

RISA Webinar

AISC 14th Edition Steel Design in RISA

Presenter: Matt Brown, P.E.





RISAFloor 6.0



RISA-3D 10.0

INTEGRATED PROGRAMS

AISC 360-10 (14th Edition Steel Construction Manual)



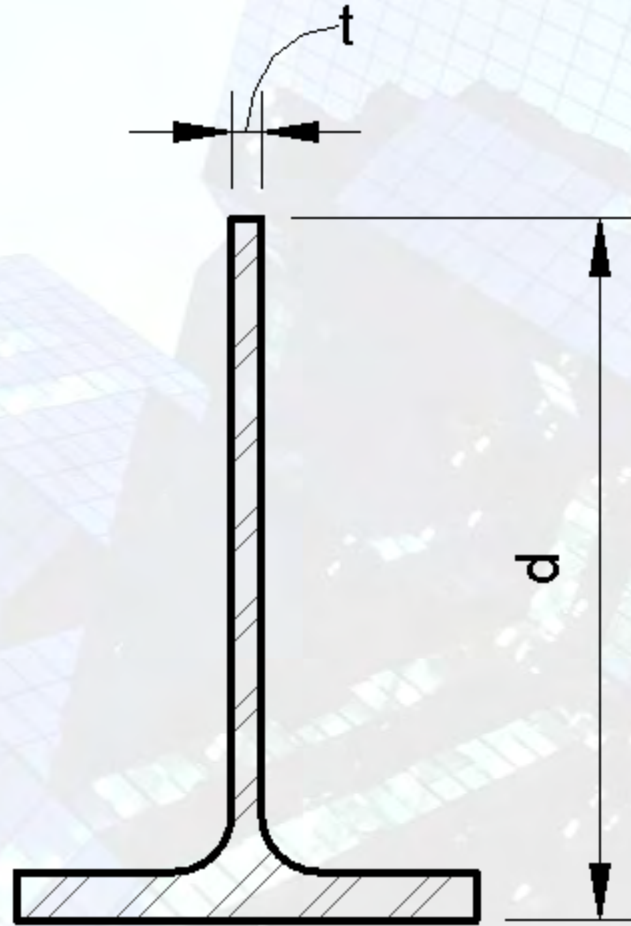
Image courtesy of AISC.org

REFERENCED CODES

Today's Topics

- Slenderness (Chapter B)
- Local Buckling (Chapter F)
- Torsional Buckling (Chapter E)
- Direct Analysis Method (Chapter C)
- Leaning Column Effect (Chapter C)

New Slenderness Check



SLENDERNESS (CHAPTER B)

Local Buckling due to Bending

- WT's and Double Angles
- Flange Local Buckling
- Stem Local Buckling

L-torque = Unbraced Length for Twisting

Torsional Buckling of Wide Flange shapes
applies when....

L-torque > L_{byy} and L-torque > L_{bzz}

AISC Specification Appendix 7

Direct Analysis Method



AISC Specification Chapter C

Design for Stability

DIRECT ANALYSIS METHOD

Direct Analysis Requirements

1. Second Order Analysis ($P-\Delta$, $P-\delta$)
2. Stiffness Reduction (EI^* , EA^*)
3. Notional Loads

Cantilever Column

- W12x45
- 200k Gravity Load
- 10k Lateral Load
- 12'-0" Tall



Initial Shear: 10k

Initial Moment: $(10k) * (12 \text{ ft}) = 120 \text{ ft-k}$

Initial Deflection: 1.021"

EXAMPLE PROBLEM 1

Deflections

Step 0 (Initial)	1.021"
Step 1	1.166"
Step 2	1.186"
Step 3	1.189"
Step 4 (Final)	1.190"

Cantilever Column

- W8x35
- 200k Gravity Load
- 10k Lateral Load
- 12'-0" Tall



Initial Shear: 10k

Initial Moment: $(10k) * (12 \text{ ft}) = 120 \text{ ft-k}$

Initial Deflection: 8.073"

Deflections

Step 0 (Initial)	8.073"
Step 1	17.146"
Step 2	27.479"
Step 3	39.565"
Step 4	54.345"

Direct Analysis Requirements

- ~~1. Second Order Analysis ($P-\Delta$, $P-\delta$)~~
2. Stiffness Reduction (EI^* , EA^*)
3. Notional Loads

REQUIREMENTS

Flexural Stiffness

$$EI^* = 0.8\tau_b EI$$

$$\tau_b = f\left(\frac{P_u}{P_n}\right)$$

Axial Stiffness

$$EA^* = 0.8EA$$

STIFFNESS REDUCTION

Without Reduction

Initial Deflection = 1.021"

Final Deflection = 1.19"

Final Moment = 140 k-ft

U.C. = 1.021

With Reduction

Initial Deflection = 1.268"

Final Deflection = 1.538"

Final Moment = 146 k-ft

U.C. = 1.042

STIFFNESS REDUCTION

Direct Analysis Requirements

- ~~1. Second Order Analysis ($P-\Delta$, $P-\delta$)~~
- ~~2. Stiffness Reduction (EI^* , EA^*)~~
3. Notional Loads

