

# RISA Technologies

Using RISAFloor for  
Commercial Building Design



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# Commercial Buildings

## Today's Agenda

- Design Criteria to optimize your beam selection
- Joist Design and Joist Girders
- Sloping Roofs
- Composite Design
- Vibration Analysis
- Using all of the RISAFloor features to build a Commercial Building

# Design Criteria- Design Rules



**Design Size/U.C. Parameters**

Size/UC | Deflection | Concrete Rebar | Masonry Wall | Wood Wall (Studs) | Wood Wall (Fasteners) | Wood Diaphragms

Label	Max Depth[in]	Min Depth[in]	Max Width[in]	Min Width[in]	Max Bending Chk	Max Shear Chk
1 Typical					1	1

**Data Entry**

- Project Grid
- Materials
- Deck Definitions
- Design Rules**
- Area Load Definitions
- Point Locations
- Columns
- Column Stacks
- Wall Panels
- Beams
- Diaphragms
- Point Loads
- Line Loads
- Tapered Area Loads
- Load Combinations
- Floors

Control your member design based on:

- Depth
- Width
- Maximum Code Check

**Design Deflection Parameters**

Size/UC | Deflection | Concrete Rebar | Masonry Wall | Wood Wall (Studs) | Wood Wall (Fasteners) | Wood Diaphragms

Label	DL Defl[in]	DL Ratio	LL Defl...	LL Ratio	DL+LL Defl[in]	DL+LL...	Categ...	Defl[in]	Ratio	Categ...	Defl[in]	Ratio
1 Typical		240		360		240	None		360	None		360

Control the Deflection using DL, LL, or DL+LL Ratios or Maximums

# Joists : Loading

- Uniform Dead Load, UDL
- Uniform Live Load, ULL includes:  
LL, LLS, RLL, SL, SLN, RL
- Uniform Total Load, UTL  
= UDL + ULL

## Important Notes:

- ✓ None of the Uniform loads include the Other Load category
- ✓ Load combinations are not used to create UDL, ULL or UTL

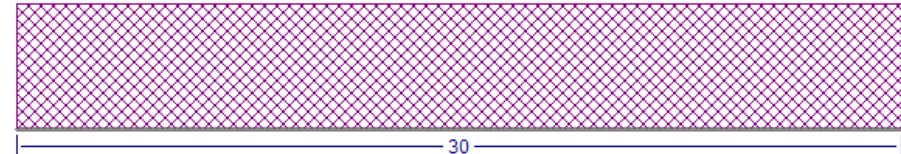
Special Joist Load Diagram : Distributed Loads (k/ft), Point Loads (k) : Spacing (ft)

Note : OL loads not included in Joist Design

Point Loads : TL / LL

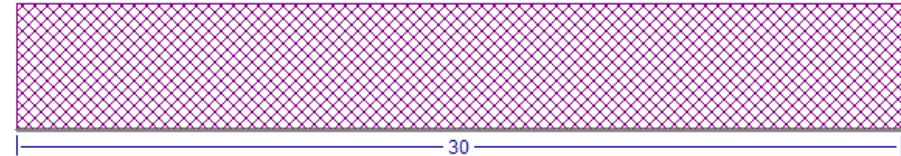
Distributed DEAD Load :

.059



Distributed LIVE Load :

.3



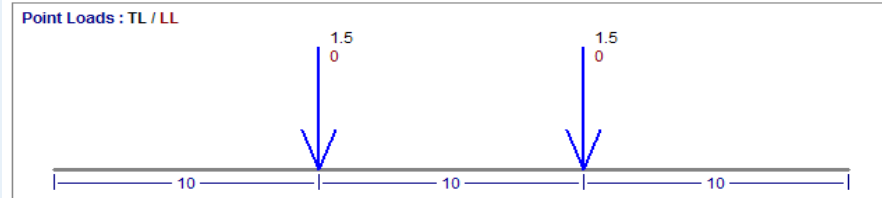
**Total Joist Load: 88.5% Capacity**

Actual UDL = .059k/ft Actual ULL = .3k/ft Actual UTL = .359k/ft Total Load Capacity = .405k/ft

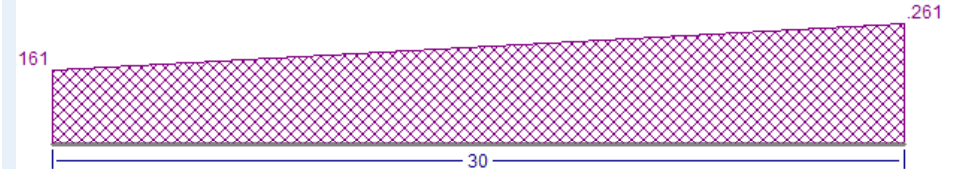
# Joists : Special Loading



**Special Joist Load Diagram:** Distributed Loads (k/ft), Point Loads (k) : Spacing (ft)  
 Note : OL loads not included in Joist Design



