

2 Sizer: Beam Mode Tutorial 2 – Determine Capacity of a pre-determined Beam Size (Canadian)

2.1 Software Version and Standard

This tutorial was completed using WoodWorks® Canada 2020, and CSA O86-19.

2.2 Introduction

Click [here](#) to download the Sizer file (.wwb) created from going through this tutorial.

2.3 Defining Beam Parameters

1. Click on the **New Beam Mode File** button on the toolbar.
2. Specify **Span** as **3 (m)**.
3. Click on **Add**.
4. Specify **Full span** from the **Span type** drop-down list.
5. In the **Pitch** field enter a value of **4**.
6. Specify **600 (mm)** from the **Joist spacing*** drop-down list.
7. Specify **Roof Joist** from the **Type** drop-down list.
8. Specify **Lumber** from the **Material** drop-down list.
9. Specify **S-P-F** from the **Species** drop-down list.
10. Specify **No.1/No.2** from the **Grade** drop-down list.
11. Specify **38 (mm)** from the **Width (b)** drop-down list.
12. Specify **184 (mm)** from the **Depth (d)** drop-down list.

Description: Tutorial 2

Spans: 5 m (selected), 5 m (list item)

Cantilevers: None

Type: Roof Joist

Pitch: 4 /12

Material: Lumber

Oblique angle: 0 deg.

Species: S-P-F

Grade: No.1/No.2

Joist spacing*: 600 mm

Width (b): 38 mm to 38 mm

Load sharing: Case 2

Depth (d): 184 mm to 184 mm

Span type: Full span

Vibration...

* You can select these items or enter your own value

Figure 1: Sizer: Beam Mode – Tutorial 2 – Defining Length and Materials of Beam

13. Under the **Supports for bearing and notch design** section, select **All supports** from the **Applies to** drop-down list.
14. Specify **Wall** from the **Type** drop-down list.
15. Specify **Timber** from the **Material** drop-down list.
16. Specify **S-P-F** from the **Species** drop-down list.
17. Specify **No.1/No.2** from the **Grade** drop-down list.
18. Specify **89 (mm)** as the **Main Lb*** under the **Bearing length*** section.
19. Specify **Same as joist** as the **Main Lb*** and **Point load*** under the **Bearing width*** section.

Supports for bearing and notch design

Applies to: All supports

Type: Wall

Material: Lumber

Species: S-P-F

Grade: No.1/No.2

☐ Bearing where support ends or is highly stressed

For unknown bearing length...

☒ Use exact minimum

Round: 1/2"