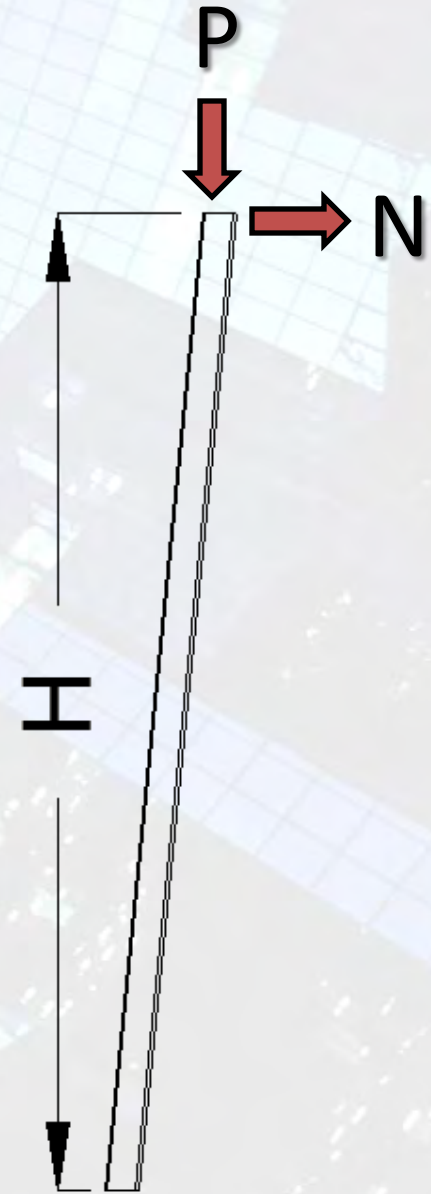
REQUIREMENTS

Per AISC Code of Standard Practice

Erection Tolerance for Columns

(out of plumb) = $H/500$

Notional Load (N) = $P/500$



NOTIONAL LOADS

Direct Analysis Requirements

- ~~1. Second Order Analysis ($P-\Delta$, $P-\delta$)~~
- ~~2. Stiffness Reduction (EI^* , EA^*)~~
- ~~3. Notional Loads~~

$$K = 1.0$$

REQUIREMENTS

Traditional Design

$M = 120 \text{ k-ft}$

$K = 2.1$

Req'd Shape:

W12x65

Direct Analysis

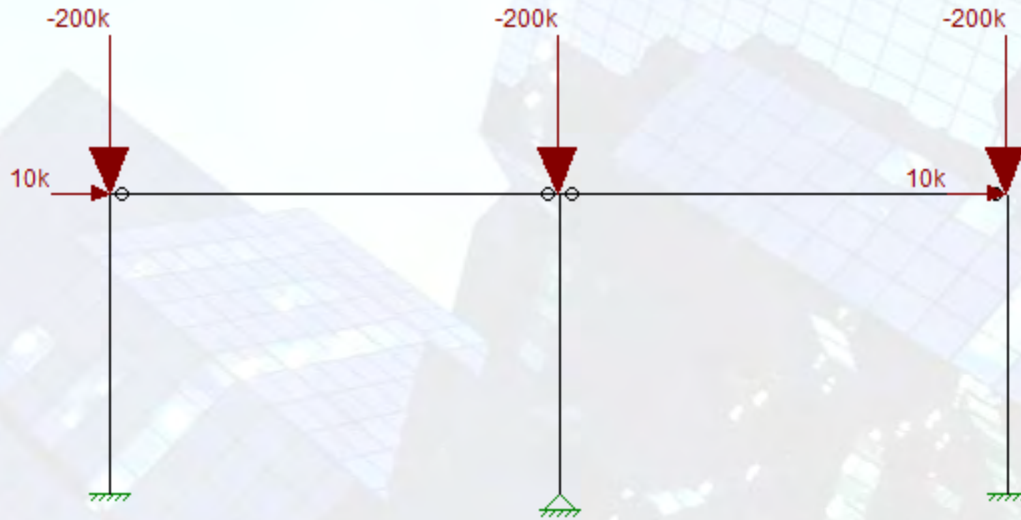
$M = 148 \text{ k-ft}$

$K = 1.0$

Req'd Shape:

