


Thank you for joining our live webinar today.  
We will begin shortly. Please standby.

**Modern Methods for Learning the Basics of Structural Stability: From Behavior to Practice**  
Session 2: Behavior of Compression Members – Practical Considerations  
October 13, 2020




### AISC Live Webinars

**Today's live webinar will begin shortly. Please stand by.**

Today's audio will be broadcast through the internet. Please be sure to turn up the volume on your speakers.

Please type any questions or comments through the chat feature in the left portion of your screen.




### AISC Live Webinars

#### AIA Credit

AISC is a Registered Provider with The American Institute of Architects Continuing Education Systems (AIA/CES). Credit(s) earned on completion of this program will be reported to AIA/CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

This program is registered with AIA/CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.



### AISC Live Webinars

#### Copyright Materials

This presentation is protected by US and International Copyright laws. Reproduction, distribution, display and use of the presentation without written permission of AISC is prohibited.

© The American Institute of Steel Construction 2020

The information presented herein is based on recognized engineering principles and is for general information only. While it is believed to be accurate, this information should not be applied to any specific application without competent professional examination and verification by a licensed professional engineer. Anyone making use of this information assumes all liability arising from such use.



## AISC Live Webinars

### Course Description

Behavior of Compression Members – Practical Considerations  
October 13, 2020

In this session, the speakers will demonstrate and review/discuss the results of the first learning module on compression members and provide some advice for further exploration. They will then present a case study from practice involving the stability of compression members. They will close out the topic of compression members with some final lessons.



## AISC Live Webinars

### Learning Objectives

- Explain how the behavior of a column is affected by slenderness.
- Describe how geometric and material nonlinearity impacts the buckling capacity of a column.
- Compare the column curve produced by structural analysis to what is codified in the AISC *Specification*.
- Identify why a shoring system may have a different capacity in the field than was found in the laboratory.



## Modern Methods for Learning The Basics of Structural Stability: From Behavior to Practice

Session 2: Behavior of Compression Members – Practical Considerations  
October 13, 2020



Ronald D. Ziemian, PE, PhD  
Professor  
Bucknell University



Craig Quadrato, PE, PhD  
Senior Associate  
Wiss, Janney, Elstner Associates, Inc.



## Modern Methods for Learning The Basics of Structural Stability: From Behavior to Practice

### Course Introduction

Compression Members – Sessions 1 & 2

Flexural Members – Session 3 & 4

Beam-Columns – Sessions 5 & 6

Systems – Session 7 & 8



### Course Overview (2)

Strength/Weight + Stiffness/Weight + Competitive \$

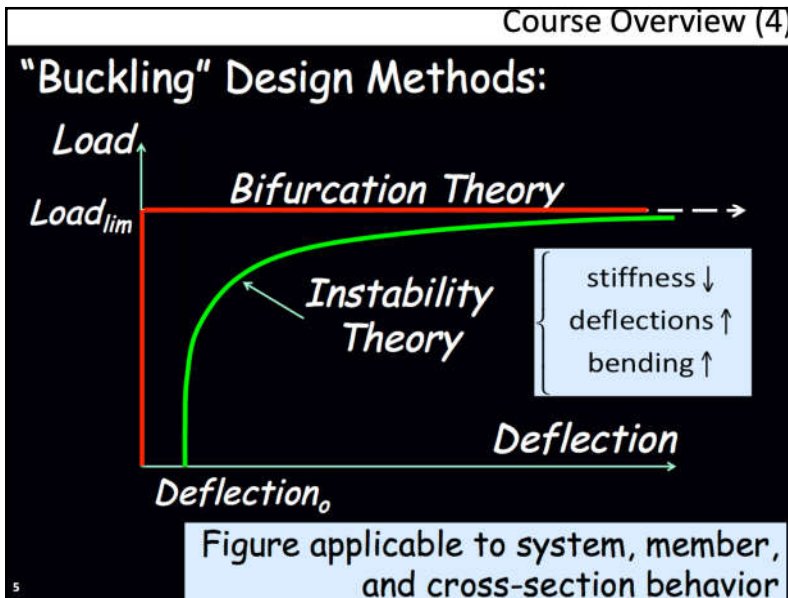
Slender Systems, Members, and Cross-sections

Design for Stability!

### Course Overview (3)

- Focus of the course is on fundamentals!
- Better understanding of behavior will result in improved design
- Key Definitions
  - **Stability:** Under load, component returns to current state after applying a small disturbance such as a deflection
  - **Bifurcation (critical load):** Theoretical point at which loading a component results in an instantaneous change from current state to significant deflection – two options: not buckled or buckled
  - **Instability:** Loading a component results in a realistic transition from small deflection to significant deflection – buckling preceded by deflection

4



### Course Overview (5)

Analysis acronyms:

**LBA:** linear buckling analysis; **elastic critical load analysis**; elastic eigenvalue analysis; assumes bifurcation theory

**GNA:** geometric nonlinear analysis; **2<sup>nd</sup>-order elastic analysis**; assumes equilibrium on the deformed shape and linear elastic material, with no initial imperfections

**GNIA:** same as GNA, but **includes initial imperfections**

**MNA:** material nonlinear analysis; **1<sup>st</sup>-order inelastic analysis**; assumes equilibrium on the undeformed shape and accounts for yielding, with no initial imperfections

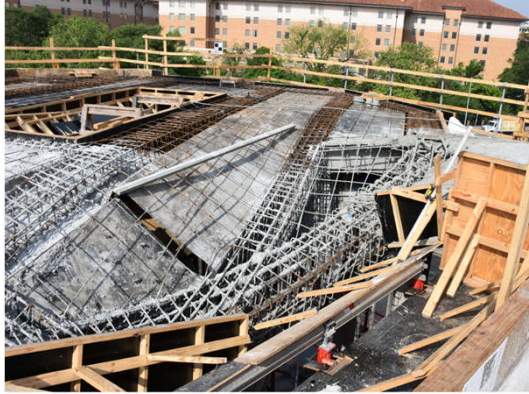
**GMNIA:** geometric and material nonlinear analysis; **2<sup>nd</sup>-order inelastic analysis**; assumes equilibrium on the deformed shape, accounts for yielding, and includes initial imperfections

6



## Session 2

### Compression Member Lab and Case Study



7

## Session Overview

- Review Learning Module (LM) 1
- Review LM2 Results
- Apply theory to case study from practice



8

## LM1 Review

- Investigated various degrees of end restraint using elastic critical load analysis
- MASTAN2
  - Six Columns
  - 40 ft long
  - W14x82
  - C-A-7.1 boundary conditions
  - 1 kip load

AISC 360-16

**TABLE C-A-7.1**  
 Approximate Values of Effective Length Factor,  $K$

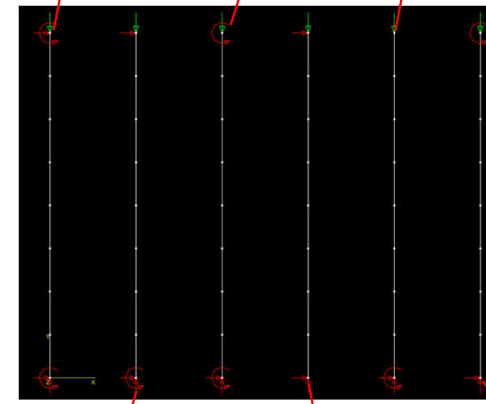
	(a)	(b)	(c)	(d)	(e)	(f)
Buckled shape of column is shown by dashed line						
Theoretical $K$ value	0.5	0.7	1.0	1.0	2.0	2.0
Recommended design value when ideal conditions are approximated	0.65	0.80	1.2	1.0	2.1	2.0
End condition code						
			Rotation fixed and translation fixed	Rotation free and translation fixed	Rotation fixed and translation free	Rotation free and translation free



