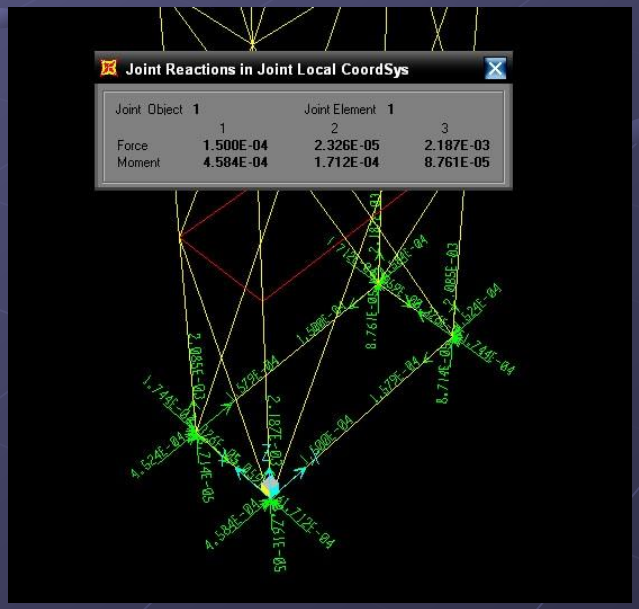


Analysis

SAP 2000 11 Analysis

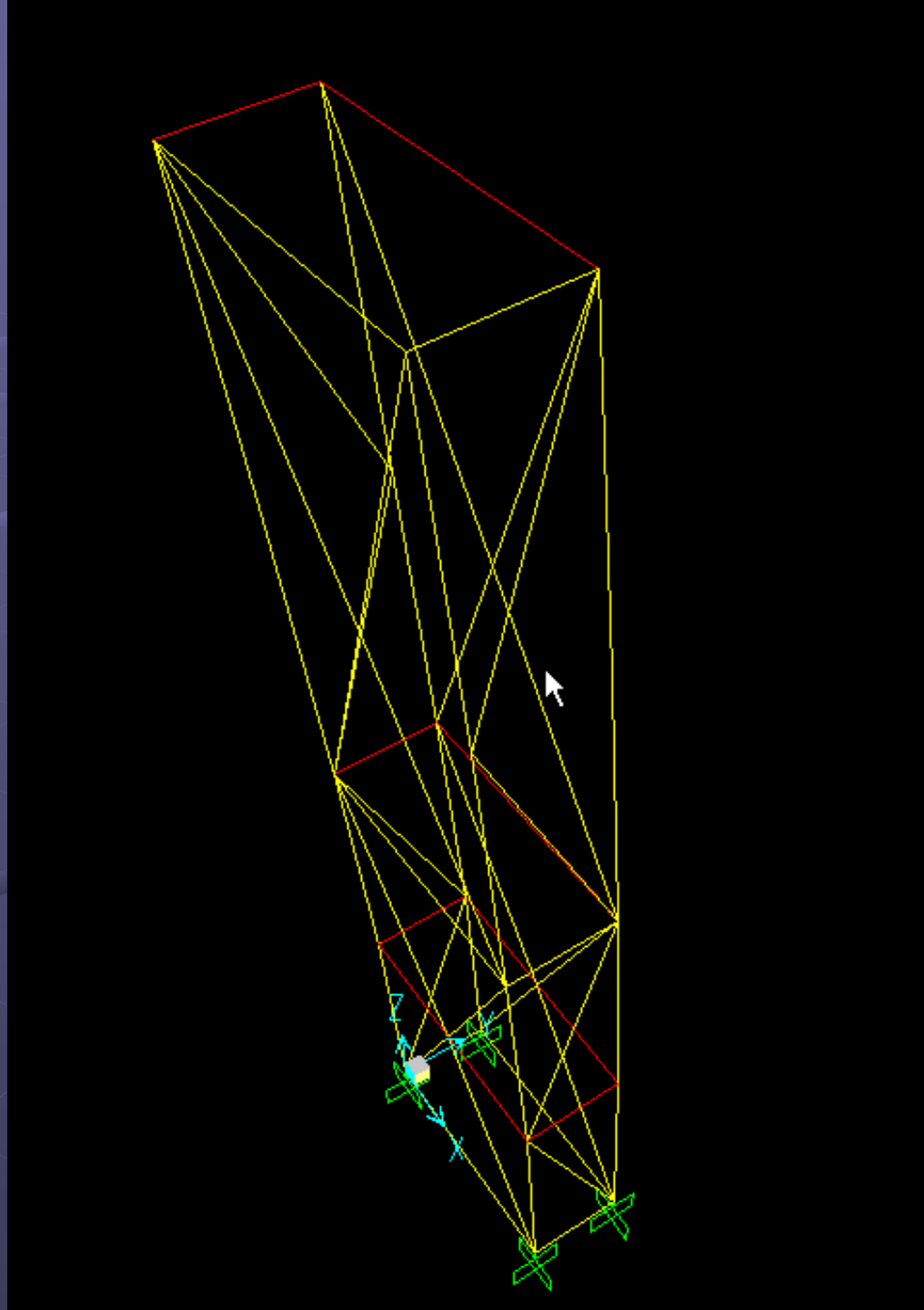
- Find Resonant Frequency
- Why?

