

REVIT 2012
Canam Parametric Families
Joists

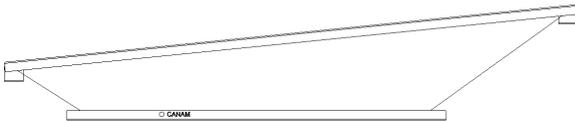
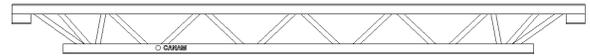


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Disclaimer

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Introduction

The purpose of this project is to provide a series of Canam Parametric Revit families to help Architects and Engineers who want to specify our Joist products in their Revit Models. The release chosen for this development is Revit 2012.

For the first release of the Canam Parametric Joist Revit families, we have made available the most commonly used Joist Shape fabricated by Canam.

Here is the list of the Canam Parametric Joists available for Revit 2012:

Canam Joist – Standard Shape

- Canadian Imperial and Canadian Metric
- SJI Joists (K Series, KCS Series, KSP, LH Series, DLH Series & LHSP)

Canam Joist – Non Standard Shape

- Joist-1 Slope, 2 Slopes, 3 Slopes & 4 Slopes.

Canam Joist – Special Shape:

- Barrel Shape, Bowstring Shape & Scissor Shape.

1. General overview of Canam Parametric Joists

We have 2 kinds of Canam Parametric Joists. The first kind, we call them "Conceptual Joists" and the second kind, we call them "Conceptual Joists with webs".

For the "Conceptual Joists", the joist webs have been modeled as a halftone volume that covers the entire web area for all the available joist shapes.

For the "Conceptual Joists with webs", our Canam Parametric Joists reflect a more realistic three-dimensional representation of the Joist Panels (webs) but the positioning of the diagonal & vertical webs remain approximate. For this reason, the "Conceptual Joists with webs" also include a transparent shape that covers the entire web area. Until now, only the Canam Joist-Standard Shape is available with webs.

1.1 Joist Shape (Envelope)

As you can see from the list of available Canam Parametric Joists, various joist shapes are available. Depending on the Canam Parametric Joists Revit family you select, the shape of the joist varies.

Please refer to the topic "**2 - Canam Parametric Joist Shapes**" for a short description of the different Joist Shapes.

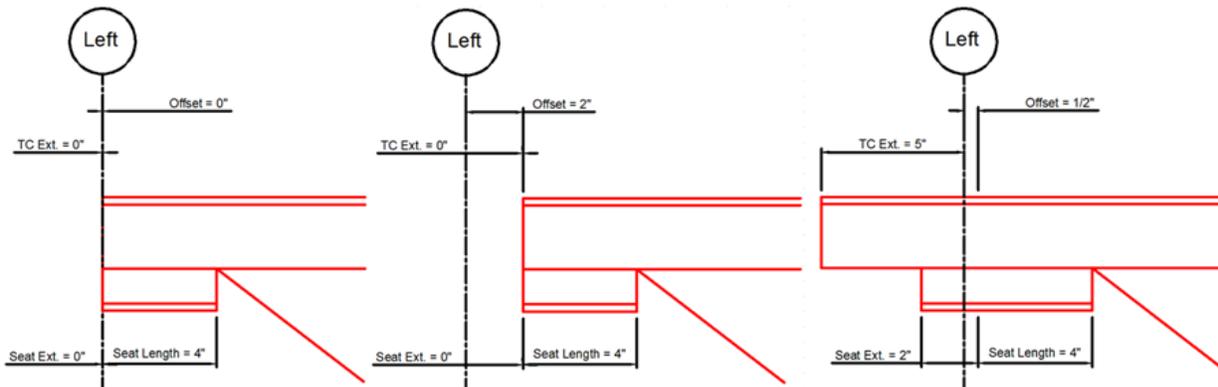
Combine with the Family Joist Shape, some customizable parameters like the Joist Depth, the Joist end conditions (Seat and TC & BC Extensions), etc., that are used to define what we call the "Envelope" of the joist. Some of the Joist Shapes also have independent Start Depth and End Depth parameters that allow controlling the slope of the bottom chord with respect to the Top Chord.

1.1.1 Common Parameters

Most of the common parameters that have an effect on the Joist Envelope are modeled as instance parameters.