9

## MASTAN2 Models

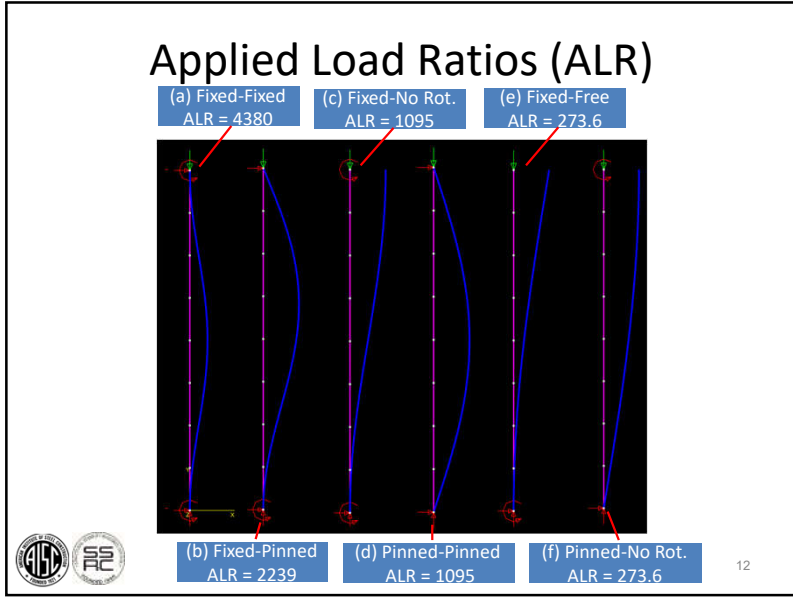
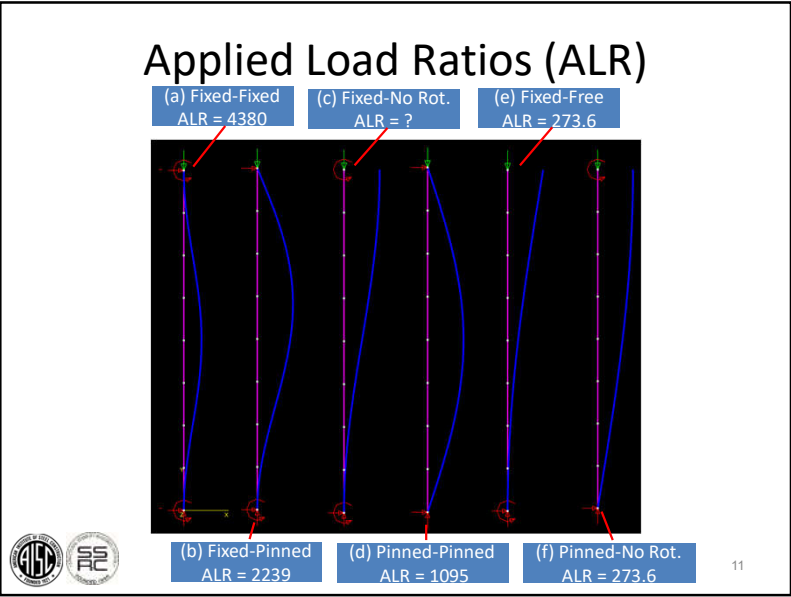
(a) Fixed-Fixed  $K=0.5$       (c) Fixed-No Rot.  $K=1.0$       (e) Fixed-Free  $K=2.0$



(b) Fixed-Pinned  $K=0.7$       (d) Pinned-Pinned  $K=1.0$       (f) Pinned-No Rot.  $K=2.0$



10



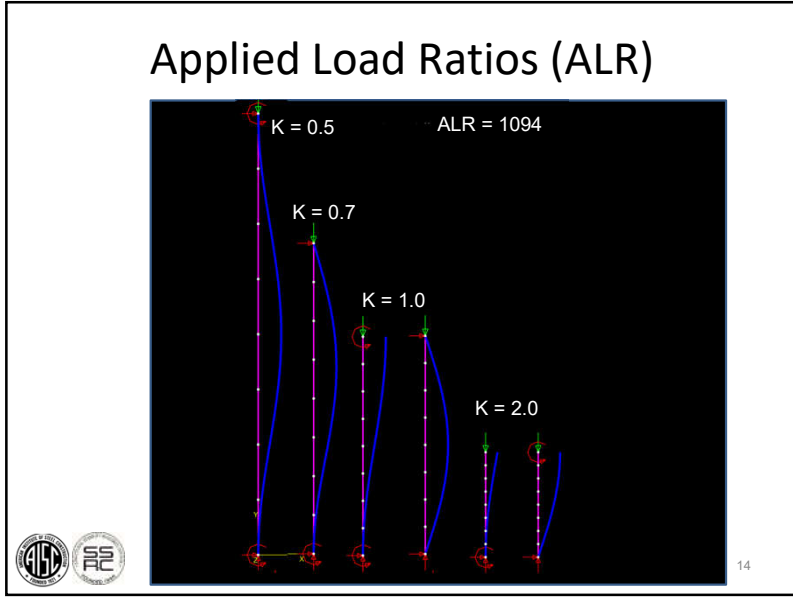
### Results Summary

- If theoretical and analysis results are so close, why are recommended K values for design different?

AISC 360-16

	(a)	(b)	(c)	(d)	(e)	(f)
Buckled shape of column is shown by dashed line.						
Theoretical K value	0.5	0.7	1.0	1.0	2.0	2.0
Recommended design value when ideal conditions are approximated	0.65	0.80	1.2	1.0	2.1	2.0
End condition code						
Rotation fixed and translation fixed						
Rotation free and translation fixed						
Rotation fixed and translation free						
Rotation free and translation free						
Analysis K	0.5	0.7	1.0	1.0	2.0	2.0

13



## Results Summary

**TABLE C-A-7.1**  
**Approximate Values of Effective Length Factor, K**

	(a)	(b)	(c)	(d)	(e)	(f)
Buckled shape of column is shown by dashed line						
Theoretical K value	0.5	0.7	1.0	1.0	2.0	2.0
Recommended design value when ideal conditions are approximated	0.65	0.80	1.2	1.0	2.1	2.0
End condition code	Rotation fixed and translation fixed Rotation free and translation fixed Rotation fixed and translation free Rotation free and translation free					
Analysis K	0.5	0.7	1.0	1.0	2.0	2.0

AISC 360-16



15

## Recall Session 1

- Leonard Euler, 1744 and 1757
- Assumptions!
  - Prismatic member ( $I = \text{constant}$ )
  - Small deflections after buckling
  - No bending prior to bifurcation
    - Perfectly straight
    - Concentrically loaded
  - Linear elastic behavior ( $E = \text{constant}$ )
  - Pinned-roller supports (frictionless)



16

## LM2 Problem Statement

- Investigate the factors influencing the flexural buckling strength of compression members
  - Initial imperfections
  - Partial yielding
  - Support conditions



17

## Recall LM2 Objectives


- Recognize limitations of theoretical Euler buckling solution
- Prepare column curves that plot member slenderness versus compressive strength
- Observe the impact that initial imperfections and partial yielding have on column buckling strength
- Compare results to the AISC column curve



18

### LM2 Modeling AISC 360-16 Analytic

Mastan2



The nominal compressive strength,  $P_n$ , shall be determined based on the limit state of flexural buckling:

$$P_n = F_{cr} A_g \quad (E3-1)$$

The critical stress,  $F_{cr}$ , is determined as follows:


(a) When  $\frac{L_c}{r} \leq 4.71 \sqrt{\frac{E}{F_y}}$  (or  $\frac{F_y}{E} \leq 2.25$ )

$$F_{cr} = \left( 0.658 \frac{F_y}{E} \right) F_y \quad (E3-2)$$

(b) When  $\frac{L_c}{r} > 4.71 \sqrt{\frac{E}{F_y}}$  (or  $\frac{F_y}{E} > 2.25$ )

$$F_{cr} = 0.877 F_y \quad (E3-3)$$


- Variables
  - W14x53
  - L/r: 15, 65, 105, 140, and 190
  - Initial imperfection: 0 and L/1000
  - With and without partial yielding
  - Elastic and inelastic analysis



19

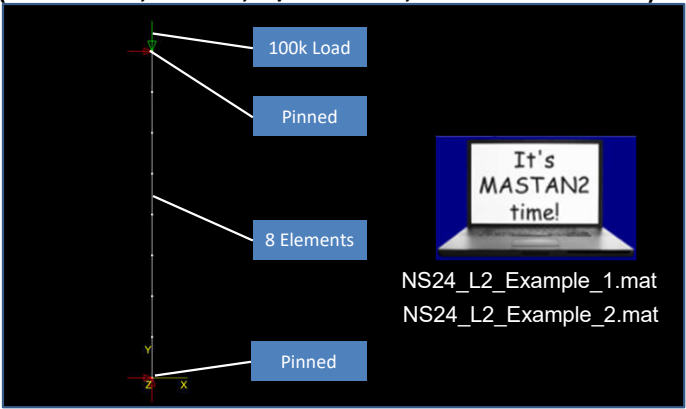
### Minor Axis Compressive Strength

- Investigate L/r = 190, 105, 15
- What do we expect?
  - Elastic or inelastic buckling
  - AISC Column curve accuracy
  - Do residual stresses matter
  - Does initial imperfection matter
  - Do initial imperfections with partial yielding matter