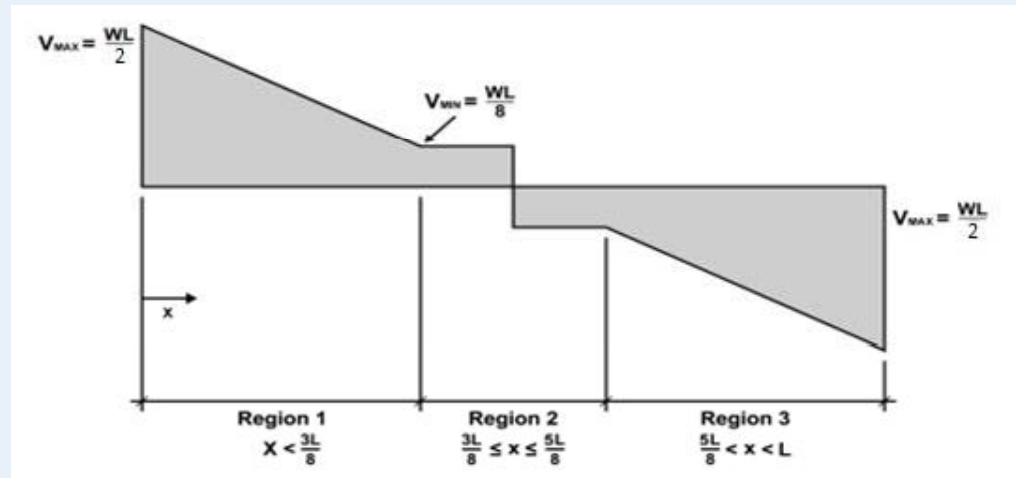
Distributed DEAD Load :



Any Non-Uniform Loading= SPECIAL JOIST (SP)

The design is based on the capacity shear envelope of the joist under a standard uniform load. (Grey outline).

Calculations from  
Designing with Vulcraft: Steel Joists,  
 Girders and Steel Deck



# Joists : Special Loading

Special Joist loading

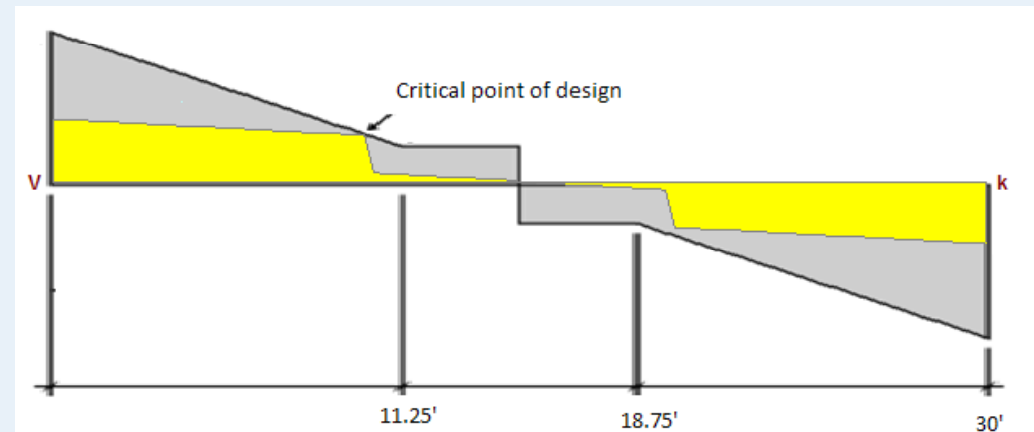
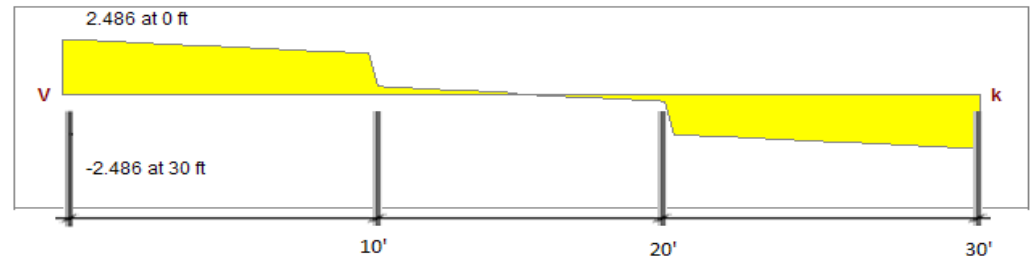
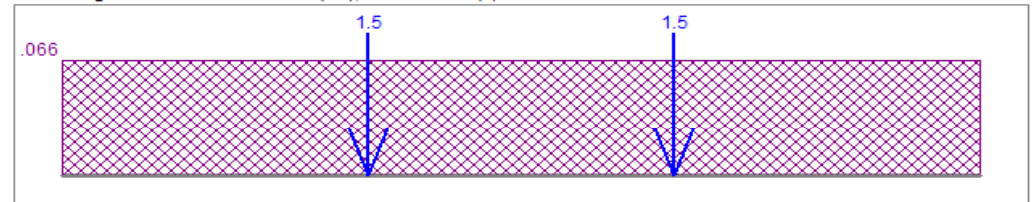
Length = 30 feet

Point loads at 1/3 points

Max Shear is not the Critical Point of design



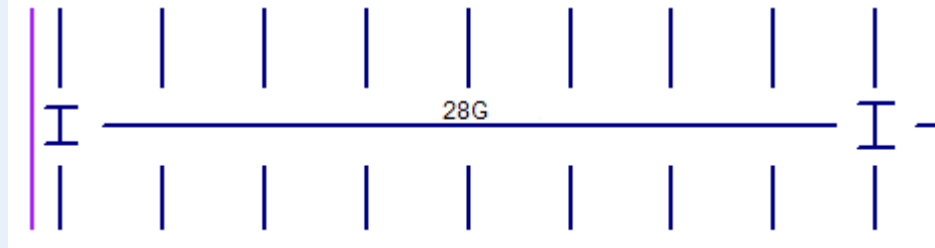
Diagrams for Load Combination 1 : Comb. 1 - DL  
Load Diagram : Distributed Loads (k/ft), Point Loads (k)





