WOOD LIGHT FRAMING DESIGN

BEARING WALLS AND SHEAR WALLS

The modeling of a light framing wall or a shearwall is possible with the wall creation tools. Those tools are used to create the wall surfaces at first, than the wall attributes can be defined and finally the geometric elements of the wall can be generated. The wall generator creates the members and load surfaces of the wall and assigns the properties to these elements.





Wall openings can be created with the **Opening Library** and are available for a group of walls. The openings are then accessible when editing the wall attributes but it is also possible to create the openings when needed directly in the **Wall Attributes** menu, since the **Opening Library** can be accessed directly from the **Wall Attributes** menu.



WOOD FLOOR DIAPHRAGMS

In the **Diaphragm** tab of the **Surface Attributes** menu, a plate section must be created and selected in the first place. Two types of plate section can be chosen in order to create the wood diaphragm, which are the **Wood Panels Type** or the **Diagonal Lumbers Type**.

Plate Sections			🔺 📐	Plate Sections		
ID = Par Type =	ID = 1 Parameters Type = Vood Panels		Table	ID = Pa Type =	2 rameters Diagonal Lumbers	Table
Standard Panel = Din Thickness (t) =	Select nensions 12	mm		Dir Thickness (t) = Pr	nensions 38 operties	mm
Pri Shear Stiffness (Bv) = Poisson Ratio (v) =	operties 11000 0.17 713	kN/m		Poisson Ratio (ν) = Voluminal Mass (ρ) = Thermal Expansion Coefficient =	0.4 420 kg 1E-006	/m.3 1/C
Thermal Expansion Coefficient =	6.1E-006	1/C	<u>O</u> K <u>C</u> ancel <u>H</u> elp	058-12MM-2E16) Dia	1-SPE-Com /	<u>O</u> K Cancel Help

Surface Attributes		
General Diaphragm		
ID: 4		
Diaphrag	m Parameters	
🗸 Change Section Shape 🚺 📿	Enable Diaphragm	
4 - PLY-15.5MM-5P (DFP)	Transfer Diaphragm Forces to Surrounding	
Consider Self Weight	Wood Diaphragm Attributes	
Thickness Modification [Self Weight]		

When the plate section is created, the diaphragm can be activated with the check box **Enable Diaphragm**, then the button **Wood Diaphragm Attributes** allows to access to the attributes menu specific to wood diaphragms.

Effective Length (L _{eff,x}) = Automatic Effective Width (L _{eff,y}) = Automatic		
Effective Width (L _{eff.y}) = Automatic	mn	m
Examina	mn	m
Framing		
Top Flange Width (B) = 38	mn	m
Blocking = No	1	~
Species factor (J _{sp}) = 0.8	0	D
Service conditions (K _S) = Dry Conditions	1	~
Fabrication conditions (KsF) = Seasoned Conditions	1	~
Sheathing		
Type = Wood Panels		
Thickness (t) = 15.5	mn	m
Continuous Panel Joints =		~
Nail Pattern		
Nail Diameter = 3.25	mm 🛛	
Nail Spacing (Edges) = 150	mm]	

JOISTS VIBRATION AND DESIGN

Standard I wood joists libraries (Boise, iLevel, LP SolidStart, Nordic, generic) and open web wood joists (generic). The system also allows the definition of custom joists when the properties are known.

Surface Attributes		🔺 🔀						
General Dianhrann								
	Change Solid Display Lolor							
Name:	Jefault 🕑							
Load Transfe								
Change the Type of Surface: Joist	Distribution							
Joists	Calculated Values							
Change Initial Step (D1)	0 mm 1875.000							
Change Inter. Steps (D2)	0 mm 1875.000							
Change Final Step (D 3)	0 mm 1875.000							
Change Nb. Joists (N)	11 11							
Change Angle (A)	90 deg							
Change Joists	21 - P189 2100 406 V							
Consider Self Weight of J	oists							
Applied to Bottom Flange	0							
Change Bearing Length	0 mm							
Deflection Criterions	Relative Absolute							
Dead Loads	L/ 0 0 mm							
✓ Live Loads	L/ 0 0 mm							
V Total Loads	L/ 0 0 mm							
Vind Loads	L/ 0 0 mm							
	Wood Floor Attributes							
Surface								
Total Area: 1.575E+008 mm.2	Total Weight 0 kg							
Joint I: 46	Joint K: 51 +							
Joint J: 52	Joint L: 45	ncel						
		elp						