☐ minimum to closest

☐ From list of bearing length choices

End supports: round minimum; interior: from bearing length choices

Bearing length*

Main Lb*: 89

Point load*: = Lb

Notch at: None

Notch length: mm

☐ Notch length = bearing length

☒ Laterally supported at support

Bearing width*

Same as joist mm

Same as joist mm

Notch depth: mm

Figure 2: Sizer: Beam Mode – Tutorial 2 – Specifying Bearing Length Details

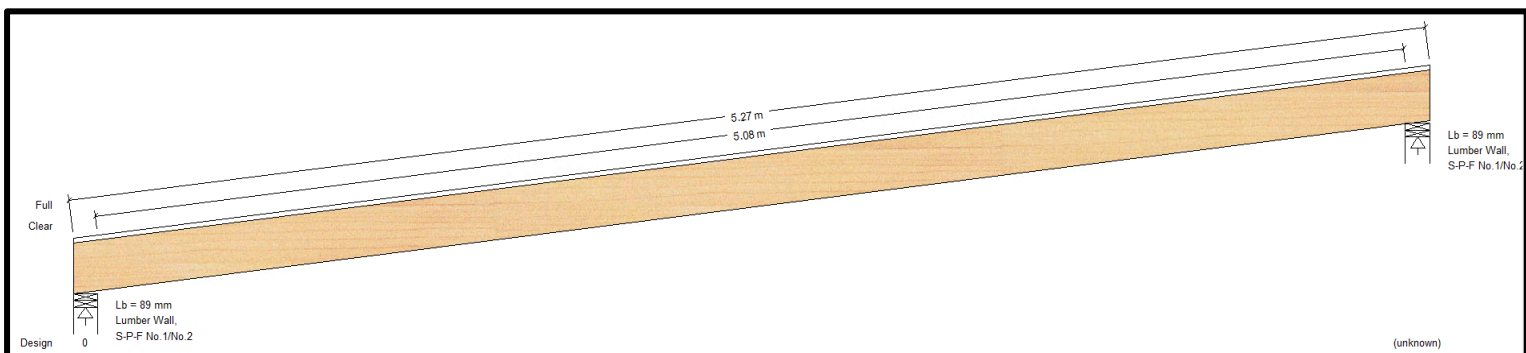


Figure 3: Sizer: Beam Mode – Tutorial 2 – Beam Diagram

2.4 Loading the Beam

1. Click on the **Loads View** button on the toolbar.
2. Select **Dead** from the **Type** drop-down list.
3. Specify **Full Uniform Area** from the **Distribution** drop-down list.
4. In the **Magnitude** field enter a value of **0.5 (kN/m²)**.
5. Click **Add**.
6. Select **Snow** from the **Type** drop-down list.
7. Specify **Full Uniform Area** from the **Distribution** drop-down list.
8. In the **Magnitude** field enter a value of **2.0 (kN/m²)**.
9. Click **Add**.