20

### Minor Axis Compressive Strength (W14x53, A992, L/r = 190, AISC = 6.95ksi)

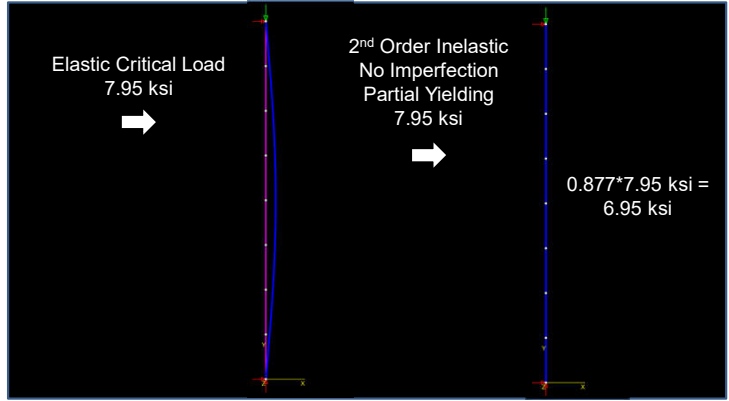


NS24\_L2\_Example\_1.mat  
 NS24\_L2\_Example\_2.mat



21

### Minor Axis Compressive Strength (W14x53, A992, L/r = 190, AISC = 6.95ksi)




Elastic Critical Load  
7.95 ksi

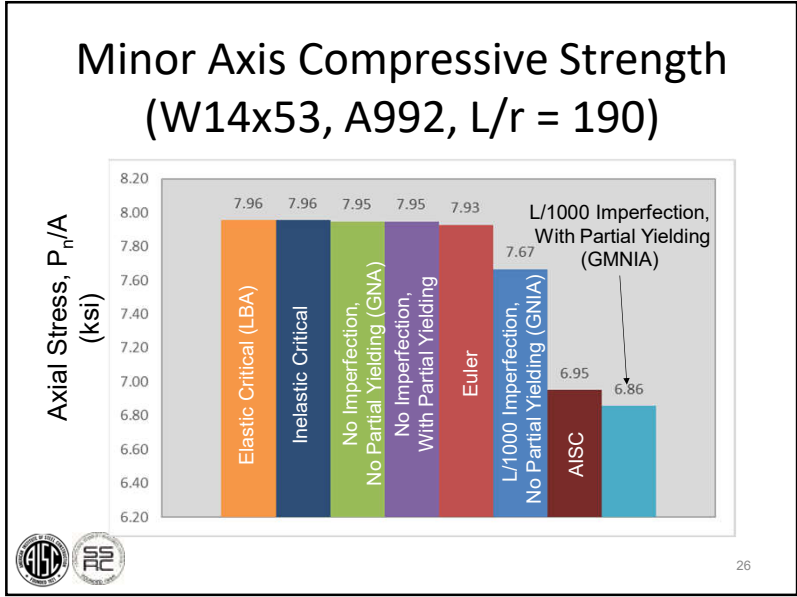
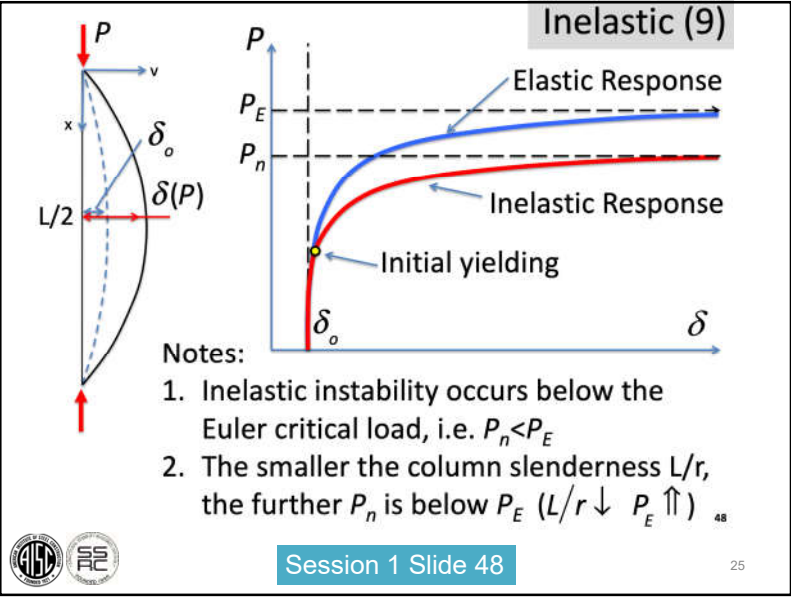
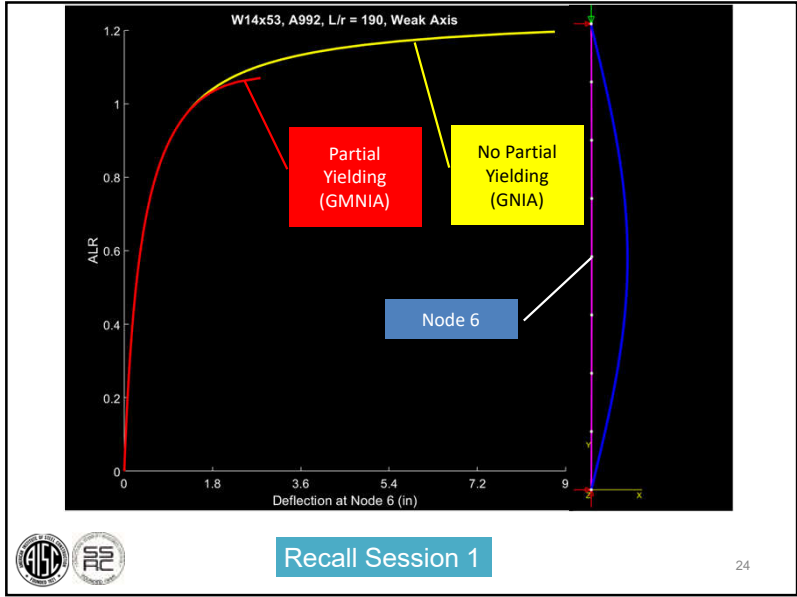
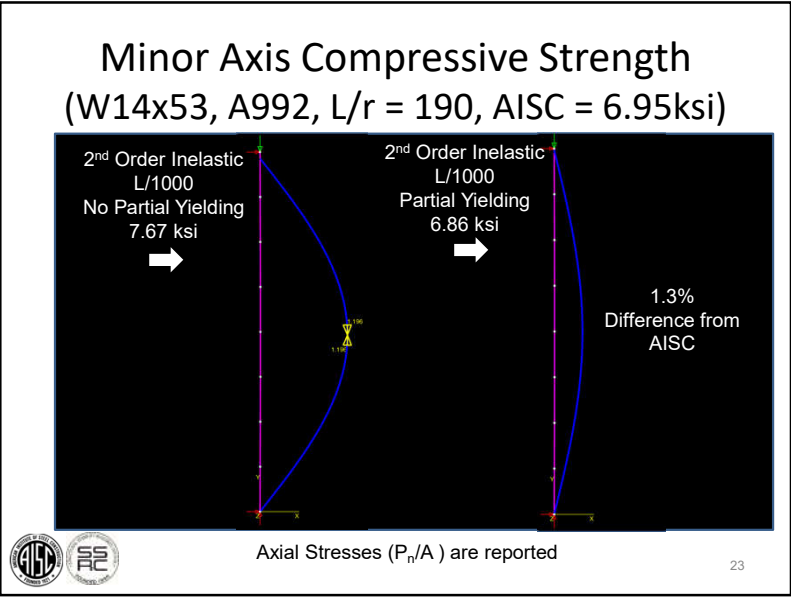
2<sup>nd</sup> Order Inelastic  
No Imperfection  
Partial Yielding  
7.95 ksi