# Joists Girders

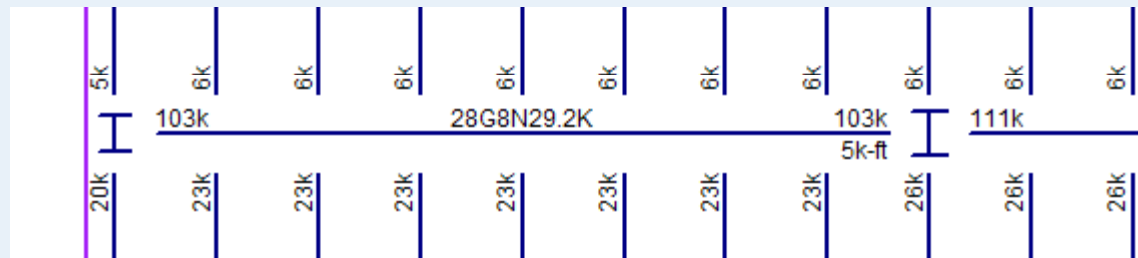
Girders are called out based on the assumed depth



28G refers to the DEPTH of the Joist Girder (28")

8N corresponds to the NUMBER of equally spaced concentrated loads

29.2K refers to the MAGNITUDE of the concentrated loads  
(23 kips + 6 kips = 29 kips)

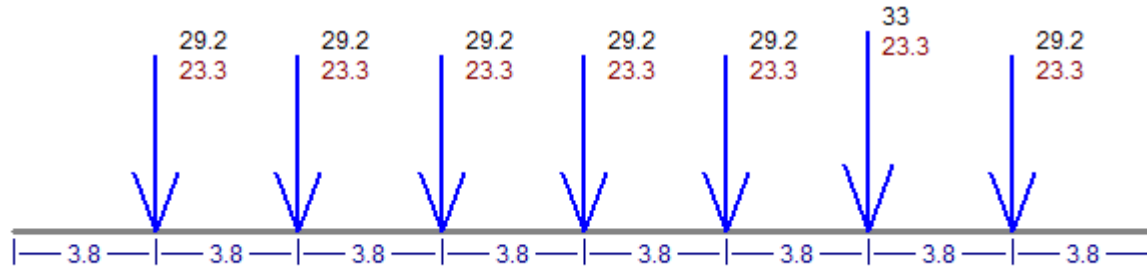




# Joists Girders- Special



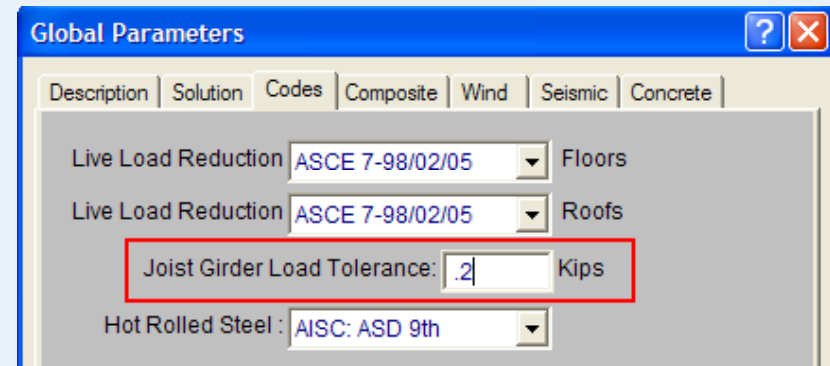
Point Loads : TL / LL



Non-Uniform Point loads → Special Joist Girders

**Joist Girder Load Tolerance** sets the maximum load variation to be allowed when specifying that standard joist girder call-out.

When the load variation exceeds this, the call-out will switch to “Special”



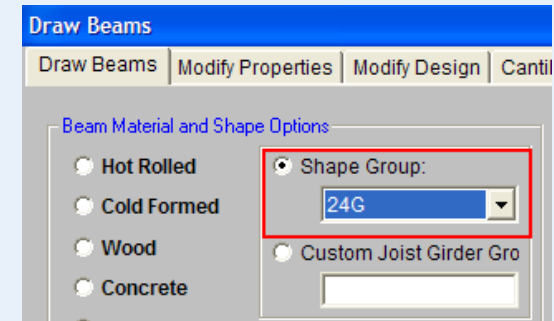
# Joists Girders- Moment of Inertia



Given: Depth only

Estimated Moment of Inertia:

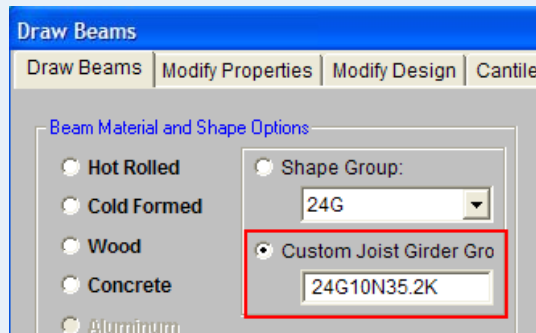
$$I_{zz} = .027 * 2 * 4 * (\text{beam length}/12) * \text{JG depth}$$



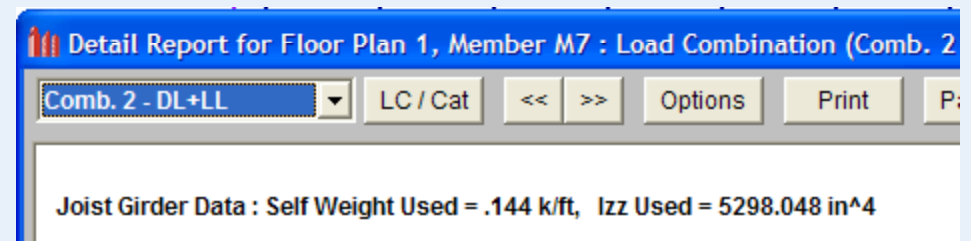
Given: Depth, number and magnitude of point loads