1.1.1.1 Instance Parameters

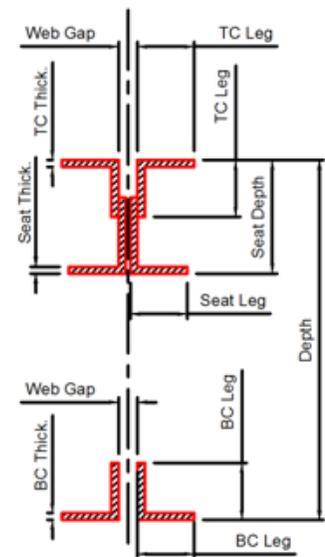
Instance parameters allow the user a better control over the different parameters as they can be modified independently for each instance of the joist.



The Start Offset and the End Offset parameters are used to position the joist ends from the axis. The Joist Seat position is calculated according to the Offset value. The Top Chord position is also calculated according to the Offset value but only when the TC Extension value is set to zero. If the TC Extension value is not equal to zero, the Top Chord Extension is calculated from the axis.

Most of the common parameters will automatically return a default suggested value depending on the joist length when this parameter is set to zero. Ex: Seat Depth, Seat Length, Web Gap, etc. If the user inputs a custom value in a parameter that use suggested values, the user custom value will overwrite the suggested value.

Please refer to the topic "**1.1.3 - Automatic Calculated Values Based on Length**" to have the values that will apply for these parameters when the parameters value is set to zero.



The instance parameters are located in the instance properties palette. Here is an example of the parameters available in the instance properties palette when a standard joist is selected in a Revit model >>>

The Non Standard & Special Shape families have more parameters that allow the control of their specific shape.

You can modify the instance parameters of one or multiple selected joists even if they are not of the same Canam Parametric Joist Family. To modify an instance parameter, click on the parameter value and input the new value.

Important: Please take the time to read the Disclaimer that is located in the Identity Data Parameter Group of every instance of Canam Parametric object.

To display the Disclaimer, simply position your cursor over it.

Construction	
Start Tie	<input type="checkbox"/>
Start TC Extension	0' 0"
Start Seat Rotation	0.000°
Start Seat Length	0' 0"
Start Seat Extension	0' 0"
Start Seat Depth	0' 0"
Start Offset	0' 0 1/4"
Start Elevation	0' 0"
Start BC Extension	0' 6"
End Tie	<input type="checkbox"/>
End TC Extension	0' 0"
End Seat Rotation	0.000°
End Seat Length	0' 0"
End Seat Extension	0' 0"
End Seat Depth	0' 0"
End Offset	0' 0 1/4"
End Elevation	0' 0"
End BC Extension	0' 6"
Dimensions	
TC Thickness	0' 0"
TC Leg	0' 0"
Start Seat Thickness	0' 0"
Start Seat Leg	0' 0"
Length	50' 0"
End Seat Thickness	0' 0"
End Seat Leg	0' 0"
BC Thickness	0' 0"
BC Leg	0' 0"
Volume	14.55 CF
Identity Data	
Disclaimer	These tools are for your inf...
Comments	
Mark	

1.1.1.2 Standard Joist Families Type Parameters

The type parameters are available in the Type Properties Dialog.

You can access the Type Properties Dialog by clicking on the icon .

The modification of a Type Parameter value will affect all the instances of the same type created in your model.

Usually, for Standard Joist Families, you should not have to modify the Type Parameters values because these values are coming from a Type Catalog file. In fact, every Canam Joist Parametric "Standard Shape" families are provided with a Type Catalog (.txt) file. This txt file contains the Type name (ex: Joist 8", Joist 10", etc., for Canadian Joist or ex: 18LH03, 18LH04, etc., for American LH Series Joist, etc.) and some specific values associated to every specific type (ex: Depth, Min Length, Max Length, etc.)

Revit uses this Type Catalog file when you load the family in your model to generate the different Joist Type using the Name and the values specified in the txt file. Here is an example of the Type Parameters available in the Type Properties Dialog for a Standard Joist 24" >>>

Parameter	Value
Dimensions	
Web Gap	0' 0"
MinLength	16' 0"
MinLengthEcono	17' 0"
MaxLength	59' 0"
MaxLengthEcono	41' 0"
Depth	2' 0"

As you can notice, the Standard Joist families also have some Length validation features that are based on the Joist Depth. The Min & Max Length validation will restrict the standard joist shape creation depending on the Joist Depth vs. Length.