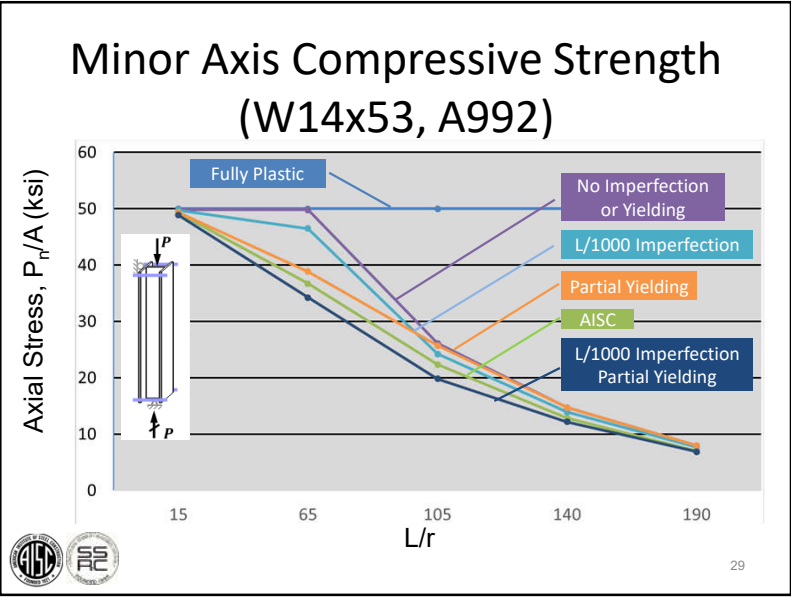
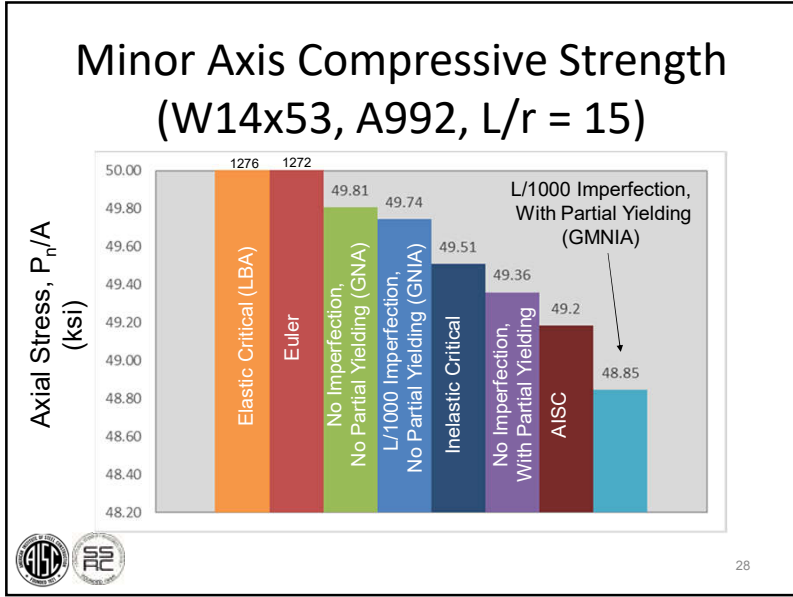
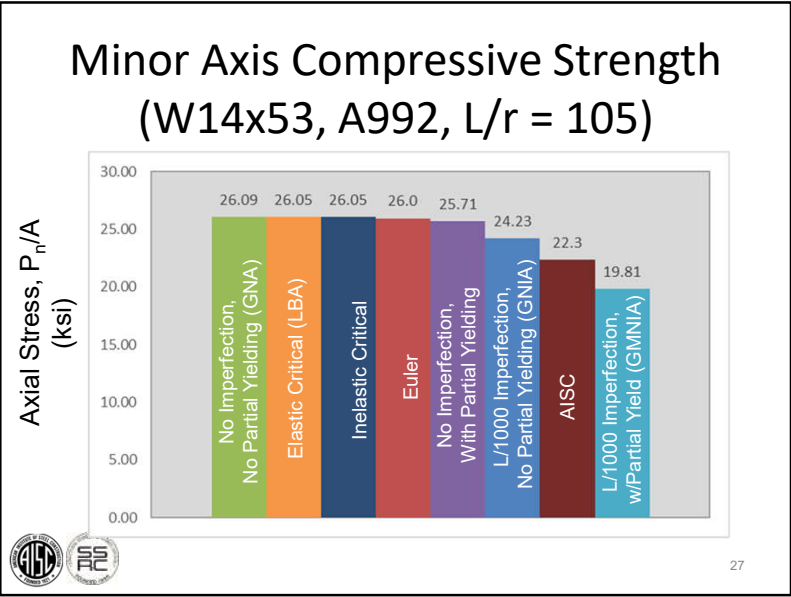
$0.877 \cdot 7.95 \text{ ksi} = 6.95 \text{ ksi}$

Axial Stresses ( $P_n/A$ ) are reported

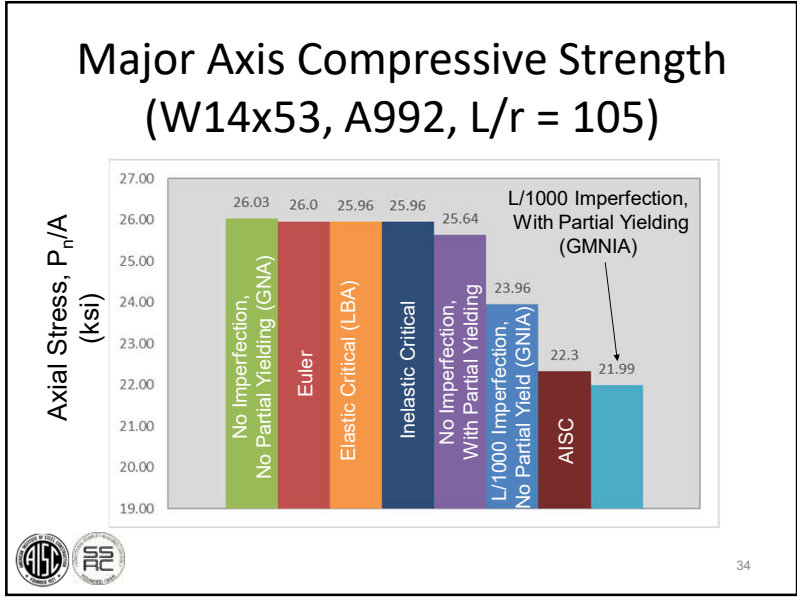
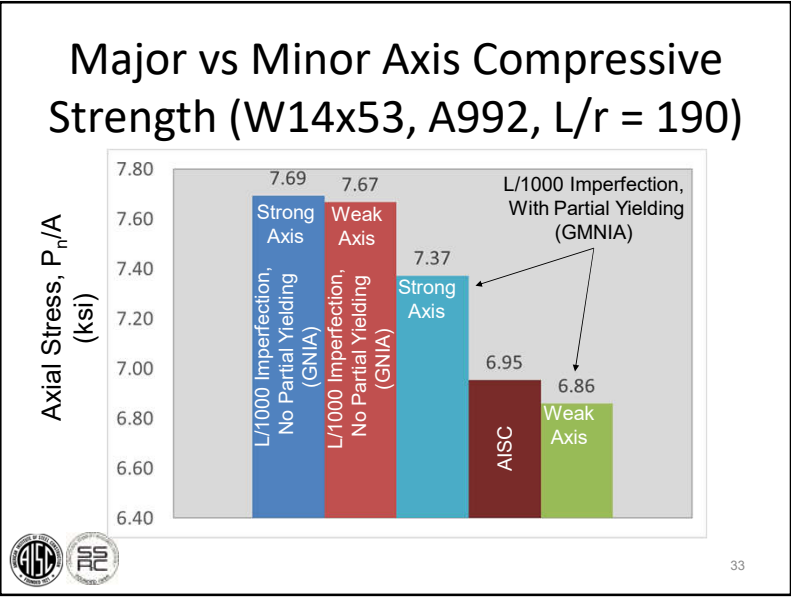
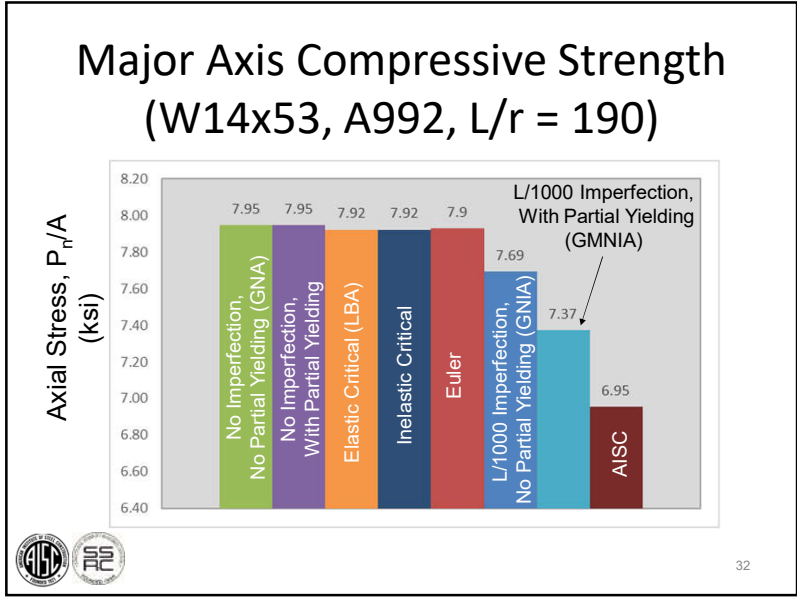
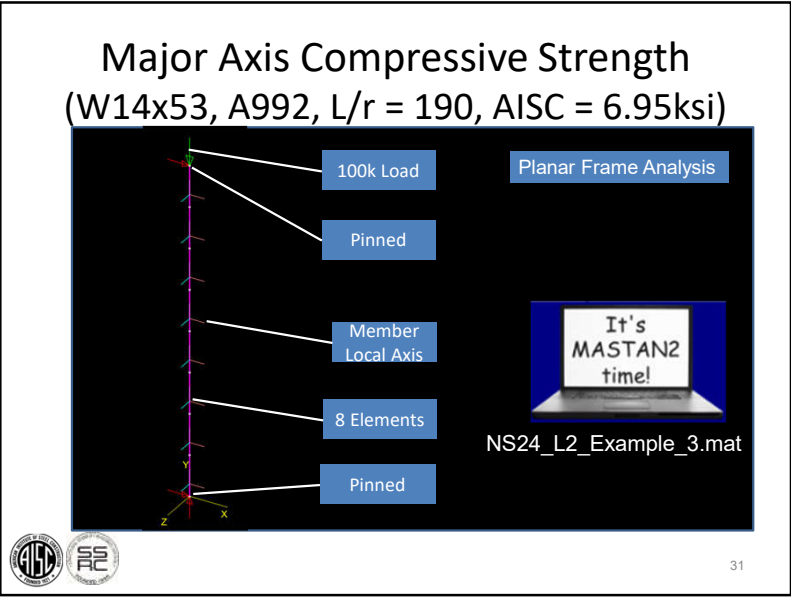