Estimated Moment of Inertia:

$$I_{zz} = .027 * \text{Joist spacing} * \text{Point load} * (\text{beam length}/12) * \text{JG depth}$$



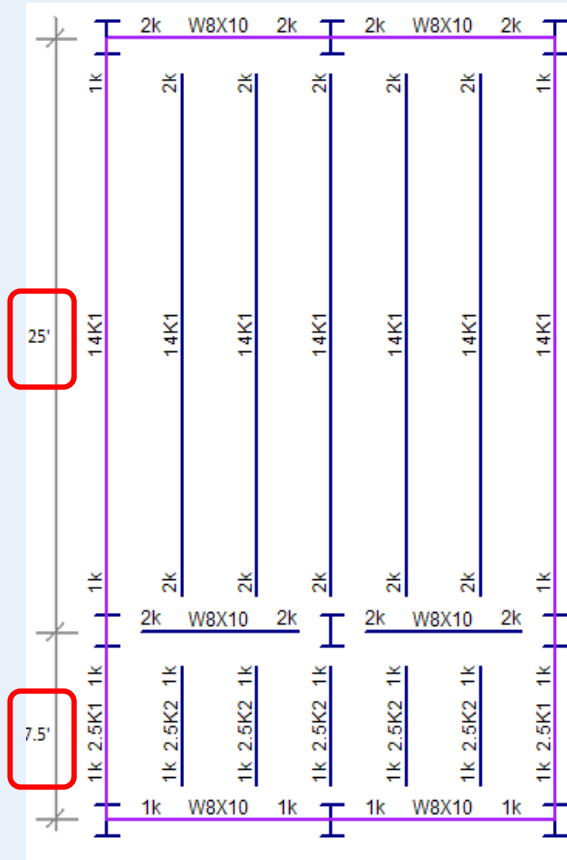
Reported in Detail Report



# Common Questions



How are my joists selected?



What is the criteria for Joist selection?

- 1) Span
- 2) Capacity
- 3) Joist Weight

How did a 2.5K2 get selected?

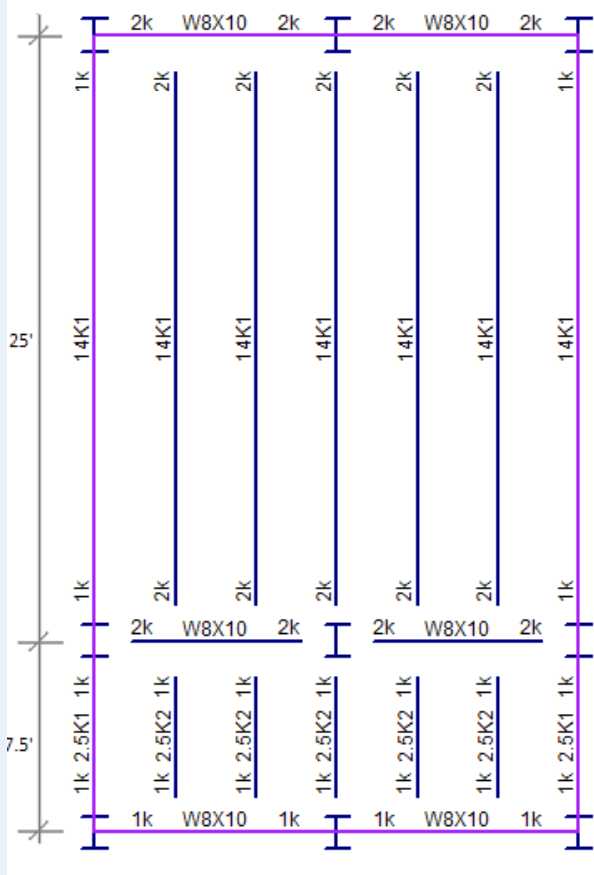
Spans below 8' are not available on the K-Joist table.

4' – 8': 2.5" K-Series Joists Substitutes used.

# Common Questions



How are my joists selected?



Total Joist Load: 64% Capacity

Actual UDL = .049k/ft Actual ULL = .067k/ft **Actual UTL = .115k/ft** Total Load Capacity = .18k/ft

STANDARD LOAD TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES  
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot

Joist Designation	8K1	10K1	12K1	12K3	12K5	14K1	14K3	14K4	14K6	16K2	16K3	18K1
Depth (in.)	8	10	12	12	12	14	14	14	14	16	16	18
Approx. Wt (lbs./ft.)	5.1	5.0	5.0	5.7	7.1	5.2	6.0	6.7	7.7	5.5	6.3	7.5
Span (ft.)												
8	550											
9	550											
10	550	550										
11	532	550										
12	444	550	550	550	550							
13	377	479	550	550	550							
14	324	412	500	500	500	550	550	550	550			
15	281	358	434	543	550	511	550	550	550			
16	240	313	380	470	550	448	550	550	550	550	550	
17	199	277	336	420	550	395	495	550	550	512	550	
18	158	234	291	366	550	324	404	443	443	488	526	
19	113	197	245	317	550	272	339	397	408	450	508	
20	113	167	207	269	550	230	287	336	383	347	386	
21	189	241	302	409	550	284	356	428	525	368	410	
22	97	142	177	230	550	197	246	287	347	297	330	
23		199	249	337	550	254	290	353	432	303	337	
24		106	132	172	550	147	184	215	259	222	247	
25		161	227	308	550	214	268	322	395	277	308	
26		93	116	150	550	128	160	188	228	194	216	
27		166	208	282	550	196	245	295	362	254	283	
28		81	101	132	550	113	141	165	199	170	189	
29		180	226	272	550	226	272	334	411	234	260	
30		100	124	155	550	100	124	145	175	150	167	
31		166	209	281	550	188	239	291	368	216	240	
32		88	110	129	550	110	129	156	194	133	148	

Actual UTL < Load Capacity (Black #)

# Common Joist Questions



Can I analyze an existing joist?