od Joists										
ID = 2 Type = P	1 Iain Web		v			Ta				
Dimensions			Properties							
Height (H)	406	mm	Weight per Unit Length (W)	0.0498832	kN/m					
Flanges Width (bf)	88.9	mm	Bending Stiffness (El)	2992	kN-m.2					
Flanges Thickness (tf)	38.1	mm	Shear Deformation Coefficient (K)	34550	kN					
Diagonals or Web Thickness (tw)	9.525	mm	Bending Resistance (Mr)	21.2	kN-m					
			Shear Resistance (Vr)	12.88	kN					
			Bearing (Short suppor	ts at ends)						
			Bearing Length (LE _{RS})	45	mm					
			Resistance w/o stiffeners (RE _{RS})	8.675	kN					
Toggle Preview M	ode		Resistance w/ stiffeners (RE _{RSS})	8.675	kN					
BIO0 0100 40	<u>, , , , , , , , , , , , , , , , , , , </u>	-	Bearing (Long supports at ends)							
P189 2100 40	6		Bearing Length (LE _{RL})	102	mm					
700.97			Resistance w/o stiffeners (RE _{RL})	10.41	kN					
t in i	ť		Resistance w/ stiffeners (RE _{RLS})	10.41	kN					
	ť		Bearing (Short intermediate supports)							
	5		Bearing Length (LI _{RS})	89	mm					
	×		Resistance w/o stiffeners (RI _{RS})	18.15	kN					
			Resistance w/ stiffeners (RI _{RSS})	18.15	kN					
ģ 🔶	z		Bearing (Long intermedia	ate supports)						
Ì			Bearing Length (LI _{RL})	140	mm					
			Resistance w/o stiffeners (RI _{RL})	19.06	kN					
9.5	3		Resistance w/ stiffeners (RI _{RLS})	20.875	kN					
						<u>O</u> l				
>\PI89 2100 406						<u>H</u> e				

The service limit states applicable to floor systems with trusses (loading surfaces with load transferred by trusses) takes into account the calculation rules as defined by the report Development of design procedures for vibration controlled spans using engineered wood members, 1997, from the Canadian Construction Materials Centre (CCMC). This report allows to define an effective composite bending stiffness (Eleff) and a distribution factor (DF) for loads distribution form a truss to another.

To calculate the vibration limit state of the joists, it is necessary to define the **Wood Floor Attributes** as shown below. In this example, the gypsum ceiling and the strappings are not considered.

		Floor Frame		
✓	Joist =	4 - Custom	✓ ▶	
	El _{joist} =	1104	kN-m.2	
	K =	33300	kN	
		Subfloor		
	Subfloor Anchorage =	Glue and Nails	~	
~	Panel =	OSB 15.8 Perso		
	Thickness (t _s) =	15.8	mm	
	Bending Stiffness (El _{sp0}) =	0.00261	kN-m.2/mm	
	Axial Stiffness (EA _{sp0}) =	66	kN/mm	
	Bending Stiffness (El _{sp90}) =	0.0001	kN-m.2/mm	
	Axial Stiffness (EA _{sp90}) =	66.7	kN/mm	
		Gypsum Ceiling		
✓	Thickness (tg) =	0	mm 🕨	
	Bending Stiffness (Elgp) =	0	kN-m.2/mm	
	Axial Stiffness (EAgp) =	0	kN/mm	
		Strapping		
	Spacing (s _{st}) =	0	mm	
~	Thickness (t _{st}) =	0	mm 🕨	
	Width (w _{st}) =	0	mm	<u>0</u> K
	Elastic Modulus (E _{05st}) =	0	MPa	

In the **Wood Design** numerical results, click on the **w** button in order to display the possible choices and select **Joists Vibration**.