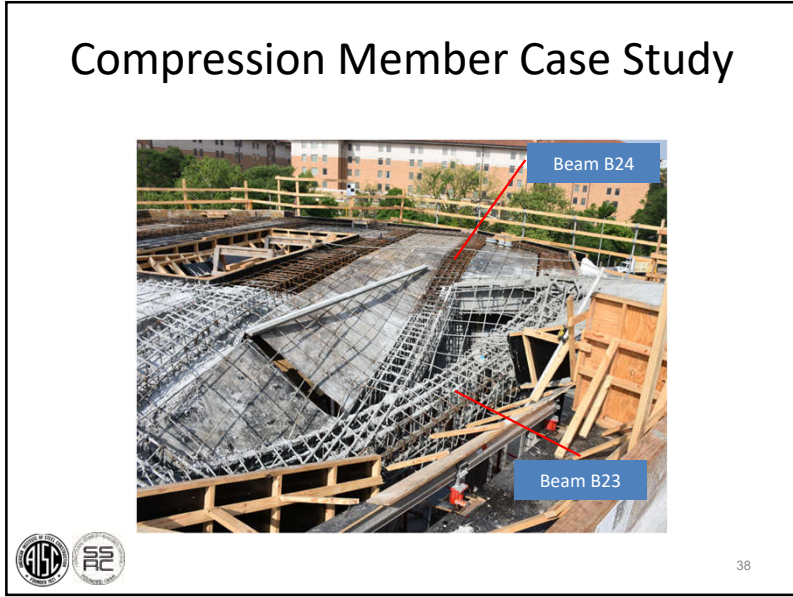
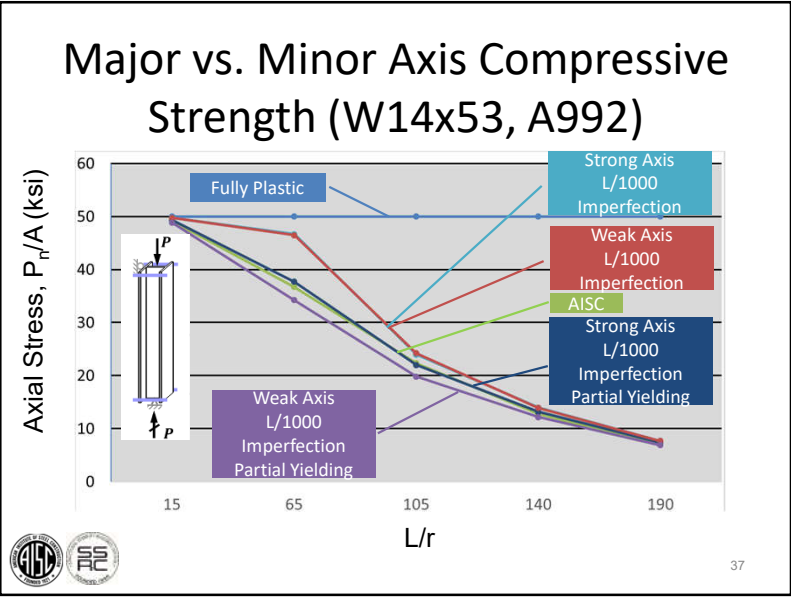
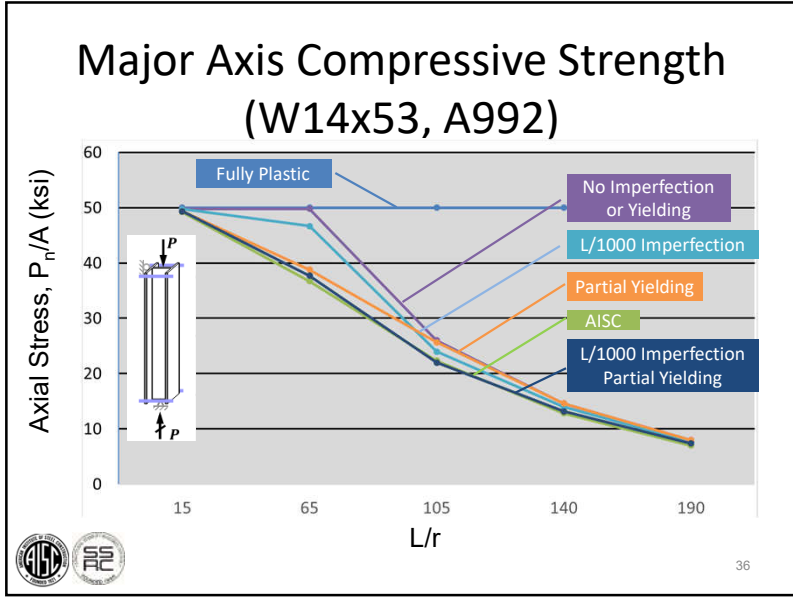
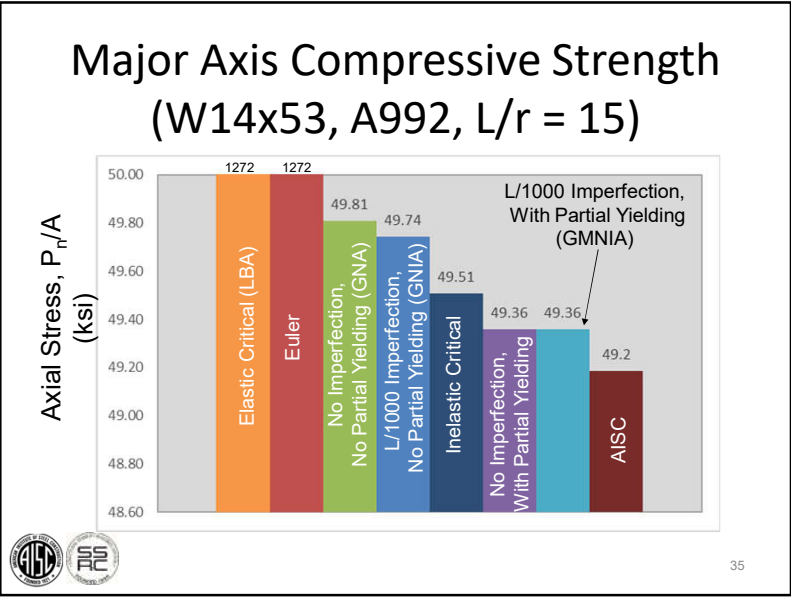
22



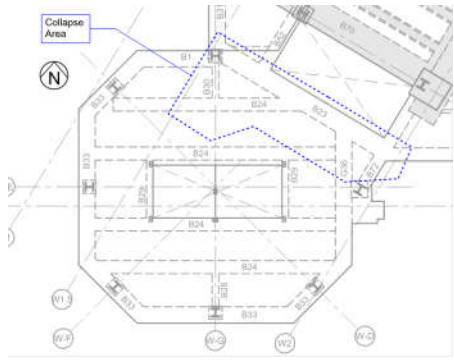


- ### Major Axis Compressive Strength
- Investigate L/r = 190, 105, 15
  - What do we expect?
    - Elastic or inelastic buckling
    - AISC Column curve accuracy
    - Do residual stresses matter
    - Does initial imperfection matter
    - Do initial imperfections with partial yielding matter



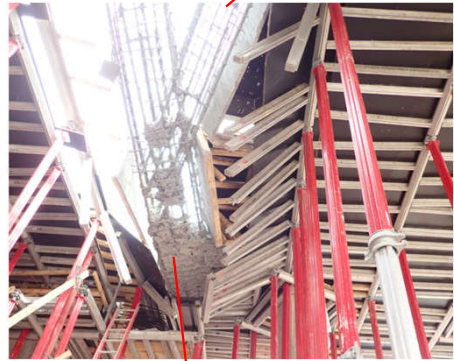



**Collapse Affected Area**  
 Collapse initiated at intersection of beam B23 and B24



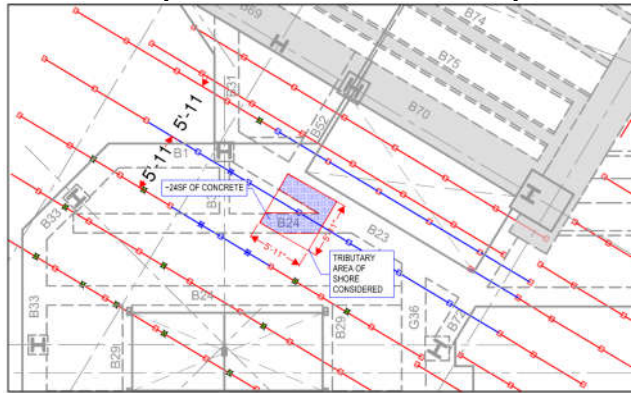


39

**Ground Level View**  
 Temporary shoring collapse during construction  
 5-inch thick slab  
 24-inch deep beams  
 Concrete approximately 19 inches deep at time of collapse



