



# Loads in RISA-3D

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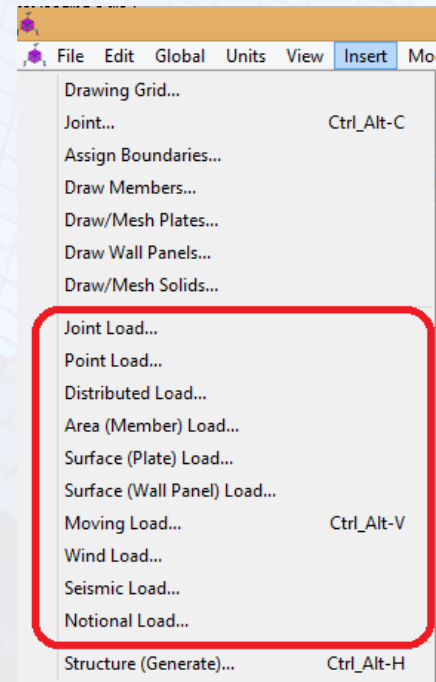


## Agenda

- Joint Loading
- Distributed Loading (aka Line Loads)
- Point Loading
- Area Loading
- Surface Loading
  - ✓ Plates
  - ✓ Walls
- Moving Loading
- Automated Loads- Wind & Seismic

## Overview

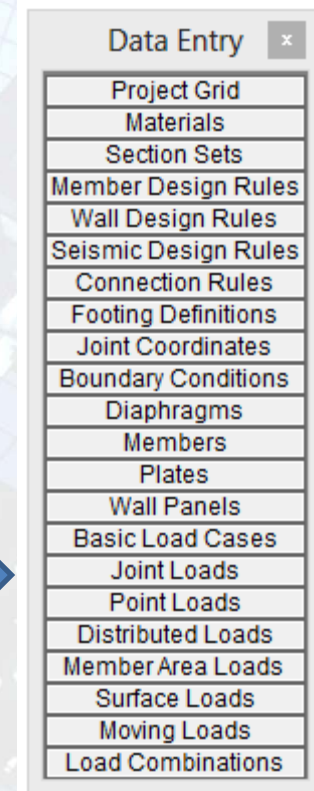
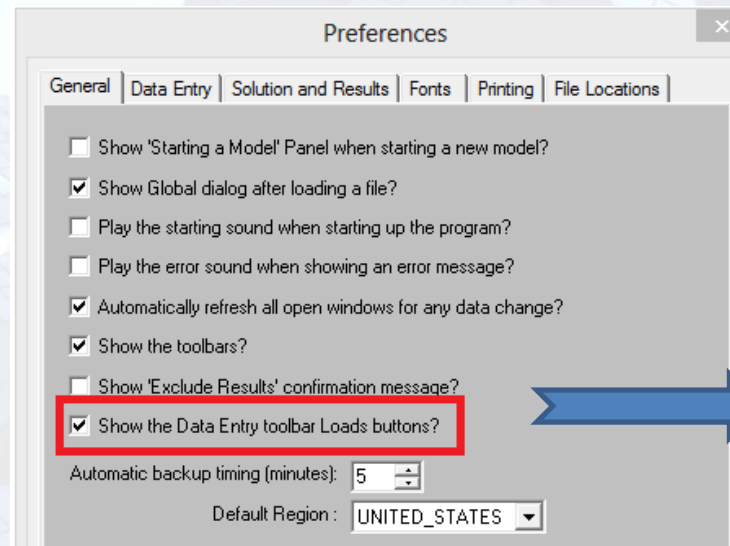
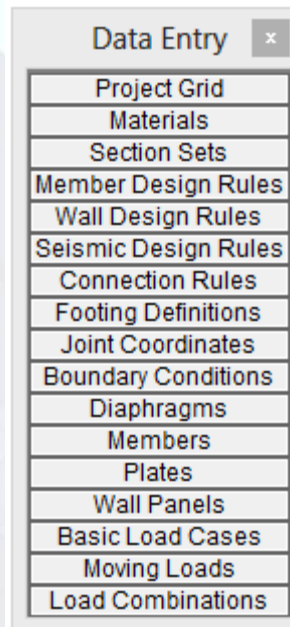
- Graphical Interface
- Windows menu- Insert



- Basic Load Cases- Allows you to access spreadsheets

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distrib...	Area(M...	Surface(...
1	Dead Load	DL		-1				1		
2	Live Load	LL							1	
3	Wind Load	WL								2
4	EQ Load	EL				2				
5	BLC 2 Transient Area Loads	None						2		
6		None								

## Spreadsheets



## Load Combinations

### ➤ Build your own combinations

Load Combinations													
Combinations		Design											
	Description	Sol...	PDelta	SRSS	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC
1	IBC 16-8	<input checked="" type="checkbox"/>			DL	1							
2	IBC 16-9	<input checked="" type="checkbox"/>			DL	1	LL	1	LLS	1			
3	IBC 16-10 (a)	<input checked="" type="checkbox"/>			DL	1							
4	IBC 16-12 (a)	<input checked="" type="checkbox"/>			DL	1	WL	.6					
5	IBC 16-13 (a)	<input checked="" type="checkbox"/>			DL	1	WL	.45	LL	.75	LLS	.75	
6	IBC 16-15	<input checked="" type="checkbox"/>			DL	.6	WL	.6					

✓ Enter the Load Category – DL, LL, WL, etc.

\*\*\* Must use Load Categories!!!

✓ Or the Basic Load Case (BLC) – 1 refers to “row 1”

BLC 1



Basic Load Cases										
	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distrib	Area(M	Surface(
1	Dead Load	DL		-1				1		
2	Live Load	LL							1	
3	Wind Load	WL								2
4	EQ Load	EL				2				

Load Combinations								
Combinations		Design						
	Description	Sol...	PDelta	SRSS	BLC	Factor	BLC	Factor
1	Dead Load	<input checked="" type="checkbox"/>			1	1		





## Load Combinations

➤ Or Use the Load Combination Generator

**LC Generator**

**Load Combination Generator - Gravity**

Gravity | Wind | Seismic

LC Region: United States  
LC Code: 2012 IBC Strength

**Rooftop Live Load Options**

Include:

- ☒ RLL (Rooftop Live Load)
- ☒ SL (Snow Load)
- ☒ RL (Rain Load)

**Notional Load Options**

- ☐ Reversible
- ☐ None
- ☐ 2D Only
- ☒ X and Z

Save as Defaults

Generate Close Help

Gravity Loads

**Load Combination Generator - Wind**

Gravity | Wind | Seismic

LC Region: United States  
LC Code: 2012 IBC Strength

**Wind Load Options**

- ☐ Reversible
- ☐ None
- ☐ 2D Only
- ☐ X and Z
- ☐ X and Z w/Ecc
- ☒ X and Z w/Ecc, Quart

☐ Generate Roof Wind Loads?