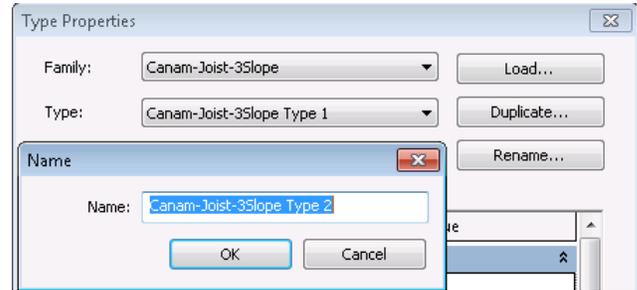
Please review the topic "**2.1 - Canam-Joist-Standard**" for more details regarding the Length Validation.

1.1.1.3 Non Standard and Special Shape Families Parameters

Type Parameters

The Non Standard Shape and Special Shape families have different Type Parameters compared to the Standard Joist families (ex: Start Depth & End Depth).

Since there are no Type Catalog files for the Non Standard and Special Shape families, you will have to create different Types. You can create a new Type, from the Type Properties Dialog by clicking on the Duplicate button.



There is no length validation for the Non Standard Shape and Special Shape families so this is why they do not have Min & Max Length parameters.

Instance Parameters

Extra Instance Parameters are available depending on the Non Standard Shape or Special Shape family you have selected.

Ex: "TC Radius" parameter (to control the Top Chord radius for the Barrel & Bowstring Shape Joist), "Ridge Depth" & "Ridge Offset" parameters (to control the Ridges of the 2, 3 & 4 slope joists), etc.

1.1.1.4 Here is a Brief Description of the Common Parameters:

Parameter Name	Description
Start/End Elevation:	Special parameter that is used in many of our formulas when joist is in sloped condition. This Special parameter is very important since it is used in the calculation of many of our instance parameters formula: TC Extension, Joist Offset, Seat Depth and Seat Rotation, BC Tie Joist and in the Ridge Offset calculation (for 2, 3 & 4 Slope joist shapes). (See 1.1.2 Sloped Joist Condition)
Depth, Start/End Depth:	Joist depth at start & end location. Depth is taken at axis location. (See 1.1.2.1 Sloped BC Condition)
Start/End Tie:	Allows the user to extend the bottom chord along a vertical projection of the joist insertion point.
Start/End Offset:	Move the reference point from which the seat and the top chord extension reference is taken. The Offset always moves towards the inside of the joist from the left or right axis.
Start/End TC Extension:	Extension length of the top chord with respect to the Start/End Offset.
Start/End BC Extension:	Extension length of the bottom chord with respect to the first panel reference plane
Start/End Seat Length:	Length of the seat from the offset reference plane towards the inside of the joist
Start/End Seat Rotation:	This parameter allows the user to manually rotate the seat.
Start/End Seat Extension:	Extension length of the seat with respect to the Start/End Offset
Start/End Seat Depth:	When Seat Depth = 0", suggested values for seat depths will be used based on joist span. When Seat Depth > 0", user-defined values will be used.
Start/End Seat Thickness:	Thickness of seat angles
TC Thickness:	Thickness of the top chord
BC Thickness:	Thickness of the bottom chord
Web Gab:	Distance between the angles of the top chord
Start/End Seat Leg:	Length of the seat leg. If 0", suggested value will be used based on joist span
TC Leg:	Length of the top chord leg. If 0", suggested value will be used based on joist span
BC Leg:	Length of the bottom chord leg. If 0", suggested value will be used based on joist span
Ridge Offset:	If applicable, distance of the ridge of the top chord, measured from the start point. If the Ridge Offset is set to 0", default value will be used (ex: centered for the 2 slopes).
Ridge Depth:	Joist Depth at the ridge, with according to the Bottom Chord location.