40

**Most Heavily Loaded Shore**  
 6.2 kips at time of collapse

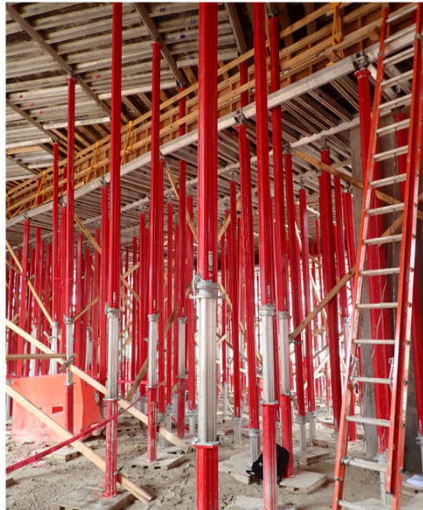

41

**Looking down into collapse area**  
 Shore post height 27'-7" in this area  
 L/r about 218



42

**Shores still standing at edge of collapse area**  
 Aluminum shoring system  
 Bases supported by wood dunnage on ground




43

**Typical Condition at Base**  
 Wood dunnage on ground  
 Varying degrees of ground flatness

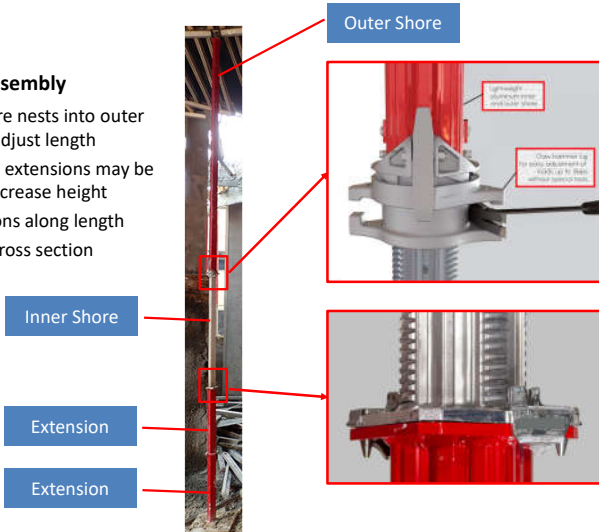

44

**Typical Condition at Top**  
 Shore posts clip into main and secondary beams using drophead

45

**Shore Assembly**  
 Inner shore nests into outer shore to adjust length  
 Up to two extensions may be used to increase height  
 Connections along length  
 Discrete cross section variation

46

**Anticipated Strengths**


Supplier Lab Test (L = 27')  
 17.9 kip nominal load  
 7.1 kip allowable load (FS = 2.5)

Analytical Code (k = 1.0, prismatic outer shore cross section)  
 5.0 kip nominal load  
 3.1 kip allowable load (FS = 1.65)

Analytical Code (k = 0.65 prismatic outer shore cross section)  
 11.9 kip nominal load  
 7.2 kip allowable load (FS = 1.65)

Lab specimen more closely matches fixed-fixed analytical solution.

But there are other differences too.




47

**Field Conditions**

Similarities to laboratory specimen  
 -Inner shore fully extended  
 -Two Extensions  
 -Connections between segments


Differences from laboratory specimen  
 -Top pinned condition  
 -Base may not be level/completely stable  
 -Height 7" taller (drophead)  
 -Buckled at 6.2 kips (field estimate) vs. 17.2 kip nominal laboratory test load



48

**Issues**

- Need to re-place concrete in collapse
- Still have another complete placement in less than a week
- Need to update shoring plan accounting for field conditions
- Need to provide updated capacities for shore posts of varying heights



49

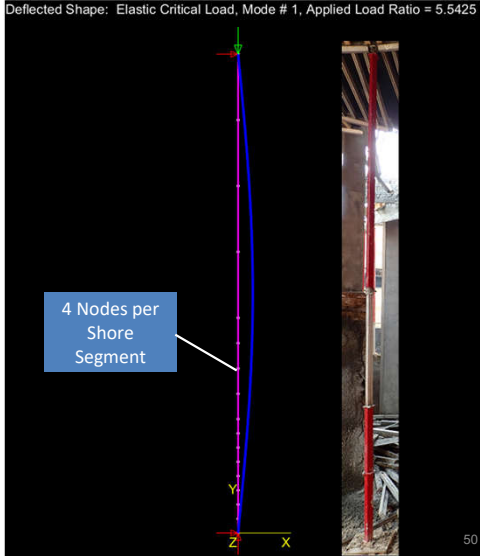
**Mastan2 Model**

Each segment subdivided into 4 elements

Neglect  
 -Weld affected zones  
 -Connections between segments


Investigate  
 -Variation in cross section  
 -End conditions

For project SAP2000 was used but Mastan2 used here



Deflected Shape: Elastic Critical Load, Mode # 1, Applied Load Ratio = 5.5425

4 Nodes per Shore Segment



50

**Step 1 Validate Lab Model with Analytical Results**

Pin-pin end condition 27' long  
**Model** elastic critical load with prismatic outer shore cross section  
 -Critical Load = 5.54 kip  
**Analytical** solution for prismatic outer shore cross section  
 -Nominal Load 5 kip/0.85 = 5.88 kip  
 -Good agreement with model  
**Model** elastic critical load with prismatic inner shore cross section (not shown)  
 -Critical Load = 3.54 kip  
**Model** non-prismatic cross section (not shown)  
 -Critical Load = 4.66 kip

Deflected Shape: Elastic Critical Load, Mode # 1, Applied Load Ratio = 5.5425

51

**Step 1 Validate Lab Model with Analytical Results**

Fixed-fixed end condition 27' long  
**Model** elastic critical load with prismatic outer shore cross section  
 -Critical Load = 22.2 kip  
**Analytical** solution for prismatic outer cross section  
 -Nominal Load = 20.1 kip  
 -Account for code initial imperfection 20.1kip/0.85 = 23.6 kip  
 -Good agreement with model

Deflected Shape: Elastic Critical Load, Mode # 1, Applied Load Ratio = 22.1796

52

**Step 2 Validate Lab Model with Laboratory Specimen**

Use fixed-fixed end conditions  
 Include non-prismatic cross section  
**Laboratory Model** Elastic Critical Load  
 -Critical Load = 20.4 kip  
**Laboratory Specimen**  
 -Nominal load 17.9 kip  
 -Adjust for assumed code initial imperfection  
 17.9 kip/0.85 = 21.1 kip  
 -Good agreement with model  
 -Indicates restraint present at specimen ends  
 Attempt to model L/960 imperfection

Deflected Shape: Elastic Critical Load, Mode # 1, Applied Load Ratio = 20.38

53

**Lab Model with Initial Imperfection**

Planar Frame Analysis

NS24\_L2\_Example\_4.mat

54

**Step 2 Validate Model with Laboratory Specimen**

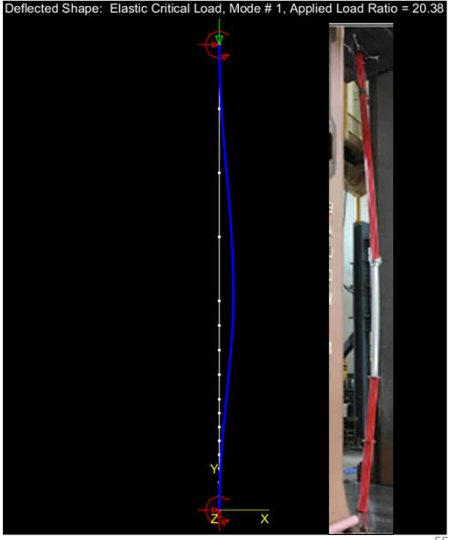
Use fixed-fixed end conditions  
 Include non-prismatic cross section

**Model Elastic Critical Load**  
 -ALR= 20.4

**Laboratory Specimen**  
 -Nominal load = 17.9 kip  
 -Adjust for assumed code initial imperfection  
 17.9 kip/0.85 = 21.1 kip  
 -Good agreement with model

**Model with L/960 imperfection**  
 -ALR = 45.3 (2<sup>nd</sup> Order Elastic)  
 -Shouldn't the buckling load decrease when an imperfection is added?