☒ Add Notional Loads to Wind Load Combinations?

RLL Options: RLL, SL, RL

Save as Defaults

Generate Close Help

Wind Loads

**Load Combination Generator - Seismic**

Gravity | Wind | Seismic

LC Region: United States  
LC Code: 2012 IBC Strength

**Seismic Load Options**

- ☐ Reversible
- ☐ None
- ☐ Include P
- ☐ 2D Only
- ☐ Include Ev (vertical)
- ☐ X and Z
- ☐ Include Non Ortho (100%+30%)
- ☒ X and Z w/Ecc
- ☐ Add Notional Loads to Seismic Load Combinations?

**Overstrength LC Options**

- ☐ Reversible
- ☐ None
- ☐ Include Ev (vertical)
- ☐ 2D Only
- ☐ Include Non Ortho (100%+30%)
- ☐ X and Z
- ☒ X and Z w/Ecc

RLL Options: RLL, SL, RL

Save as Defaults

Generate Close Help

Seismic Loads

## Joint Loads

Apply to any Joint 

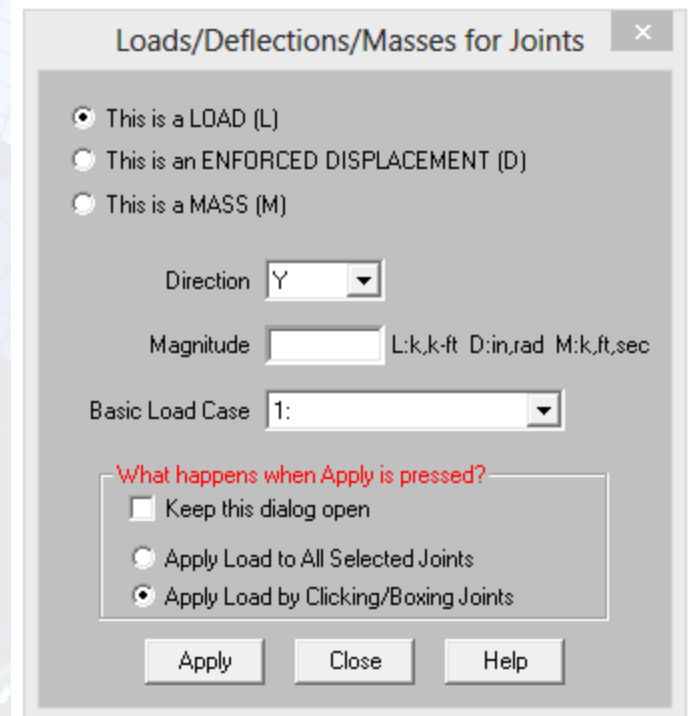
➤ Load

- ✓ Global Axis X, Y, Z
- ✓ Moment MX, MY, MZ

➤ Enforced Displacement

➤ Mass

- ✓ Directional Mass
- ✓ Mass Moment of Inertia



Loads/Deflections/Masses for Joints

☒ This is a LOAD (L)  
☐ This is an ENFORCED DISPLACEMENT (D)  
☐ This is a MASS (M)

Direction

Magnitude  L:k,k-ft D:in,rad M:k,ft,sec

Basic Load Case

What happens when Apply is pressed?

☐ Keep this dialog open  
☐ Apply Load to All Selected Joints  
☒ Apply Load by Clicking/Boxing Joints

Apply Close Help

## Joint Loads

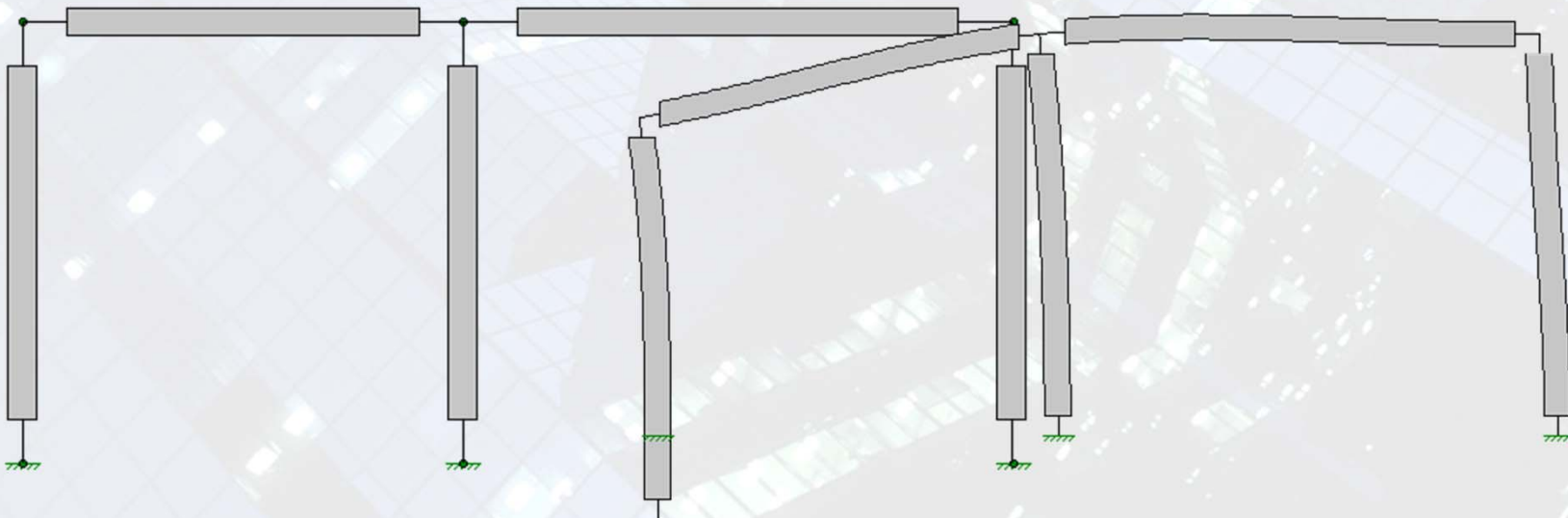


## Enforced Displacement

Joint Loads and Enforced Displacements

BLC 1:

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft, k*ft^2/2)]
1	N1	D	Y	-4



Joint Loads

## Distributed Loads

- Apply Distributed Loads to Members or Walls
- Taper loads
- Start or Stop anywhere

Apply Member/Wall Panel Distributed Loads

Direction

Start Magnitude  k/ft, F

End Magnitude  k/ft, F

Start Location  ft or %

End Location  ft or %

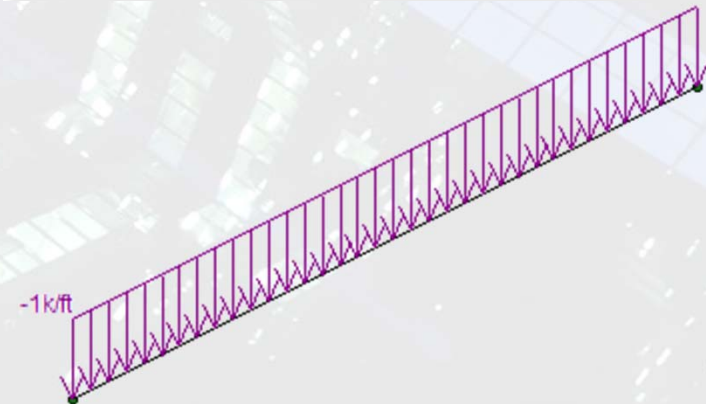
Basic Load Case

What happens when Apply is pressed?

☐ Keep this dialog open

☐ Apply Load to All Selected Members

☒ Apply Load by Clicking Members/Wall Panel Edges Individually

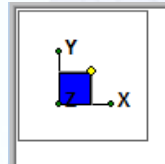


Distributed Loads

## Distributed Loads

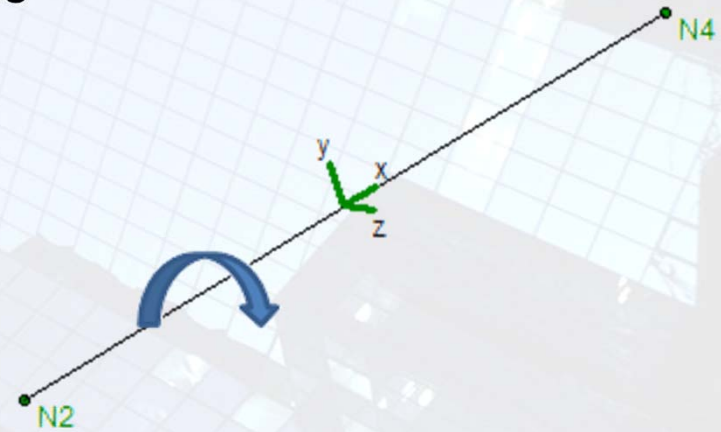
X, Y, Z

Global Axis



x, y, z

Local Axis



Mx

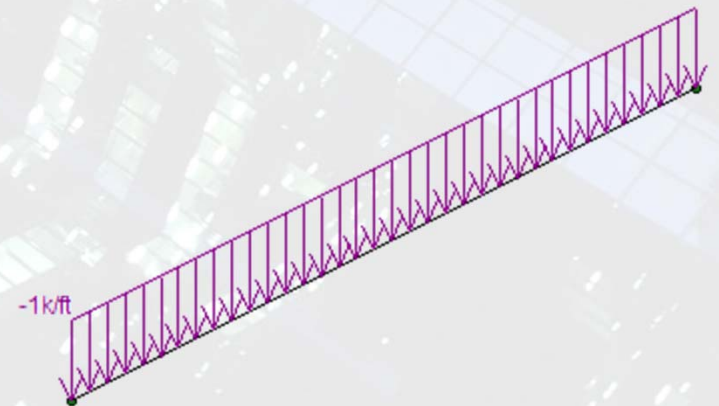
Torque about local x-axis

T

Thermal Loading

PX, PY, PZ

Projected Loading

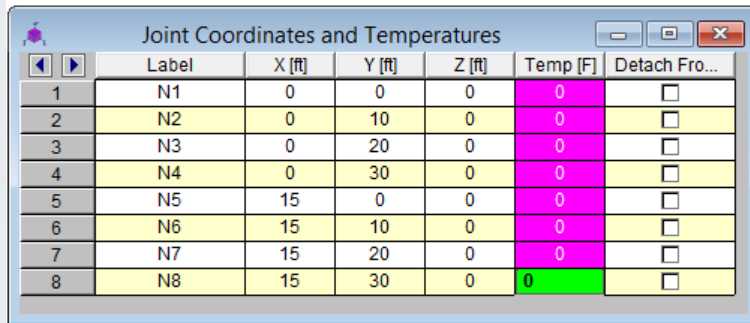


## Distributed Loads

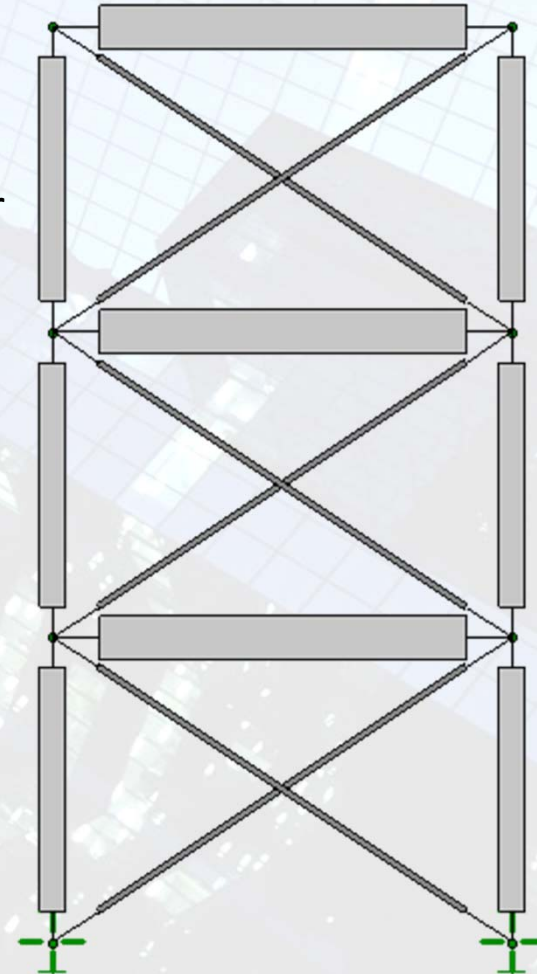
## Thermal Loading

- Thermal Loads → effects of temperature differentials
- Cause the axial expansion or contraction of the member