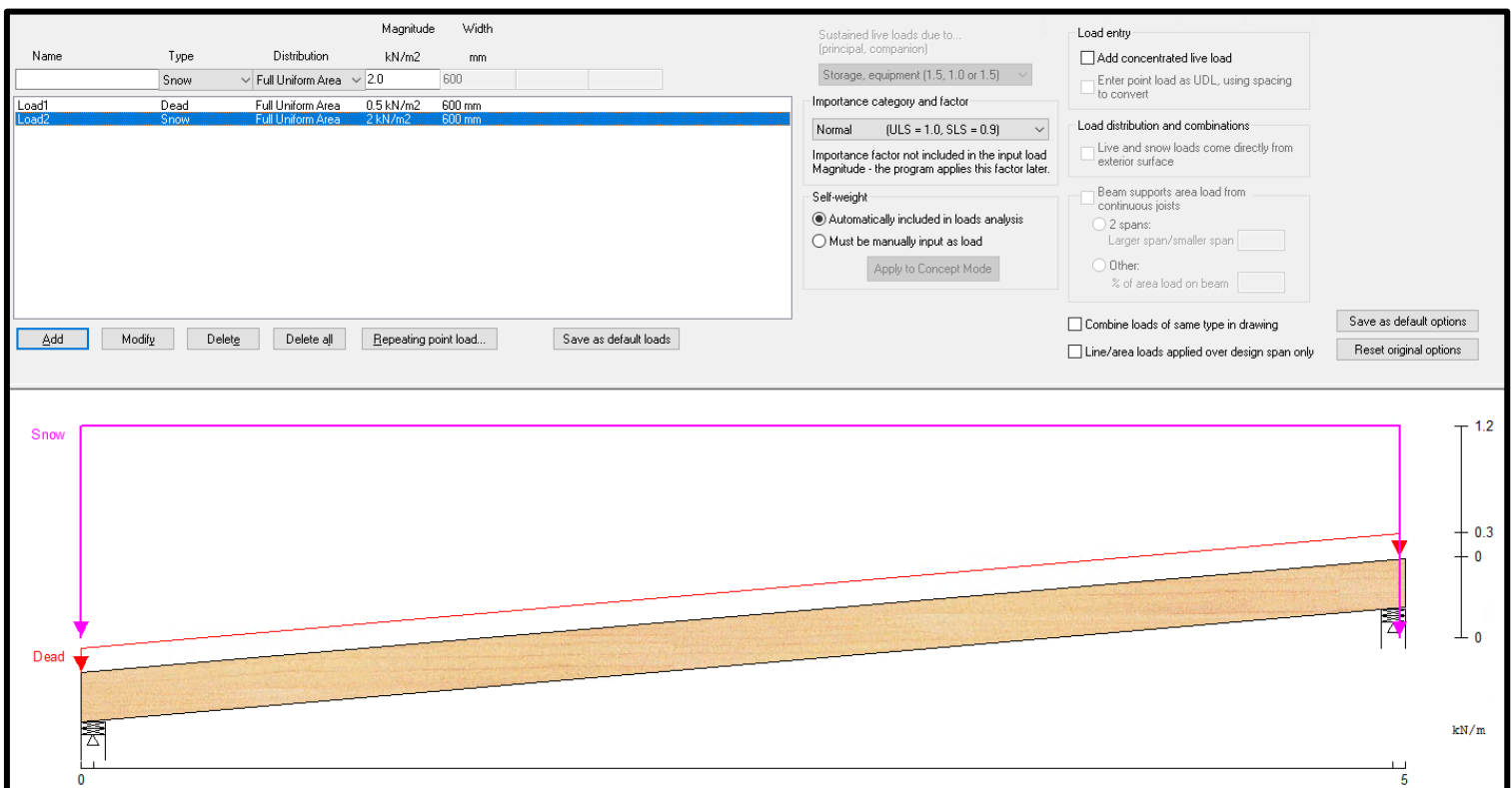


Figure 4: Sizer: Beam Mode – Tutorial 2 – Loaded Beam

2.5 Designing the Beam

1. Click the **Run** button on the toolbar. *Sizer* automatically designs the member.

Note: *Sizer* will prompt you to save the project file.

Sizer will complete the design, and will automatically generate the **Design Summary**, **Analysis Results**, and **Analysis Diagrams**. These buttons are displayed on the toolbar.



Figure 5: *Sizer: Beam Mode – Tutorial 2 – Beam Design*

2.6 View the Design Check Calculation Sheet

The **Design Check Calculation Sheet** will appear and summarizes the loads, maximum reactions, bearing resistances, bearing lengths, force vs. resistance and deflection information, additional data and most importantly if the section passes or fails the design.

Note: The selected section **fails in bending and deflection** as it cannot resist the applied load.

Click [here](#) to download a PDF of the design check calculation sheet.

Click [here](#) to download a PDF of the analysis results.

Click [here](#) to download a PDF of the analysis diagrams.

Tutorial 2
Lumber, S-P-F, No.1/No.2, 38x184 mm
Supports: All - Lumber Wall, S-P-F No.1/No.2
Roof joist spaced at 600 mm c/c; Total length: 5.332 m; Clear span(horz): 4.8 m; Volume = 0.037 m³; Pitch: 4/12
Load sharing: Case 2; Lateral support: top = continuous, bottom = at supports;

This section FAILS the design check
WARNING: This section violates the following design criteria: Bending and deflection

Force vs. Resistance and Deflection using CSA O86-19:

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	Vf @d = 4.74	Vr = 10.57	kN	Vf/Vr = 0.45
Moment(+)	Mf = 6.58	Mr = 3.83	kN-m	Mf/Mr = 1.72
Perm. Defl'n	14.9 = L/344	14.2 = L/360	mm	1.05
Live Defl'n	46.3 = L/110	21.3 = L/240	mm	2.17
Total Defl'n	61.2 = L/83	28.4 = L/180	mm	2.15

Additional Data:

FACTORS:	f/E (MPa)	KD	KH	KZ	KL	KT	KS	KN	LC#
Fv	1.5	1.00	1.40	1.200	-	1.00	1.00	-	#2
Fb+	11.8	1.00	1.40	1.200	1.000	1.00	1.00	-	#2
Fcp	5.3	-	-	1.000	-	1.00	1.00	-	#-
Es	9500	-	-	-	-	1.00	1.00	-	#2

CRITICAL LOAD COMBINATIONS:

Shear : LC #2 = 1.25D + (1.0)1.5S

Moment(+) : LC #2 = 1.25D + (1.0)1.5S

Deflection: LC #1 = 1.0D (permanent)

LC #2 = 1.0D + (0.9)1.0S (live)

LC #2 = 1.0D + (0.9)1.0S (total)

Bearing : Support 1 - LC #2 = 1.25D + (1.0)1.5S

Support 2 - LC #2 = 1.25D + (1.0)1.5S

Load Types: D=dead S=snow

All Load Combinations (LCs) are listed in the Analysis output

CALCULATIONS:

EI = 187e06 kN-mm²

"Live" deflection is due to all non-dead loads (live, wind, snow...)

Bearing: Factored compressive resistance at an angle to grain (Nr) calculated for each support as per O86 6.5.7

Figure 6: Sizer: Beam Mode – Tutorial 2 – Design Check Calculation Sheet (Fail)

2.7 Modify Beam Parameters to Ensure a Suitable Section

1. Increase **Depth (d)** to **286 (mm)**.

Tutorial 2									
Lumber, S-P-F, No.1/No.2, 38x286 mm									
Supports: All - Lumber Wall, S-P-F No.1/No.2									
Roof joist spaced at 600 mm c/c; Total length: 5.366 m; Clear span(horz): 4.8 m; Volume = 0.058 m ³ ; Pitch: 4/12									
Load sharing: Case 2: Lateral support: top = continuous, bottom = at supports;									
This section PASSES the design code check.									
Force vs. Resistance and Deflection using CSA O86-19:									
Criterion	Analysis Value	Design Value	Unit	Analysis/Design					
Shear	Vf @d = 4.58	Vr = 13.69	kN	Vf/Vr = 0.33					
Moment (+)	Mf = 6.64	Mr = 7.70	kN-m	Mf/Mr = 0.86					
Perm. Defl'n	4.1 = < L/999	14.2 = L/360	mm	0.29					
Live Defl'n	12.3 = L/414	21.3 = L/240	mm	0.58					
Total Defl'n	16.5 = L/310	28.4 = L/180	mm	0.58					
Additional Data:									
FACTORS:	f/E (MPa)	KD	KH	KZ	KL	KT	KS	KN	LC#
Fv	1.5	1.00	1.40	1.000	-	1.00	1.00	-	#2
Fb+	11.8	1.00	1.40	1.000	1.000	1.00	1.00	-	#2
Fcp	5.3	-	-	1.000	-	1.00	1.00	-	#-
Es	9500	-	-	-	-	1.00	1.00	-	#2
CRITICAL LOAD COMBINATIONS:									
Shear : LC #2 = 1.25D + (1.0)1.5S									
Moment (+) : LC #2 = 1.25D + (1.0)1.5S									
Deflection: LC #1 = 1.0D (permanent)									
LC #2 = 1.0D + (0.9)1.0S (live)									
LC #2 = 1.0D + (0.9)1.0S (total)									
Bearing : Support 1 - LC #2 = 1.25D + (1.0)1.5S									
Support 2 - LC #2 = 1.25D + (1.0)1.5S									
Load Types: D=dead S=snow									
All Load Combinations (LCs) are listed in the Analysis output									
CALCULATIONS:									
EI = 704e06 kN-mm ²									
"Live" deflection is due to all non-dead loads (live, wind, snow...)									
Bearing: Factored compressive resistance at an angle to grain (Nr) calculated for each support as per O86 6.5.7									

Figure 7: Sizer: Beam Mode – Tutorial 2 – Design Check Calculation Sheet (Alternative 1)