Let's look at the deflected shape



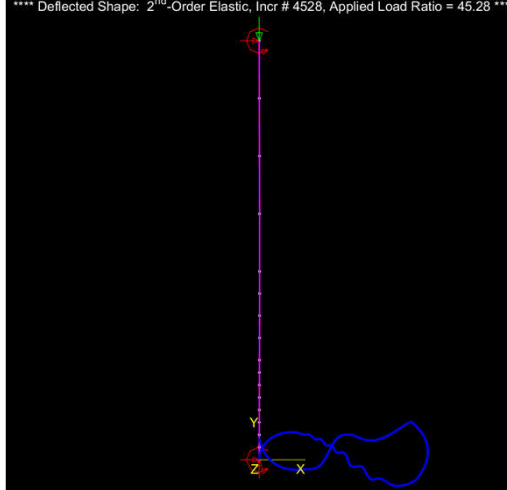
Deflected Shape: Elastic Critical Load, Mode # 1, Applied Load Ratio = 20.38

55

**Step 2 Validate Model with Laboratory Results**

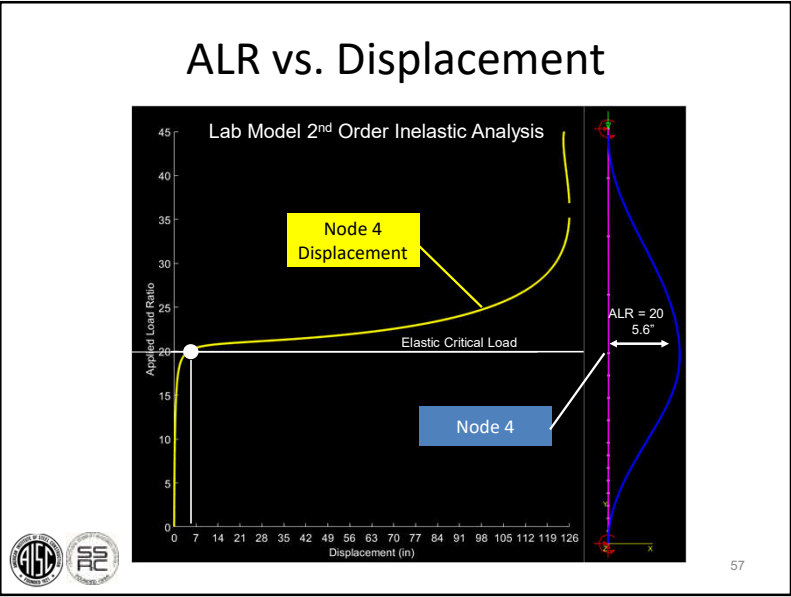
Deflected shape is a mess, what is happening?

Investigate load displacement with MSA plot



\*\*\*\* Deflected Shape: 2<sup>nd</sup>-Order Elastic, Incr # 4528, Applied Load Ratio = 45.28 \*\*\*\*

56

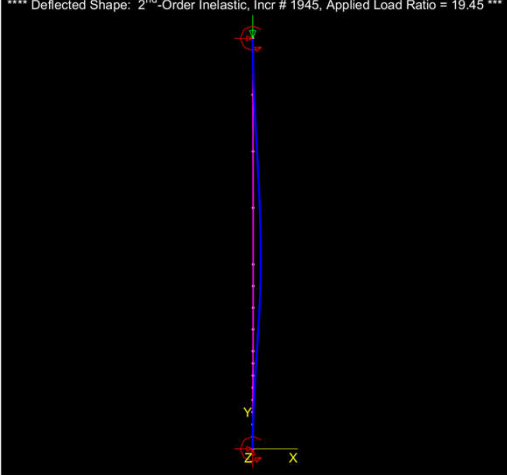


**Step 2 Validate Model with Laboratory Results**

Using an estimate of the plastic section modulus and 2<sup>nd</sup> Order Inelastic analysis gives applied load of 19.5 k

Recall **Laboratory Specimen**  
 -Nominal load = 17.9 kip

Good agreement with laboratory specimen



\*\*\*\* Deflected Shape: 2<sup>nd</sup>-Order Inelastic, Incr # 1945, Applied Load Ratio = 19.45 \*\*\*\*

58

**Step 2 Validate Lab Model with Laboratory Results**

In lieu of the second order inelastic analysis could we take 0.85 of the elastic critical load?

- accounts for out of straightness of L/960

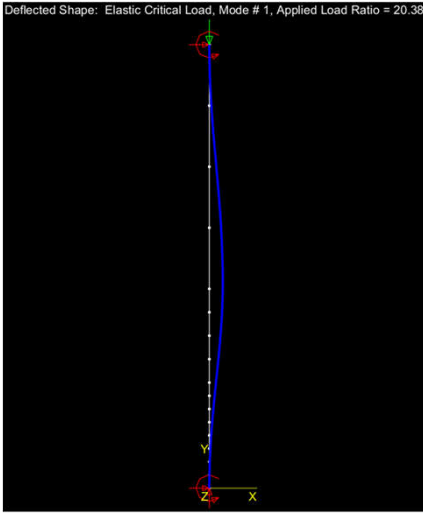
**Lab Model**

- Elastic critical load = 20.4 kip \* 0.85 = 17.3 kip
- 2<sup>nd</sup> order inelastic analysis = 19.5 kip


Doing so in this case is conservative

Recall **Laboratory Specimen**

- Nominal load = 17.9 kip



Deflected Shape: Elastic Critical Load, Mode # 1, Applied Load Ratio = 20.38



59

**Step 3 Validate Model with Field Data**

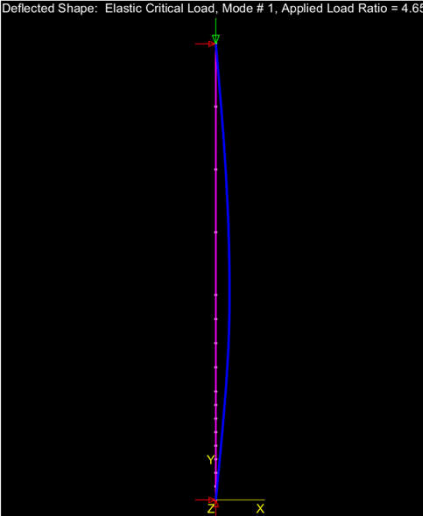
Estimate pin-pin end condition  
 27'-7" long  
 Non-prismatic cross section

**Field Specimen**


- Estimated load at collapse = 6.2 kip

**Field Model**

- Elastic critical load = 4.65 kip
- 75% of estimated load at collapse
- Base likely provides some stability
- Model fixed base

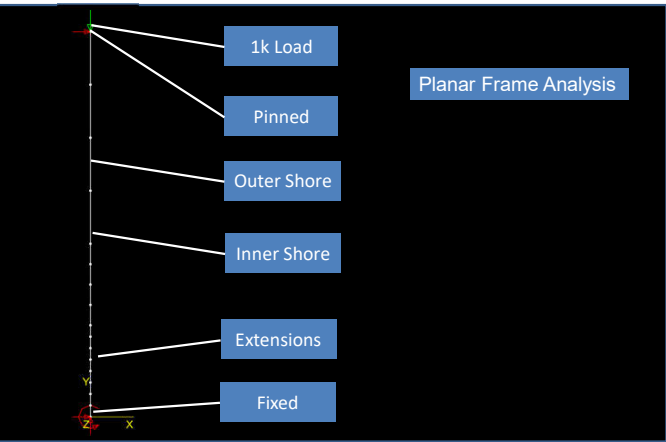


Deflected Shape: Elastic Critical Load, Mode # 1, Applied Load Ratio = 4.6565



60

**Field Model with Fixed Base**



1k Load

Pinned


Outer Shore

Inner Shore

Extensions

Fixed

Planar Frame Analysis



61

**Step 3 Compare Field Model to Field Specimen**

Fixed-pin end condition  
 27'-7" long  
 Nonprismatic cross section

**Field Specimen**

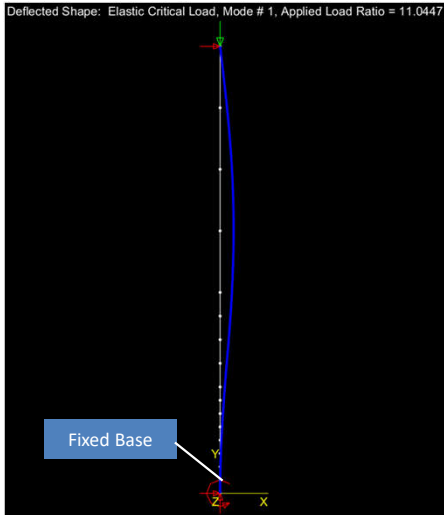
- Estimated collapse load = 6.2 kip

**Field Model**

- Elastic critical load = 11.0 kip
- Adjust for code imperfection  
 $11.0 \text{ kip} * 0.85 = 9.35 \text{ kip}$
- 150% of estimated field specimen  
 $9.35 \text{ kip} * 1.5 = 14.0 \text{ kip}$
- 2<sup>nd</sup> order inelastic analysis = 12.6 kips