Ambient Temperature defined:



	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach Fro...
1	N1	0	0	0	0	<input type="checkbox"/>
2	N2	0	10	0	0	<input type="checkbox"/>
3	N3	0	20	0	0	<input type="checkbox"/>
4	N4	0	30	0	0	<input type="checkbox"/>
5	N5	15	0	0	0	<input type="checkbox"/>
6	N6	15	10	0	0	<input type="checkbox"/>
7	N7	15	20	0	0	<input type="checkbox"/>
8	N8	15	30	0	0	<input type="checkbox"/>

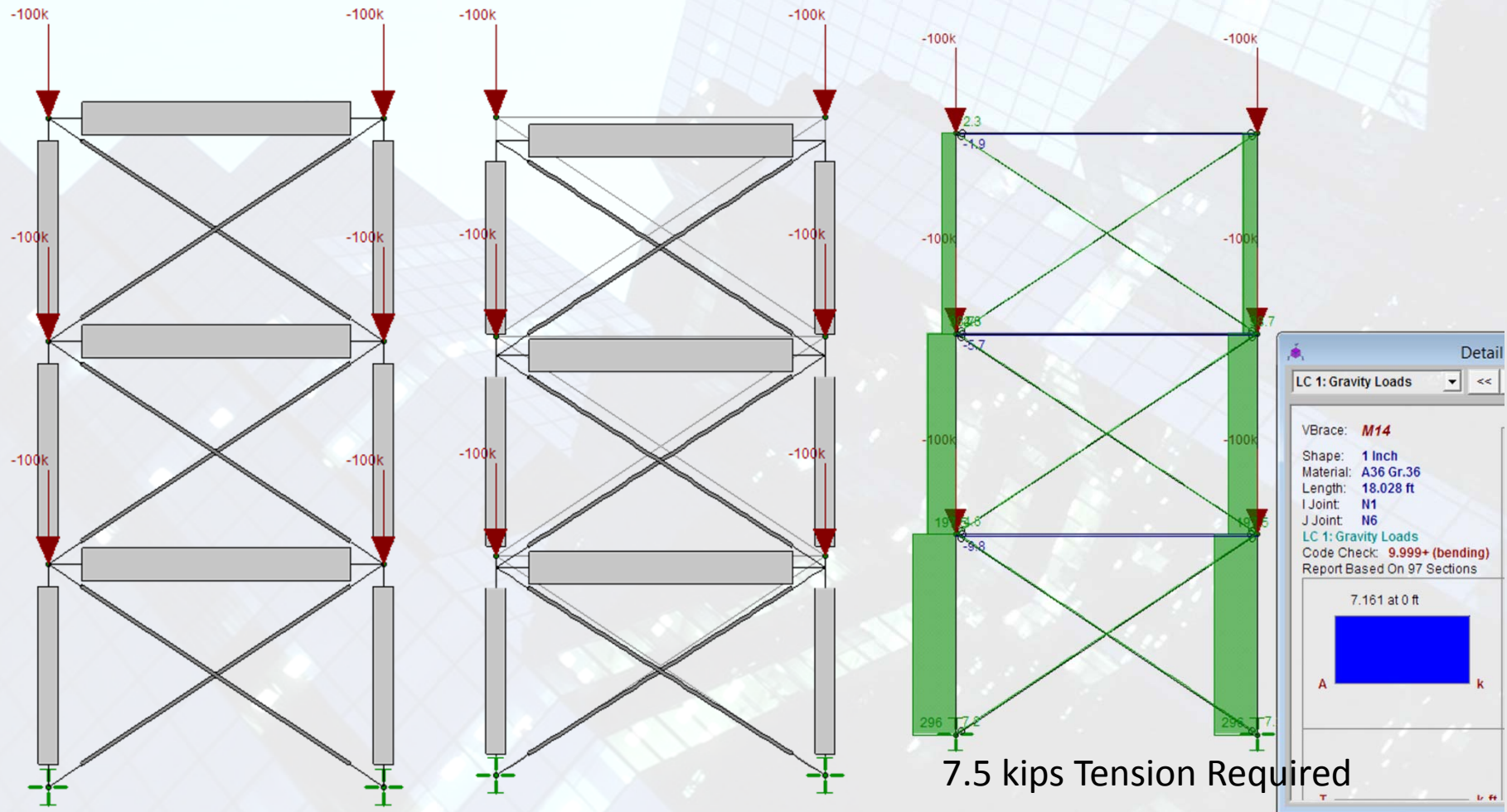


Distributed Loads



# Thermal Loading

For Example: Pre-Stress Brace Members



Distributed Loads



## Thermal Loading

$$F_t = A * E * \alpha * \Delta T$$

Re-organized:  $\Delta T = F_t / (A * E * \alpha)$

$F_t$  = Calculated Thermal force

$F_t = 7.5$  kips

$A$  = Member Cross Sectional Area

$A = 0.785$  in<sup>2</sup>

$E$  = Elastic Modulus

$E = 29000$ ksi

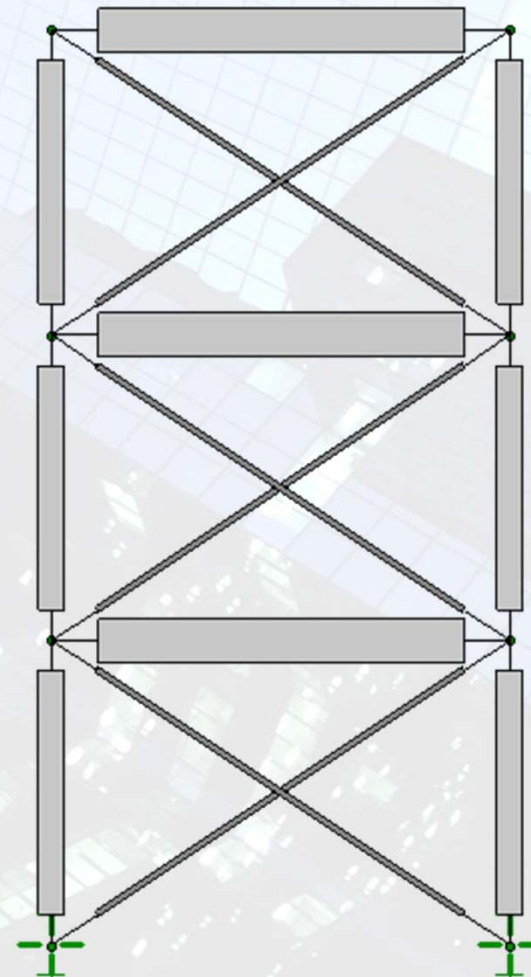
$\alpha$  = Coeff. of Thermal Expansion

$\alpha = .0000065$

Therefore:

$\Delta T$  = Stress Inducing Temperature  
= 50

Let's see this model now!