**Modify Beam Properties**

Draw Beams | Modify Properties | Modify Design | Cantilevers | Detailing

Beam Material and Shape Options

- Hot Rolled
- Cold Formed
- Wood
- Concrete
- Aluminum
- Steel Product**
- Wood Product
- General

Shape Group: K Joist

Custom Joist Girder Gro: [ ]

Explicit Shape:  Use? 14K6

Design Rules: Typical

Function: Lateral Gravity

Orientation for Bending: Strong Axis Weak Axis

End Releases: Start Fixed End Fixed

**Shape Selection**

General | Hot Rolled | Cold Formed | Wood | Concrete | **Steel Prod** | Wood Prod

Shape Type

- K Series**
- LH Series
- DLH Series
- SLH Series
- KCS Series
- Joist Girder

Depth: [0] G  
Spaces: [0] N  
Point Load: [0] K

(D) 14 in  
(W) 2 in

Database / Manufacturer: Steel Joists

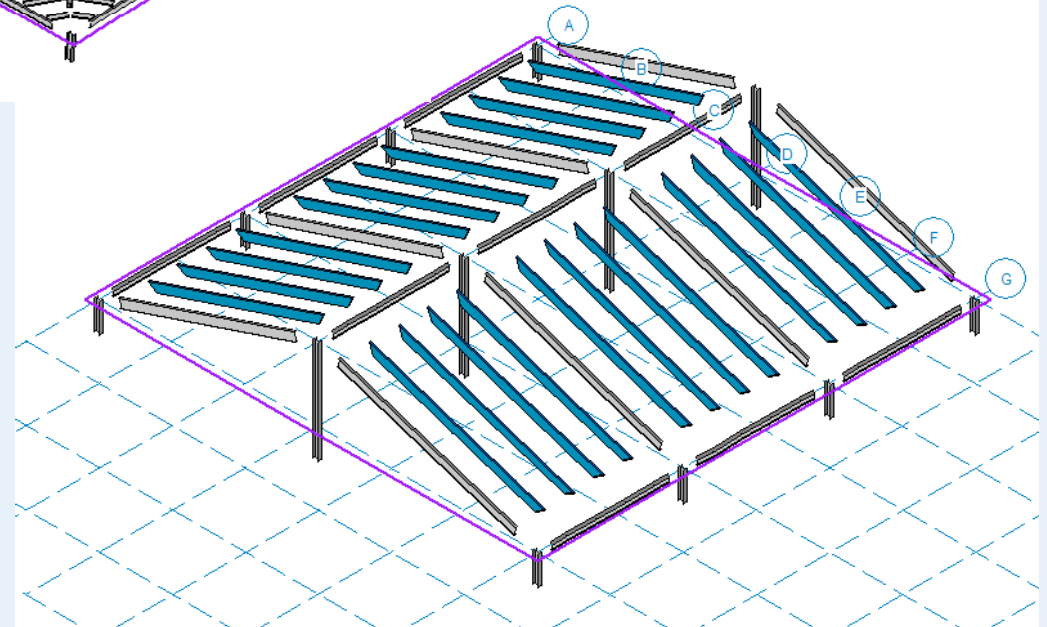
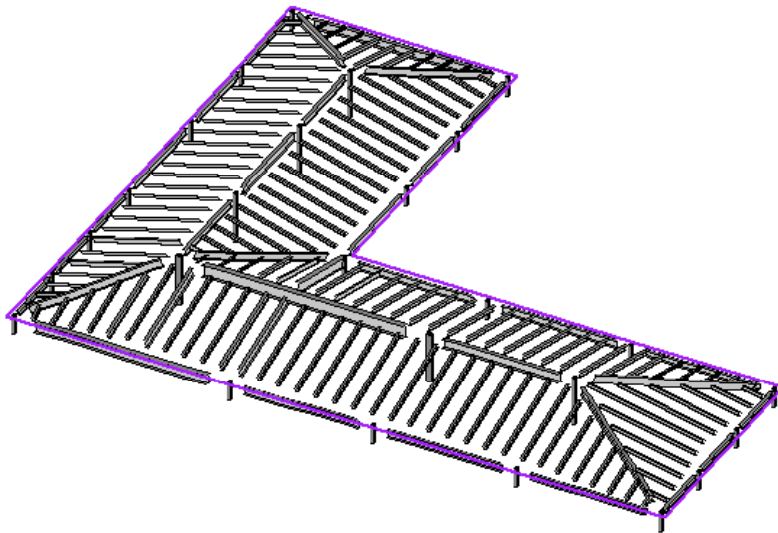
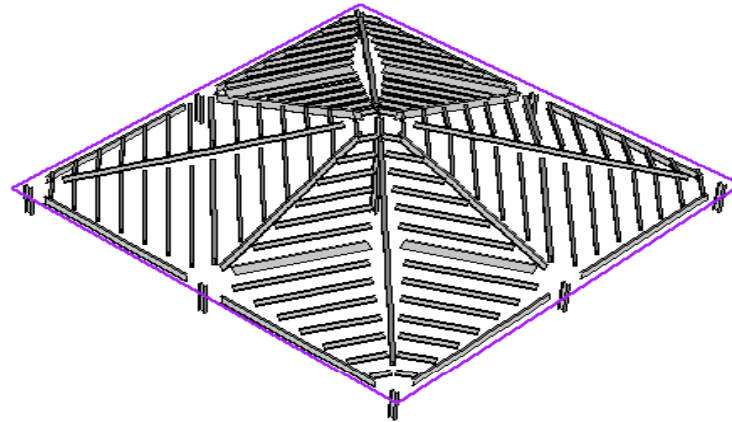
Make Default Database