**Likely that**

- Base was not fully fixed
- Connections played a role



Deflected Shape: Elastic Critical Load, Mode # 1, Applied Load Ratio = 11.0447

Fixed Base



62

**Step 4 Propose model for use**

Deflected Shape: Elastic Critical Load, Mode # 1, Applied Load Ratio = 4.6565

Model with

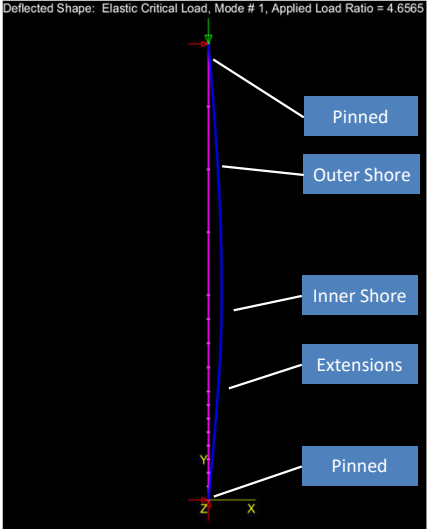
- Pin-pin end conditions
- Non-prismatic cross section
- Critical load at 27' 7" was 4.65 kips

Recall

- Manufacturer allowable load = 7.1k (L=27' & FS = 2.5)
- Estimated field load = 6.2k (L=27' 7")

Bracing shores was considered, but much easier just to add more shores where demand exceeded model allowable load

Some demand to capacity ratios were 1.2, but based on conservatism in model, this was deemed acceptable



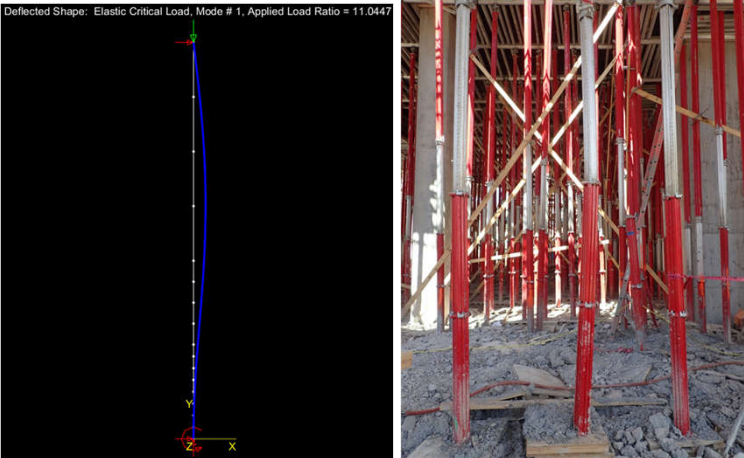
63

## Summary

- Euler is a great mathematical solution
- Reality throws your compression members some curves
- Understanding behavior is key to knowing how and when to use computational modelling
- Laboratory test conditions may vary from field conditions

64

Deflected Shape: Elastic Critical Load, Mode # 1, Applied Load Ratio = 11.0447



AISC | Questions?

Smarter. Stronger. Steel.

## Single-Session Registrants

### CEU / PDH Certificates

- You will receive an email on how to report attendance from: [registration@aisc.org](mailto:registration@aisc.org).
- Be on the lookout: Check your spam filter! Check your junk folder!
- Completely fill out online form. Don't forget to check the boxes next to each attendee's name!

Smarter. Stronger. Steel.

## Single-Session Registrants

### CEU / PDH Certificates

- Reporting site (URL will be provided in the forthcoming email).
- Username: Same as AISC website username.
- Password: Same as AISC website password.



## 8-Session Registrants

### CEU / PDH Certificates

One certificate will be issued at the conclusion of the course.



## 8-Session Registrants

### Attendance and PDH Certificates

- You have two options to receive credit for a given session.
  - Option 1: Watch the live session. Credit for live attendance will be displayed on the Course Resources table within two days of the session.
  - Option 2: Watch the recording and pass the associated quiz.

### Videos and Quizzes

- For each session, find access within two business days after the live air date. (An email will be sent from [nightschool@aisc.org](mailto:nightschool@aisc.org).)
- Reasons for quiz:
  - EEU – You must take all quizzes and the final exam to receive EEU.
  - PDHs – If you watch a recorded session, you must pass quiz for PDHs.
  - Reinforce what you learn in the lectures and get more out of the course!

### Distribution of Certificates

All certificates will be issued after the course is completed. Only the registrant will receive a certificate for the course.



## 8-Session Registrants

### Course Resources

Find all your handouts, quizzes and quiz scores, recording access, and attendance information in one place!



## 8-Session Registrants

### Course Resources

Go to [www.aisc.org](http://www.aisc.org) and sign in.

The screenshot shows the AISC website's navigation menu with links for EDUCATION, PUBLICATIONS, STEEL SOLUTIONS CENTER, AWARDS AND COMPETITIONS, and TECHNICAL RESOURCES. Below the menu is a login form with fields for USERNAME and PASSWORD, a Remember Me checkbox, and a LOGIN button. To the right of the login form is a 'DON'T HAVE AN ACCOUNT?' section with a REGISTER NOW button.

## 8-Session Registrants

### Course Resources

Go to [www.aisc.org](http://www.aisc.org) and sign in.

The screenshot shows the MyAISC user profile page. On the left, a sidebar menu includes 'Course Resources', which is circled in red. The main content area has sections for 'MY PROFILE', 'MY PURCHASED DOWNLOADS', and 'MY COURSE RESOURCES'. The 'MY COURSE RESOURCES' section is also circled in red and contains a 'VIEW RESOURCES' button.

## 8-Session Registrants

### Course Resources

The screenshot shows the 'Course Resources' page with a breadcrumb trail: AISC > MY ACCOUNT > COURSE RESOURCES. Below the header is a table listing various sessions.

Event	Start Date
Session Overview on Steel	1/2/2009 12:00:00 AM
8-Session Package: Design of Facade Attachments	5/9/2019 1:00:00 PM
NS 24 8-Session Package: Night School 24 - Fundamentals of Connection Design	10/13/2020 7:00:00 PM
NS 16 8-Session Package: Night School 16 - Structural Design on Steel	2/9/2018 7:00:00 PM
NS 12 8-Session Package: Night School 12 - Design of Frame Structures	7/26/2018 7:00:00 PM
NS 28 8-Session Package: Night School 28 - Steel Construction: Mid To Towers Out	10/5/2018 7:00:00 PM
NS 28 8-Session Package: Night School 28 - Connections Design	2/9/2019 7:00:00 PM
NS 20 8-Session Package: Night School 20 - Classical Methods of Structural Analysis	6/9/2019 7:00:00 PM
8-Session Package: Seismic Design on Steel - Concepts & Examples	7/16/2018 1:00:00 PM

## 8-Session Registrants

### Course Resources

Night School 24: Modern Methods for Learning Structural Stability

#### 8-SESSION PACKAGE RESOURCES

Event	Date	Platform	Video	Cost	Attendance
NS24.1 - Compression Members - The Fundamentals	Oct 6 2020 7:00PM EST	OnDemand	Available 10/06/2020 5:00PM EST	Available 10/06/2020 5:00PM EST	Pending
NS24.2 - Compression Members - Practical Considerations	Oct 13 2020 7:00PM EST	OnDemand	Available 10/13/2020 5:00PM EST	Available 10/13/2020 5:00PM EST	Pending
NS24.3 - Behavior of Tension Members - The Fundamentals	Oct 20 2020 7:00PM EST	OnDemand	Available 10/20/2020 5:00PM EST	Available 10/20/2020 5:00PM EST	Pending
NS24.4 - Tension Members - Practical Considerations	Oct 27 2020 7:00PM EST	OnDemand	Available 10/27/2020 5:00PM EST	Available 10/27/2020 5:00PM EST	Pending
NS24.5 - Stability of Beam-Columns - The Fundamentals	Nov 3 2020 7:00PM EST	OnDemand	Available 11/03/2020 5:00PM EST	No longer available	Pending
NS24.6 - Stability of Beam-Columns - Practical Considerations	Nov 10 2020 7:00PM EST	OnDemand	Available 11/10/2020 5:00PM EST	No longer available	Pending
NS24.7 - Behavior of Structural Systems - The Fundamentals	Nov 17 2020 7:00PM EST	OnDemand	Available 11/17/2020 5:00PM EST	No longer available	Pending
NS24.8 - Structural Systems - Practical Considerations	Nov 24 2020 7:00PM EST	OnDemand	Available 11/24/2020 5:00PM EST	No longer available	Pending
NS24 - Final Exam	N/A	N/A	Available 12/01/2020 5:00PM EST	No longer available	Pending