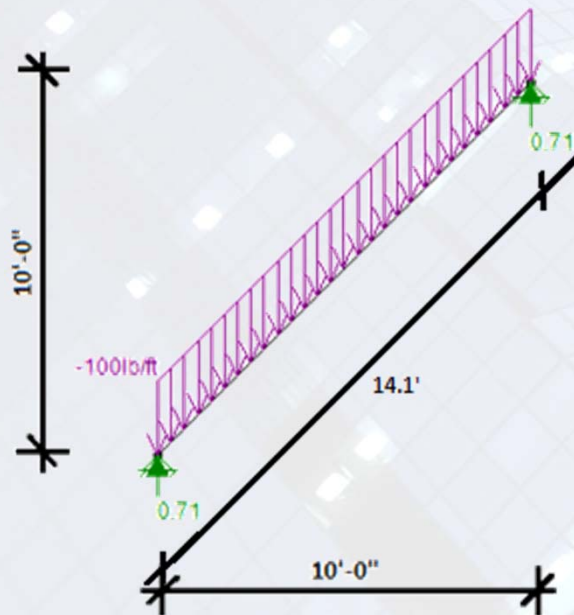
## Distributed Loads

## Projected Loading

Projected Loads → Snow loads

Projected Load = Applied Load X  $\frac{\text{Member Length in Horz. Plane}}{\text{Actual Member Length}}$

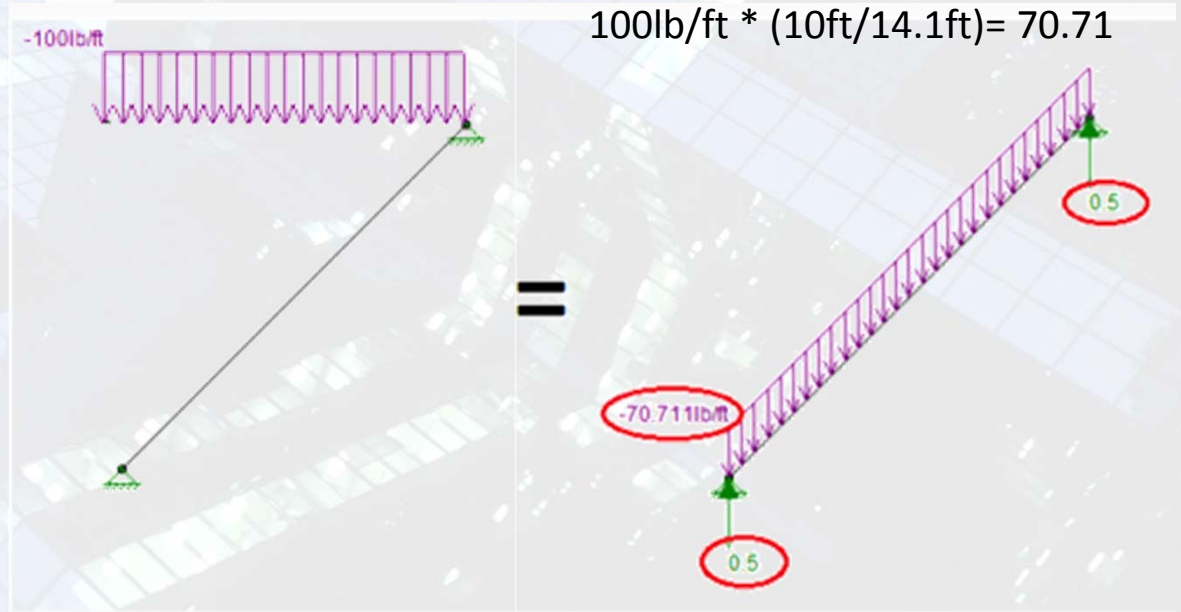
100 lb/ft Distributed Load on Y Axis



100 lb/ft Projected PY Load

→ Converts Load

$$100 \text{ lb/ft} * (10 \text{ ft} / 14.1 \text{ ft}) = 70.71$$



Distributed Loads

## Point Loads

Point Loads for Selected Members/Wall Panels

Direction: Y

Magnitude: -5 k,k-ft

Location: 33% ft or %

Basic Load Case: 1:

What happens when Apply is pressed?

☐ Keep this dialog open

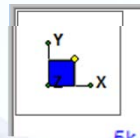
☐ Apply Load to All Selected Members

☒ Apply Load by Clicking Members/Wall Panel Edges Individually

Apply Close Help

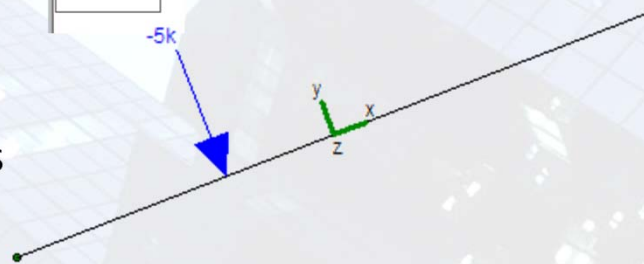
X, Y, Z

Global Axis



x, y, z

Local Axis

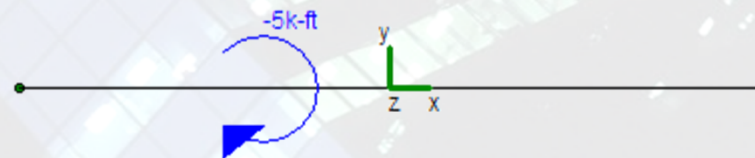


My, Mz

Moment about the member local axis

Mx

Torsional Moment about local x axis

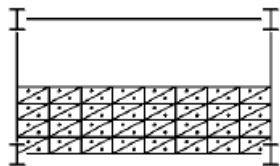


## Point Loads

## Area Loading

- Define polygon (3 or 4 sides)
- Loads applied to Members & Walls
- Define One-Way or Two-Way Load Attribution