1.1.1.5 Shared Parameters

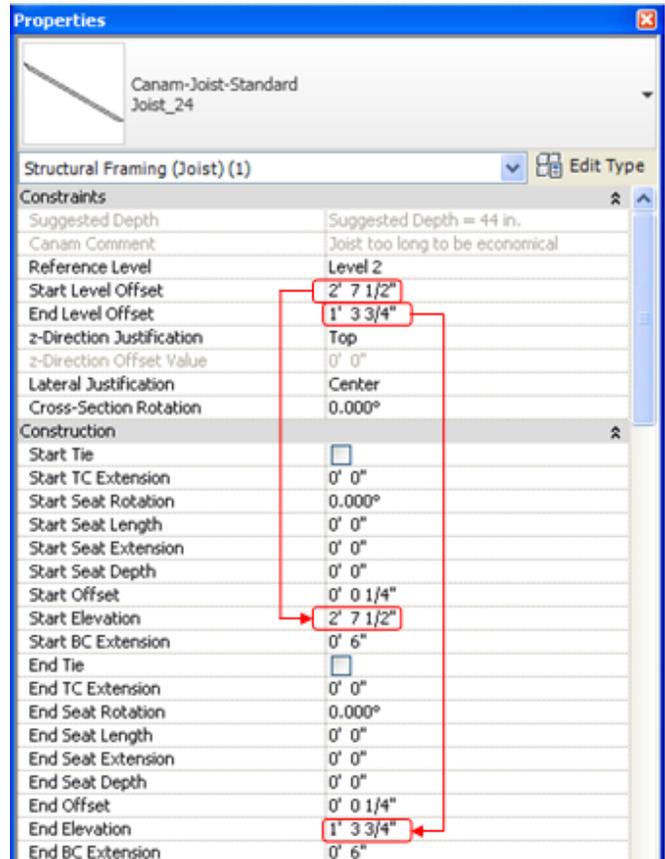
In our Canam Parametric Joists Families, most of the Instance Parameters have been defined as "Shared parameters". This provide you the ability to switch an existing joist from one Parametric Joist Family to another (ex: from a 2 Slopes to a Scissor or a Bowstring Shape) keeping all the custom values that have been input by the user in an instance parameter (ex: Start TC Extension, Seat Depth, etc.), these values will be kept and transferred in the new joist instance. The Shared Parameters also give the possibility to update these parameters in batch (multiple selections) even if the selected joists are created using different Parametric Joist Families or if they have different Types of the same family.

1.1.2 Sloped Joist Condition

Most of the parameter calculated values are given linearly on the theoretical line that runs between the start point and end point that define the joist. When the joist is in a sloped condition, the start point and the end point are not at the same elevation.

This situation will cause some of the length parameters used in our parametric joist families to return their value in a plan that is not parallel to the ground. This can become a complex task for the users to perform all these calculations to obtain the accurate length expected.

The solution to this situation is simply to copy/paste the Revit Built-in "Start/End Level Offset" parameter value in our "Start/End Elevation" parameter. When these values are accurate and reflect the real joist elevations condition, the joist parameter formulas will adjust the length parameters calculation accordingly. This will also calculate the "Seat Rotation" automatically and will make the seat bearing to be parallel to the ground if the Seat Rotation parameters are set to zero.



The Start/End Elevation parameters will affect the following parameters: TC Extension, Joist Offset, Seat Depth and Seat Rotation, BC Tie Joist and the Ridge Offset calculation (for 2, 3 & 4 Slope joist shapes).

1.1.2.1 Sloped BC Condition

The Joist Depth is always calculated perpendicular to the Bottom Chord. For some joist shapes that support Start Depth & End Depth with different values, this can make the BC slope. In the case where the Joist is in a Sloped Condition (start & end point are not at the same elevation), you might want to make the BC parallel to the ground. To do so, simply change the Start Depth or End Depth value in the Joist family Type Parameters.

Some specific parameters like the Ridge Depth (2, 3 & 4 Slope Joist shapes) are also always calculated perpendicular to the BC.

1.1.3 Automatic Calculated Values Based on Length

Here are the default automatic calculated values that will apply to a parameter when a parameter value is set to zero:

- For the Canadian Standard Joist and for All the Non Standard Shapes & Special Shapes

	Joist Length	Seat Depth	Seat Length	Web Gap	TC & BC Thick	TC & BC Leg	Seat Thick	Seat Leg
	< 30'					2"		
	< 40'			1"	1/4"		1/4"	
	< 50'		4"					
	< 60'	4"				3"		3 1/2"
	>= 60'					4"		4"
	< 70'			1 1/2"				
	< 90'	5"	5"		3/8"		3/8"	
	>= 90'	7 1/2"	6"		1/2"		1/2"	
	< 100'			2"				
	>= 100'			3"				