OK Cancel Help

# Sloping Roofs



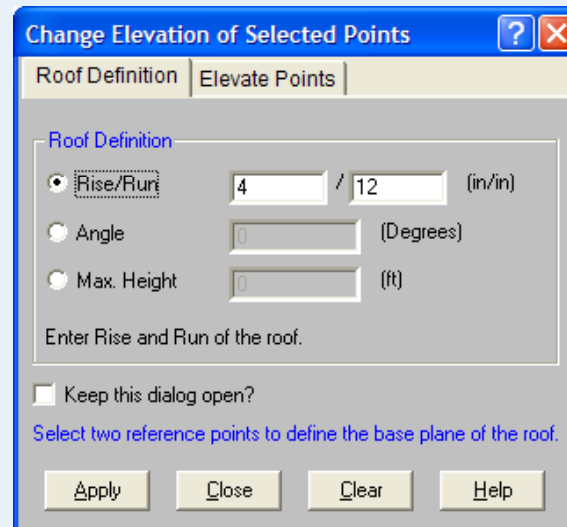
Slope the roof in any direction, in multiple pitches or a single pitch.



# Sloping Roofs



- Rise/Run
- Angle
- Max Height



Change Elevation of Selected Points

Roof Definition Elevate Points

Roof Definition

Rise/Run 4 / 12 (in/in)

Angle 0 (Degrees)

Max. Height 0 (ft)

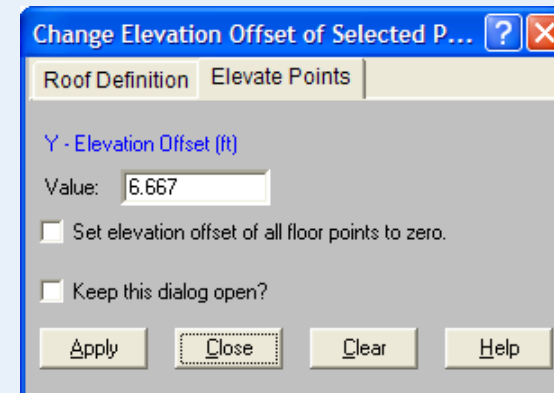
Enter Rise and Run of the roof.

Keep this dialog open?

Select two reference points to define the base plane of the roof.

Apply Close Clear Help

Or Just Elevate the Points



Change Elevation Offset of Selected P...

Roof Definition Elevate Points

Y - Elevation Offset (ft)

Value: 6.667

Set elevation offset of all floor points to zero.

Keep this dialog open?

Apply Close Clear Help



# Composite Beam Design



Global Parameters

Description | Solution | Codes | Composite | Wind | Seismic | Concrete

Composite Options

Use Non-Composite if Optimum

Effective Width End Offset  %

Orthogonal Beam Angle  Degrees

Beam/Deck Parallel Angle  Degrees

Stud Options

Use Uniform Studs Only

Min. Percent Composite  %

Max. Percent Composite  %

Max. Stud Spacing  in

Min. Stud Spacing  in

Stud End Offset  in

Min. Width for 2 Rows  in

Min. Width for 3 Rows  in

Save as Defaults

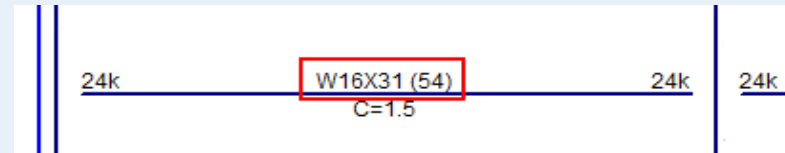
OK Cancel Apply Help

Control the Composite parameters in the Global Parameters

# Composite Beam Design

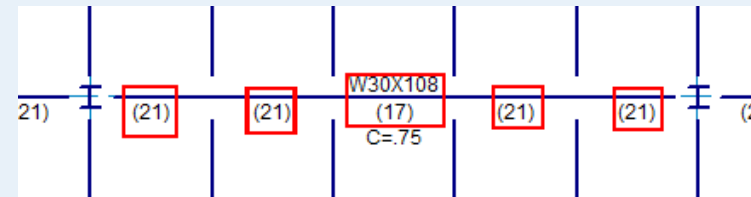


- Uniform Studs (# Studs)