- Force and deflection at joints
- Why?
- Failure

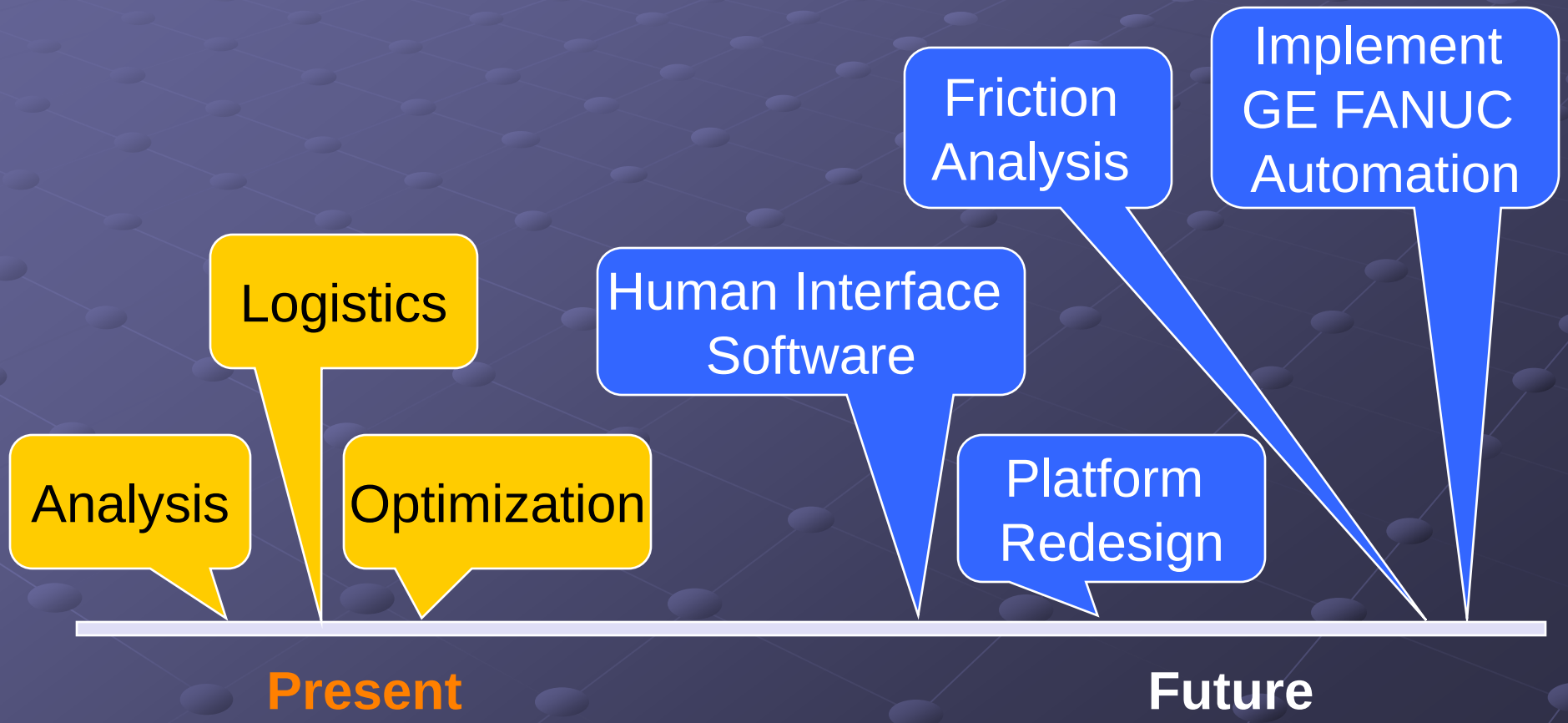


Dynamic Analysis

- Resonant Frequency
  - Analysis f =.52 Hz
  - Motor f = 30 Hz
  - Analysis f ≠ Motor f
- Deflection
  - Analysis δ = .0015 in
  - Standard δ < .0025 in
- Force at joints
  - Negligible