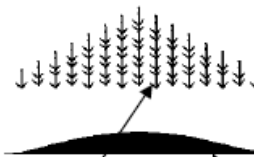
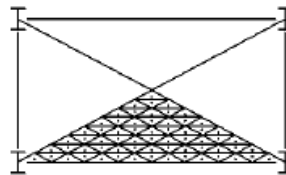
### ONE WAY DISTRIBUTION



Point Loads = Area of Load \* Load Magnitude (Applied at the Centroid of the Area)

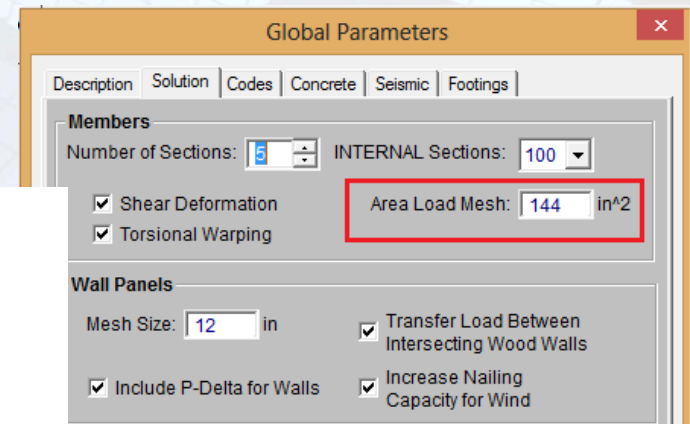
Transient Load Diagram (After Smoothing Algorithm)

### TWO WAY DISTRIBUTION



Point Loads = Area of Load \* Load Magnitude (Applied at the Centroid of the Area)

Transient Load Diagram (After Smoothing Algorithm)



Global Parameters

Description | Solution | Codes | Concrete | Seismic | Footings

**Members**

Number of Sections: 5 INTERNAL Sections: 100

☒ Shear Deformation ☒ Torsional Warping

**Area Load Mesh:** 144 in<sup>2</sup>

**Wall Panels**

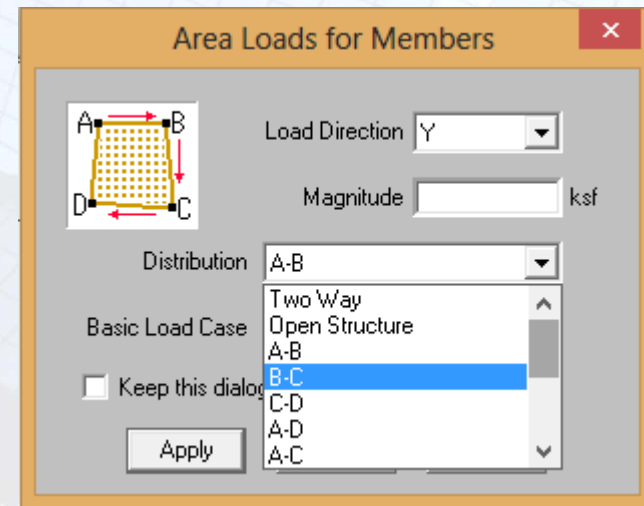
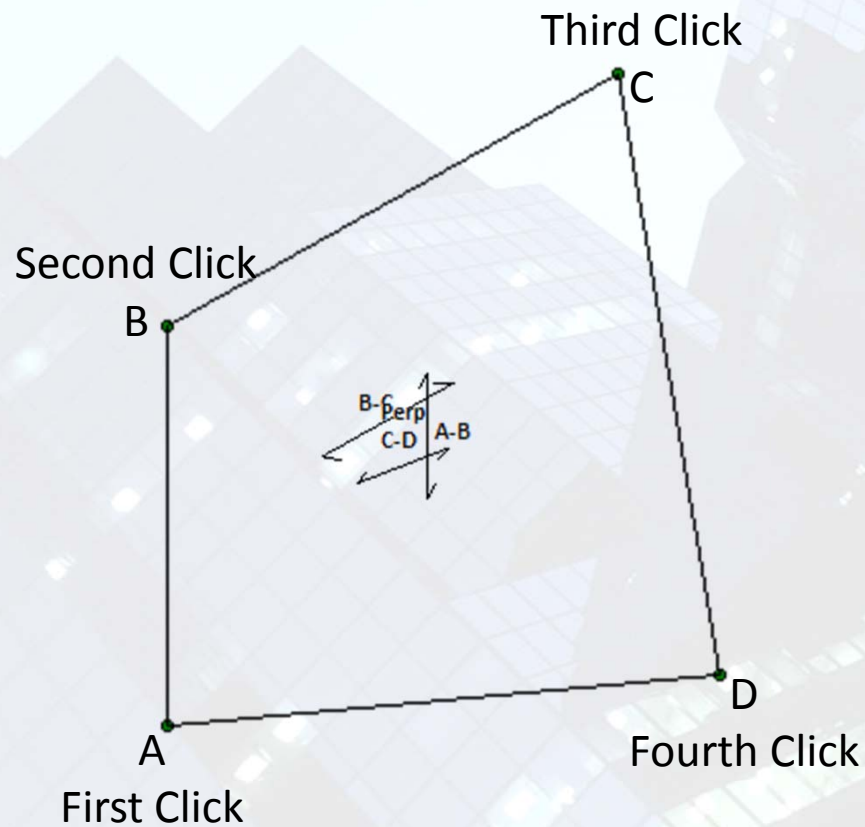
Mesh Size: 12 in

☒ Transfer Load Between Intersecting Wood Walls

☒ Include P-Delta for Walls ☒ Increase Nailing Capacity for Wind

# Area Loads

## Area Loading



Area Loads



## Area Loading

- What is a Transient Area Load?

Basic Load Cases						
	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint
1	Dead Load	DL		-1		
2	Live Load	LL				
3	Wind Load	WL				
4	EQ Load	EL				2
5	BLC 2 Transient Area Loads	None				
6		None				

Let's take a look at an example model...