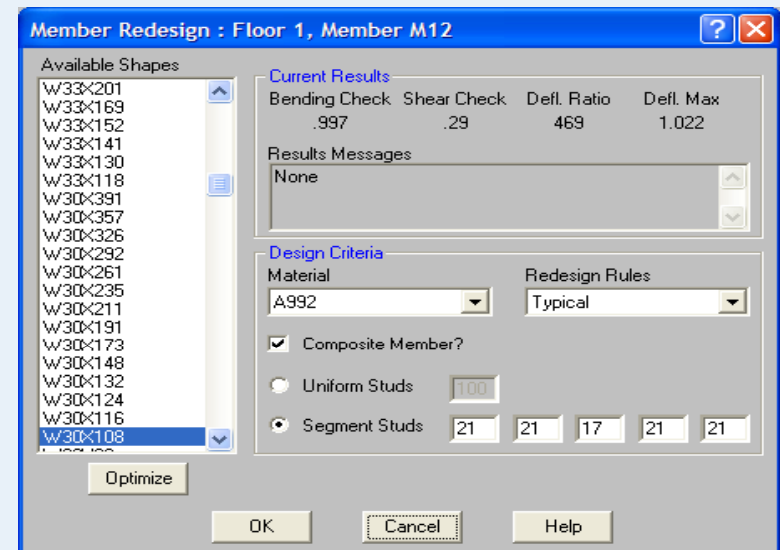
OR

- Segmented Studs  
(# Studs) shown at every Segment



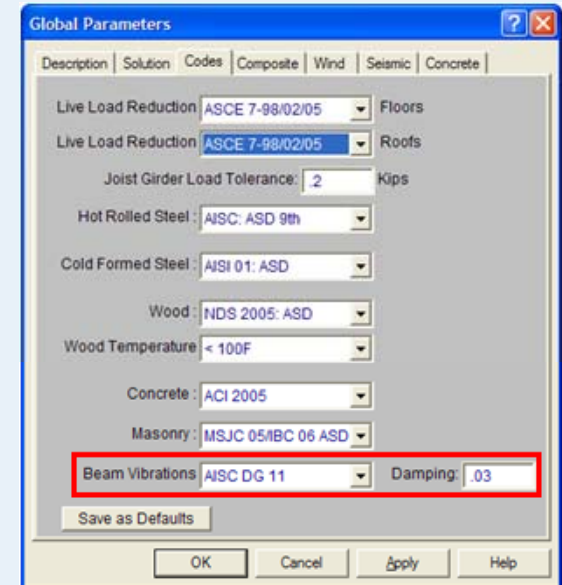
OR

- Manually Change your Studs with the Redesign Tool



# Vibration

- ✓ Based on the AISC Design Guide 11
- ✓ Total Vibration Loads applied =  
Self wt (members + deck) + Vibration Load (VL)  
  
VL = Superimposed Dead Load + Live Load
- ✓ Applied as a uniform distributed load  
(Section 3.3 of the AISC Design Guide)



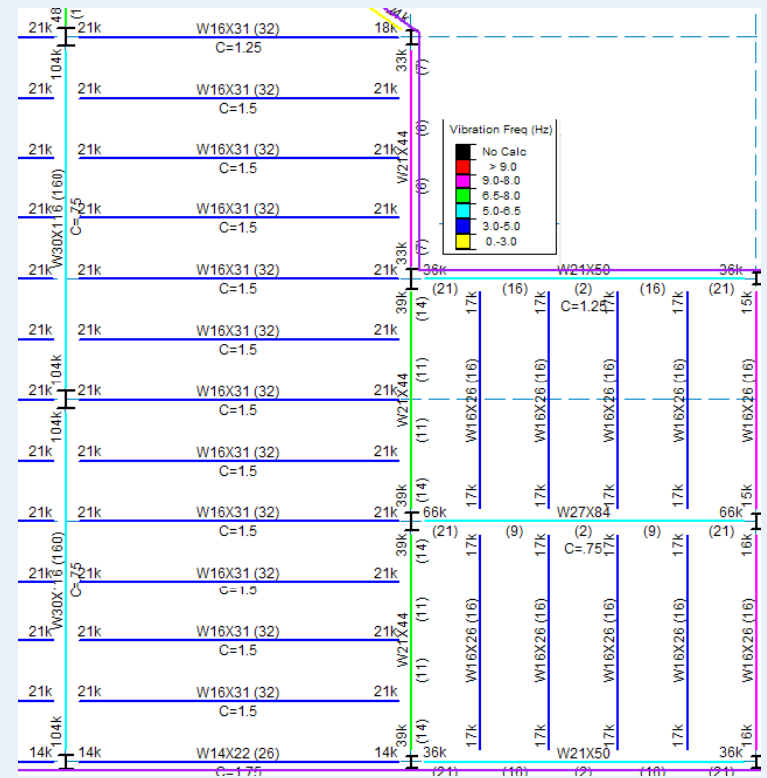
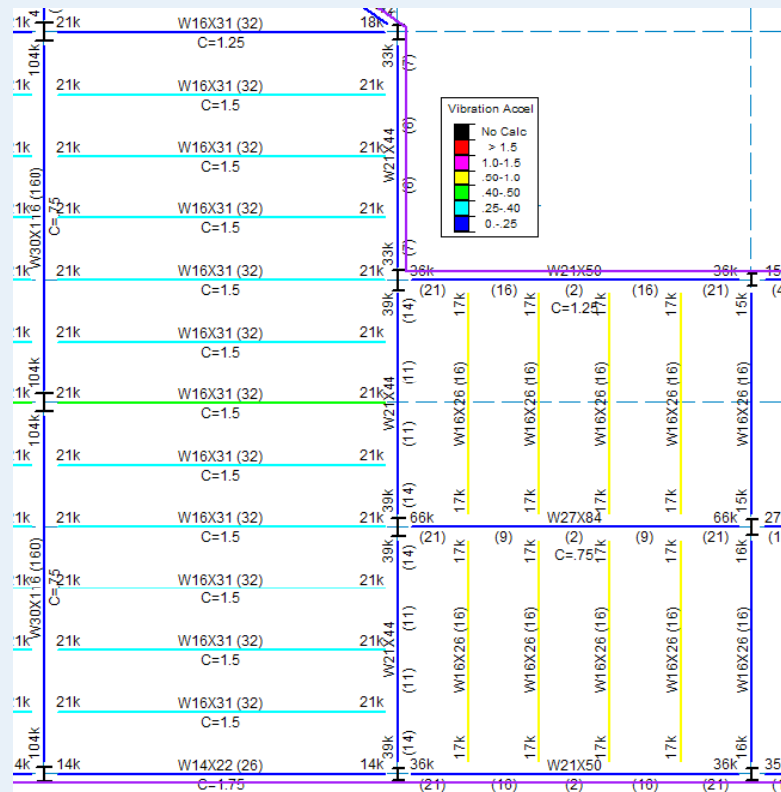
Uniform Area Loads								
Standard   Other								
	Label	Addit...	PreDL[ksf]	PostDL[ksf]	LL[ksf]	LL Type	VL[ksf]	Dyn Load[ksf]
1	Office	<input type="checkbox"/>		.01	.08	LL-Reduce	.011	.075
2	Storage	<input type="checkbox"/>		.01	.125	LLS-Non	.011	.175
3	Public	<input type="checkbox"/>		.01	.1	LL-Non	.004	.075
4	Add Piping	<input checked="" type="checkbox"/>		.02		LL-Non	.011	