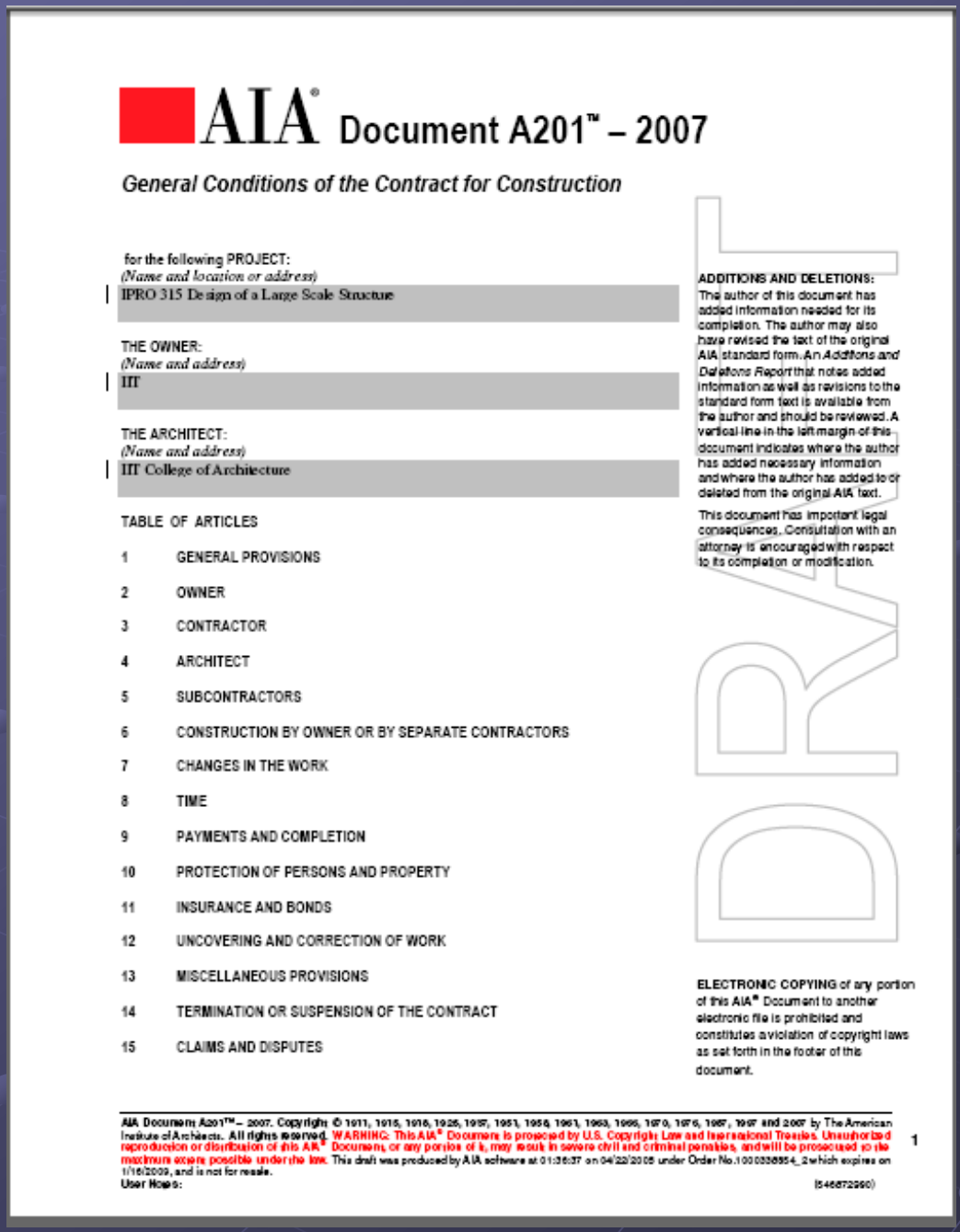
Timeline


Implement GE FANUC Automation
Friction Analysis
Logistics
Human Interface Software
Analysis
Optimization
Platform Redesign
Present
Future

Construction Management Group

- Current Status
  - Completed AIA A201 General Conditions Contract
  - Completed parametric estimate
- Goals for Spring 2008
  - Provide contract documents needed to complete a project manual
  - Provide a project cost estimate

- Utilized standard AIA documents for contracts to be included in project manual



AIA Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)
IPRO 315 Design of a Large Scale Structure

THE OWNER:
(Name and address)
IIT

THE ARCHITECT:
(Name and address)
IIT College of Architecture

TABLE OF ARTICLES

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10 PROTECTION OF PERSONS AND PROPERTY
11 INSURANCE AND BONDS
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13 MISCELLANEOUS PROVISIONS
14 TERMINATION OR SUSPENSION OF THE CONTRACT
15 CLAIMS AND DISPUTES

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DRAFT

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Construction Management Group

- Parametric Cost Estimate: $9.8 M
- Final Cost Estimate: $13.3 M

Green Options

- Costs $2,459,000
- 21.4 years to pay back
- 30 years predicted
- 25 year Warranty
- Green Roof
- Grants

Question and Comments

IPRO 315, Spring 2008

Design of Large Scale Structure

Automated Parking Garage