Area Loads

## Open Structure Loading

Loads applied based on Projected Surface Area

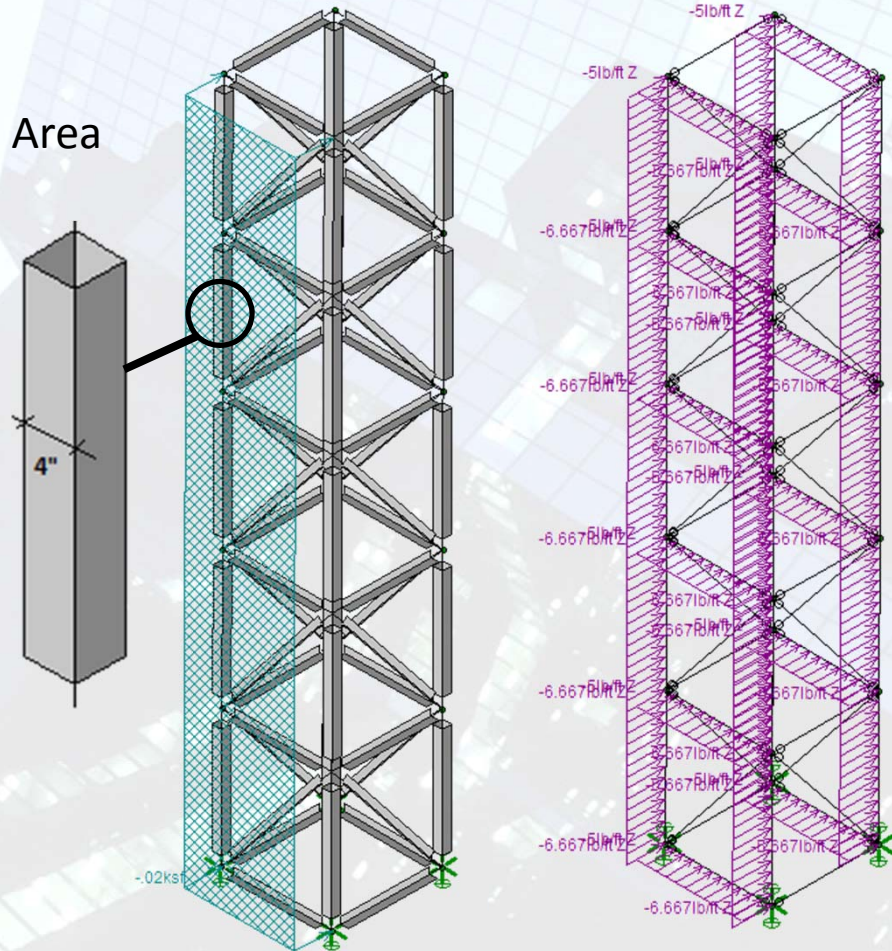
HSS4x4x6  
width = 4in

Transient Load:

$$20\text{lb} \cdot \text{ft} \cdot 4''/12'' = 6.667 \text{ lb/ft}$$

Note:

- Braces don't get area loads
- No Shielding



## Area Loads

## Apply to Plates

X, Y, Z

Global Axis

x, y, z

Local Axis

PX, PY, PZ

Projected Loading

T

Thermal Loading

Let's take a look at an example of a tank now!

Surface Loads for Selected Plates

Direction z

Magnitude 1 ksf, F

Basic Load Case 1:

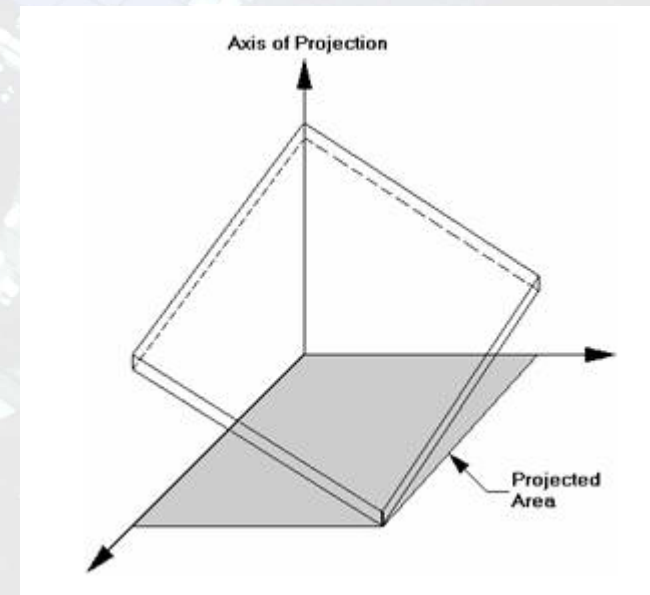
What happens when Apply is pressed?

☐ Keep this dialog open

☒ Apply Load to All Selected Plates

☐ Apply Load by Clicking Plates Individually

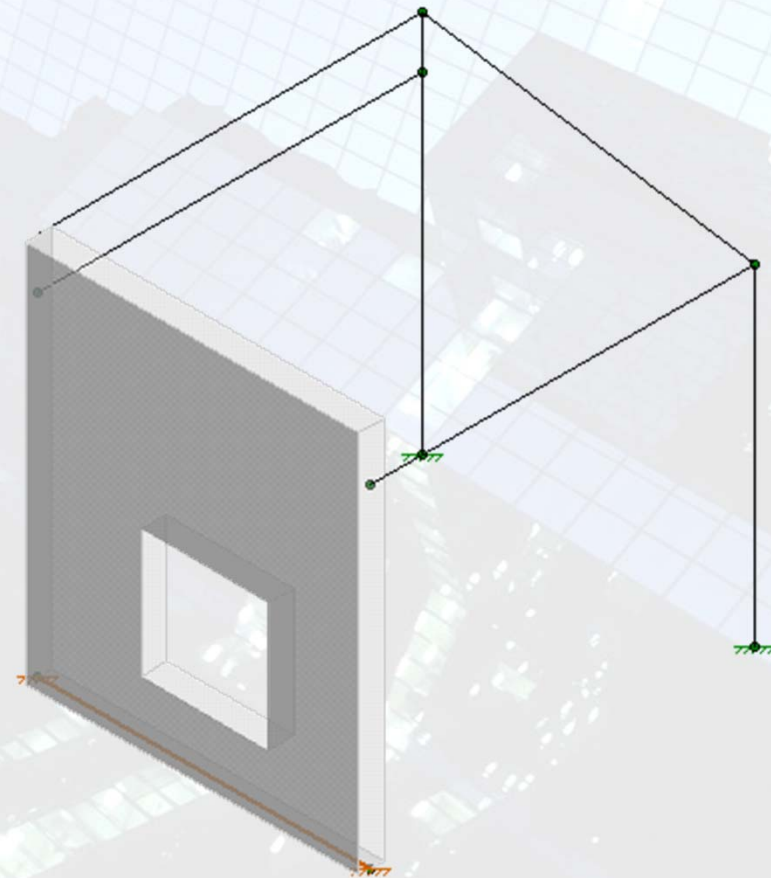
Apply Close Help



## Surface Loading

# Wall Panel Loading Options

- Surface Loading
  - ✓ Full wall or Partial
  - ✓ Constant or Tapered force
- Distributed Loading
- Joint Loading
  - ANYWHERE!
- Area Loading