# Vibration- Color Coded

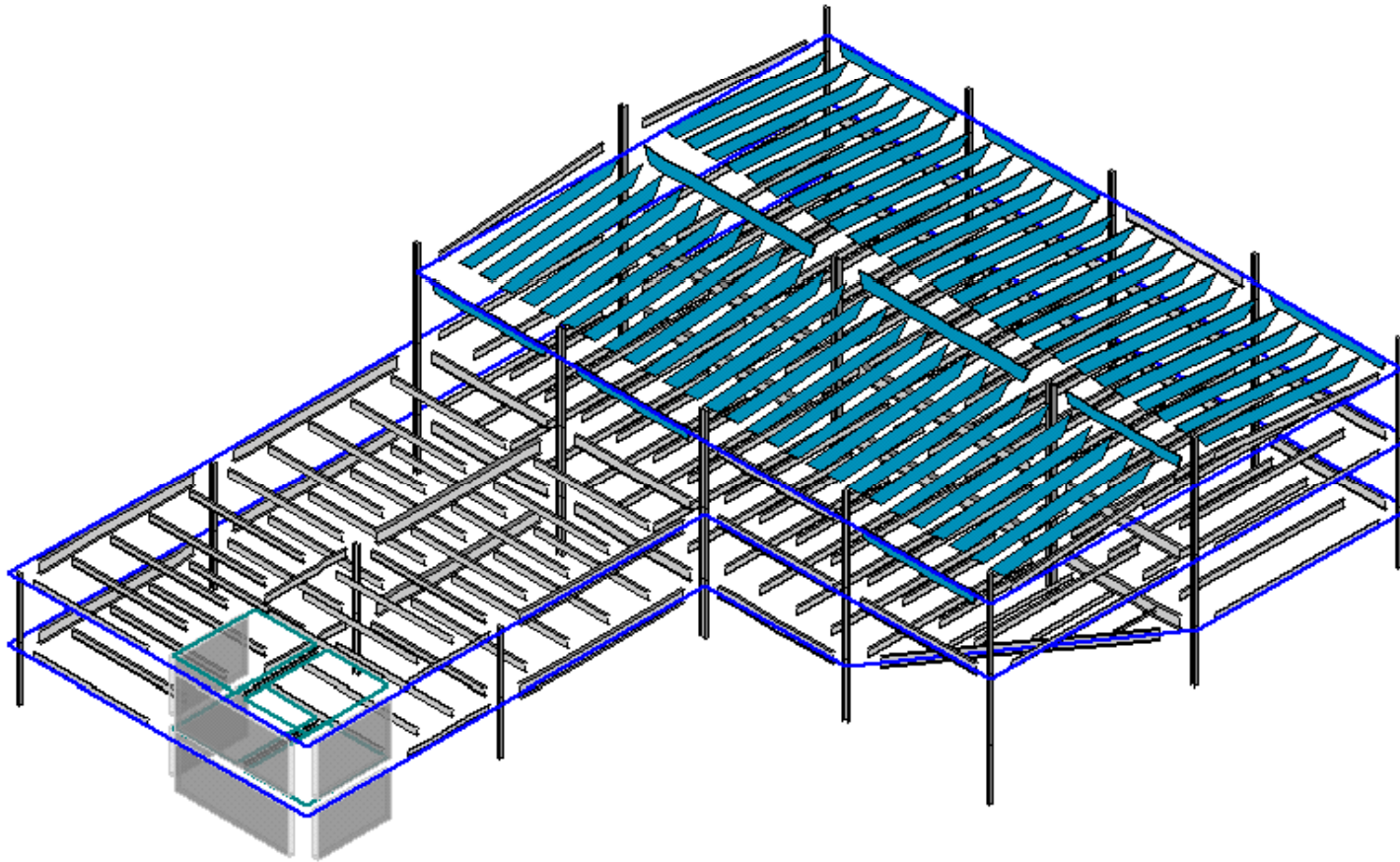


Based on Acceleration

Based on Frequency



# Let's build a Commercial Building Model



# Final Things to Consider About RISAFloor

- **Import and Export Geometry**

- ✓ **Revit Structure**

- RISA has the most comprehensive link with Revit

- \*\* New Webinar\*\* May 27, 2010

- Complete Integration between RISA and Autodesk Revit Structure

- ✓ **DXF**

- **One Model for both Gravity and Lateral Design**

- ✓ **You can also design your foundation with RISAFoundation**

- \*\* New Webinar\*\* August 11, 2010

- Comprehensive Design of Shallow Foundations with RISAFoundation

# 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.risatech.com](http://www.risatech.com)

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

**THANK YOU!**