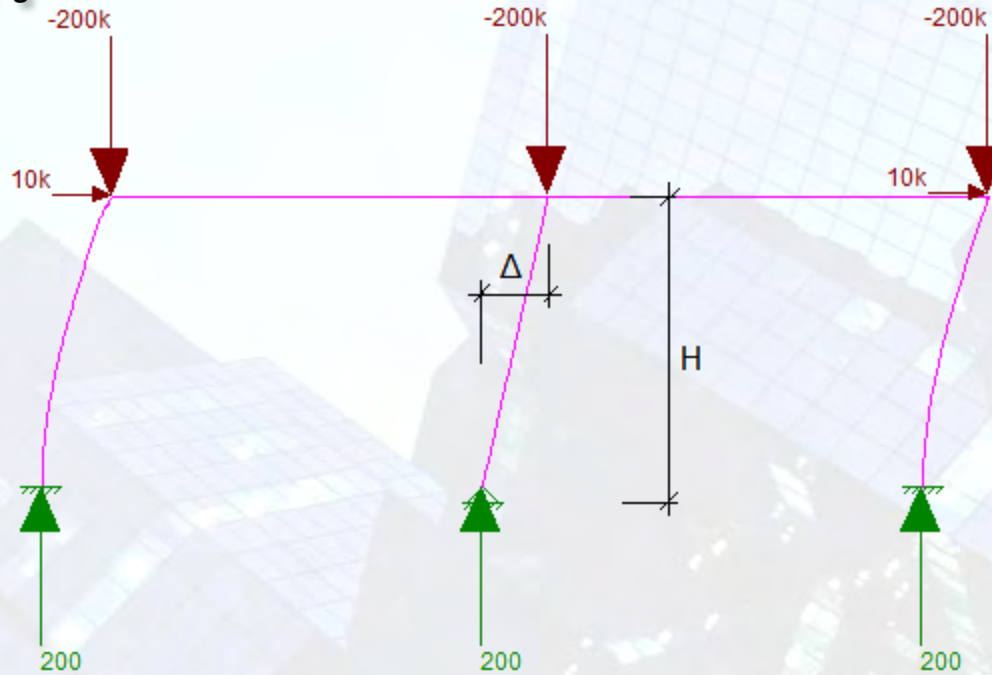
W12x50

COMPARISON



Middle Column is Pin-Pin (Leaning)

LEANING COLUMN EFFECT (CHAPTER C)

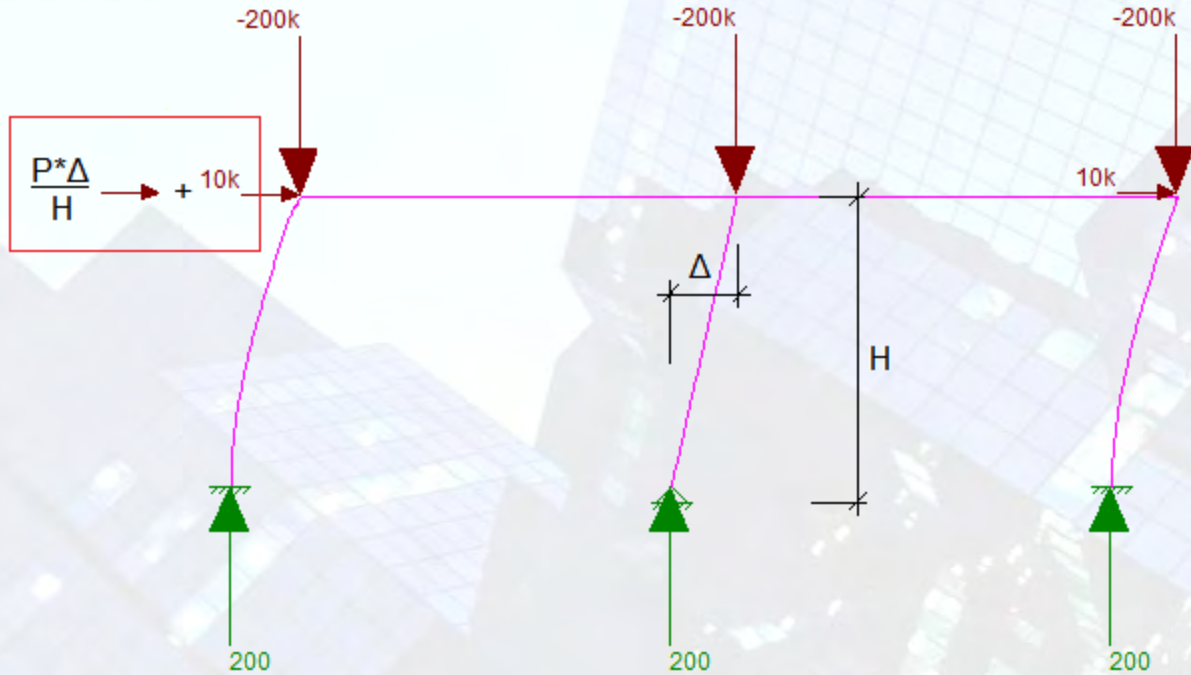


Problem:

P- Δ effect on Middle Column adds to Destabilizing (Leaning) Effect.

Because column is Pin-Pin it cannot resist this effect

LEANING COLUMN EFFECT (CHAPTER C)



Solution:

Add additional (fictitious) story shear which will be carried by the non-leaning columns

LEANING COLUMN EFFECT (CHAPTER C)

Additional Resources

- AISC Publications
- RISA-3D Help File / Manual
- www.risanews.com

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Questions?

Please let us know if you have questions.

We will answer as many questions as time permits during the webinar.

Once the webinar is closed, we will post all Q&A's, as well as the Quick Reference Guide, to our website: www.risa.com

For further information, contact us at: info@risatech.com

Thank you for Attending!