Ħ	Jois	ts Vibra	ition													
File	⊆o	mmands	Columns													
	0 3	Surface ID	Span mm	Spacing mm	El _{Joist} kN-m.2	El _{Joist} Apparent (kN-m.2)	El _{eff} Composite (kN-m.2)	Stif joist Kj (kN/m)	Stif components ΣK _{bi} (kN/m)	Factor DF	A _{vibration} under 1 kN (mm)	Allowed $\Delta_{vibration}$ (mm)	SLS Vibration	Notes		
	ĺ	1	4880.0000	406.0001	1104.0000	973.8489	1341.9725	11.5474	111.3366	0.4317	0.7789	1.0189	0.7644		1	
		2	4880.0000	406.0001	1104.0000	973.8489	1341.9725	11.5474	111.3365	0.4317	0.7789	1.0189	0.7644			
		3	4880.0000	406.0001	1104.0000	973.8489	1341.9725	11.5474	111.3365	0.4317	0.7789	1.0189	0.7644			
																<u>C</u> lose <u>H</u> elp

In the **Wood Design** numerical results, click on the **w** button in order to display the possible choices and select **Joists Resistance**.

i I	ists Resi	stance																						
File	<u>C</u> ommands	Columns																						
4	Q @ ≈ Q & ഈ 目 □ 桷 @ ♀ ♥ 田 尋																							
0	Surface ID	Comb ID	Avibration under 1 kN (mm)	Allowed Avibration (mm)	∆ _y mm	Deflection Criterion	∆ _{Max} mm	Кр	Bearing Length (mm)	Bearing Stiffeners	Qfy kN	Qry kN	∀fy kN	Vry kN	Mf× kN-m	Mr× kN-m	SLS Vibration	SLS Deflec joist	SLS Deflec flanges	ULS Qf/Qr	ULS Vfy∕Vry	ULS Mf/Mr	SLS-ULS max	Notes
	1	1 - D+L	0.7789	1.0189	17.9233			1.0000	89.0000	No	5.9067	10.0143	5.9067	10.0200	7.2062	11.3200	0.7644			0.5898	0.5895	0.6366	0.7644	
	1	2 - S: L	0.7789	1.0189	7.2144	Live	13.5556	1.0000	89.0000	No	2.3775	10.0143	2.3775	10.0200	2.9006	11.3200	0.7644	0.5322		0.2374	0.2373	0.2562	0.7644	
	1	3 - S: D+L	0.7789	1.0189	12.8958	Total	20.3333	1.0000	89.0000	No	4.2498	10.0143	4.2498	10.0200	5.1848	11.3200	0.7644	0.6342		0.4244	0.4241	0.4580	0.7644	
	1	2 1 - D+L	0.7789	1.0189	24.9239			1.0000	89.0000	No	5.9944	10.0143	5.9944	10.0200	11.0859	11.3200	0.7644			0.5986	0.5982	0.9793	0.9793	
	1	2 - S: L	0.7789	1.0189	11.8814	Live	13.5556	1.0000	89.0000	No	2.4360	10.0143	2.4360	10.0200	5.4871	11.3200	0.7644	0.8765		0.2433	0.2431	0.4847	0.8765	
	1	2 3 - S: D+L	0.7789	1.0189	17.5628	Total	20.3333	1.0000	89.0000	No	4.3083	10.0143	4.3083	10.0200	7.7713	11.3200	0.7644	0.8637		0.4302	0.4300	0.6865	0.8637	
	3	3 1 - D+L	0.7789	1.0189	11.0958			1.0000	89.0000	No	9.0868	10.0143	9.0868	10.0200	4.3854	11.3200	0.7644			0.9074	0.9069	0.3874	0.9074	
	3	3 2 - S: L	0.7789	1.0189	2.7391	Live	13.5556	1.0000	89.0000	No	4.4976	10.0143	4.4976	10.0200	1.5519	11.3200	0.7644	0.2021		0.4491	0.4489	0.1371	0.7644	
	3	3 - S: D+L	0.7789	1.0189	8.3329	Total	20.3333	1.0000	89.0000	No	6.3699	10.0143	6.3699	10.0200	3.2891	11.3200	0.7644	0.4098		0.6361	0.6357	0.2906	0.7644	
-																								

DESIGN OF TRUSSES BASED ON TPIC-2011

Some particular factors for light metal plate connected wood trusses elements can be taken into account in resistance and limit states calculations. These factors are then calculated according to the Truss Plate Institute of Canada (TPIC) rules which are described in the report Truss design procedures and specifications for light metal plate connected wood trusses, Limit States Design, 2011.



SAFI QUALITY SOFTWARE INC. ALL RIGHTS RESERVED.