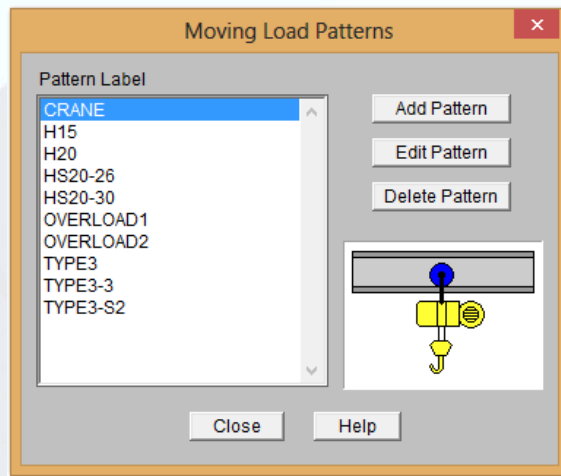


Wall Panel Loads



# Moving Loads- Two Step Process

1. Define the Moving Load Pattern



2. Apply the Moving Load

Moving Loads										
	Tag	Pattern	Increment[ft]	Both Ways	1st Joint	2nd Joint	3rd Joint	4th Joint	5th Joint	6th J...
1	M1	HS20-26	1	<input type="checkbox"/>	N41	N40	N39	N38	N37	

Let's take a look at an example!

## Moving Loading



# Automatic Load Generation

- Building Design with Rigid Diaphragms → Automated Loads

Wind Loads

Wind Load Parameters

Wind Code

ASCE 7-10

Wind Speed (mph)

110

Base Elevation

0

ft

Exposure Cat.

C

Topographic Fac. K1

0

Topographic Fac. K2

0

Topographic Fac. K3

0

Directionality Fac. Kd

1

Seismic Loads

Seismic Load Parameters

Seismic Code

ASCE 7-10

Base Elevation

ft

Risk Cat

I or II

S<sub>D1</sub>

.566

g

Ct (Z)

.035

Ct (X)

.035

TL

sec

S<sub>DS</sub>

1

g

T (Z)

sec

T (X)

sec

S<sub>1</sub>

.566

g

R (Z)

5

R (X)

3.5

☐ Add Base Weight

Ct Exp. (Z)

.75

Ct Exp. (X)

.75

Seismic Load Results

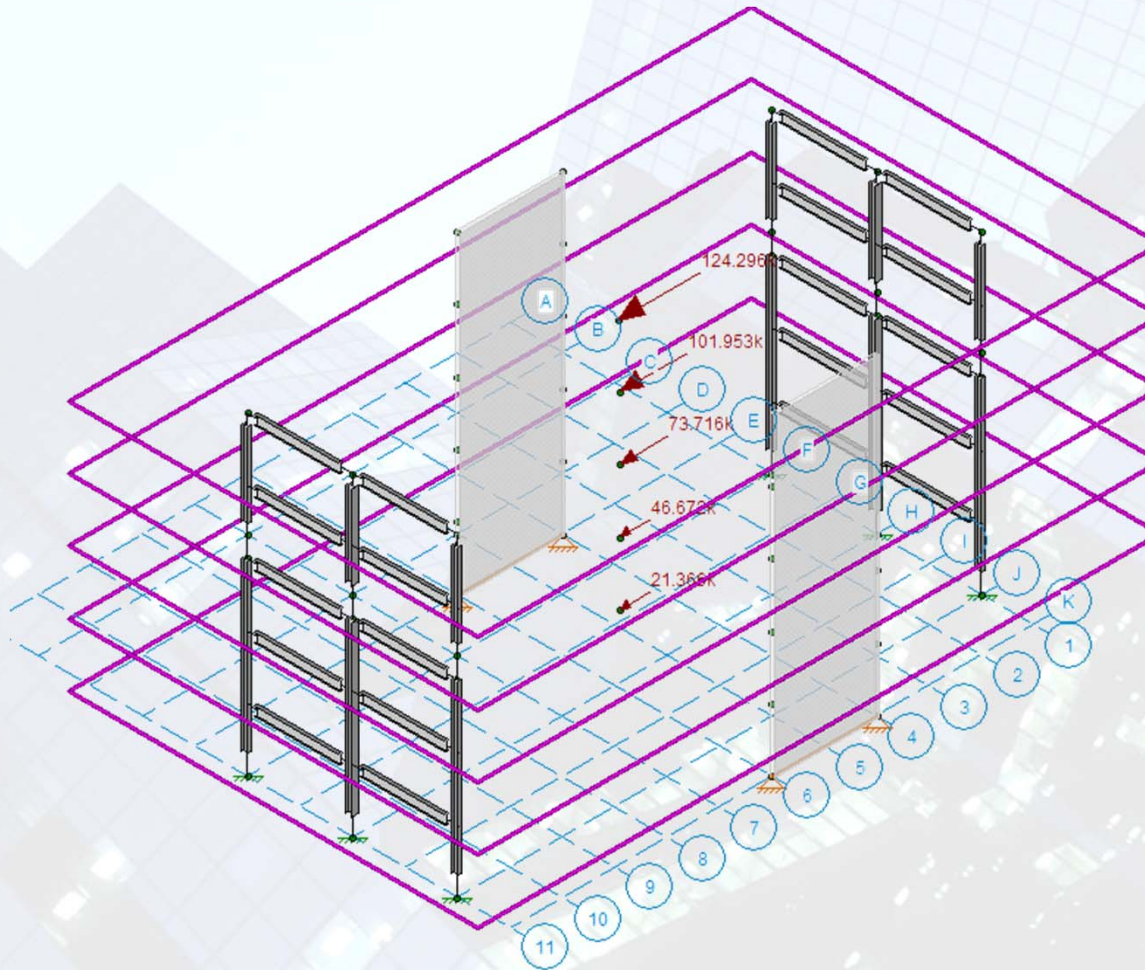
Seismic Weight LC:

1: Seismic Weight

Calc Loads

## Wind & Seismic Loading

# Automatic Load Generation



Wind & Seismic Loading



## 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 to our website: [www.risa.com](http://www.risa.com)

For further information, contact us at: [webinar@risatech.com](mailto:webinar@risatech.com)

Presenter: Deborah Penko, P.E.