- For the American Standard Joists (SJI), we have different default values

K Series	Joist Length	Seat Depth	Seat Length	Web Gap	TC & BC Thick	TC & BC Leg	Seat Thick	Seat Leg
	< 40'	2 1/2"	5"	1"	1/4"	2"	1/4"	2 1/2"
	>= 40'	2 1/2"	5"	1 1/2"	3/8"	2 1/2"	3/8"	2 1/2"

KCS Series	Joist Length	Seat Depth	Seat Length	Web Gap	TC & BC Thick	TC & BC Leg	Seat Thick	Seat Leg
	< 30'	2 1/2"	5"	1"		2"		2 1/2"
	>= 30'	2 1/2"	5"	1 1/2"		2 1/2"		2 1/2"
	< 40'				1/4"		1/4"	
	>= 40'				3/8"		3/8"	

KSP	Joist Length	Seat Depth	Seat Length	Web Gap	TC & BC Thick	TC & BC Leg	Seat Thick	Seat Leg
	< 40'	2 1/2"	5"	1"	1/4"	2"	1/4"	2 1/2"
	>= 40'	2 1/2"	5"	1 1/2"	3/8"	2 1/2"	3/8"	2 1/2"

LH Series	Joist Length	Seat Depth	Seat Length	Web Gap	TC & BC Thick	TC & BC Leg	Seat Thick	Seat Leg
	< 30'					2"		
	< 40'	5"	6"	1"	1/4"		1/4"	
	>= 40'	5"	6"					
	< 60'					3"		3 1/2"
	>= 60'					4"		4"
	< 70'			1 1/2"				
	>= 70'			2"				
	< 90'				3/8"		3/8"	
	>= 90'				1/2"		1/2"	

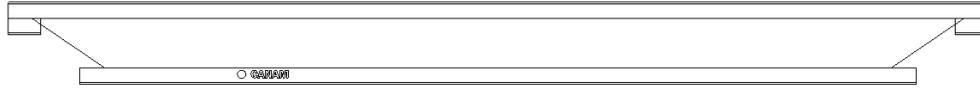
DLH Series	Joist Length	Seat Depth	Seat Length	Web Gap	TC & BC Thick	TC & BC Leg	Seat Thick	Seat Leg
	< 80'			1 1/2"				
	< 90'	5"	6"		3/8"	4"	3/8"	4"
	>= 90'	5"	6"		1/2"	5"	1/2"	5"
	< 110'			2"				
	>= 110'			3"				

LHSP	Joist Length	Seat Depth	Seat Length	Web Gap	TC & BC Thick	TC & BC Leg	Seat Thick	Seat Leg
	< 30'					2"		
	< 40'			1"				
	< 60'					3"		3 1/2"
	< 70'			1 1/2"				
	< 90'	5"	6"			4"		4"
	>= 90'	5"	6"			5"		5"
	< 100'			2"				
	>= 100'			3"				

2. Canam Parametric Joist Shapes

Here is a brief description of the available Canam Parametric Joist Shapes.

2.1 Canam-Joist-Standard



The Canam-Joist-Standard families allow the creation of Joists using two Working Points (Placement Points). These Joist Families reflect the Canam Standard Joists available depths as listed in the Canam Joist Catalog.

There are various families for the Standard Joist Shapes:

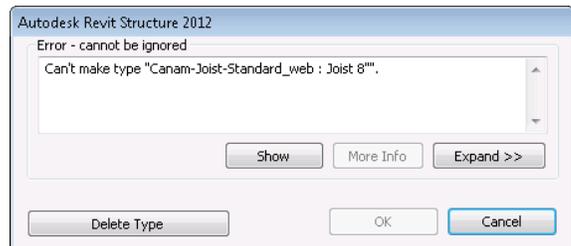
- Canadian Imperial and Canadian Metric
- SJI Joists (K Series, KCS Series, KSP, LH Series, DLH Series & LHSP)

Important: A Revit Type Catalog file is provided with every Canam-Joist-Standard family. The Type Catalog file (.txt file) must always be located in the same folder as the Revit family (.rfa file) it is associated to and both files must have the exact same name. If these conditions are not respected, the Type Catalog file will not be found when you load the family in your model.

When loading a Canam-Joist-Standard family associated to a Type Catalog file in your Revit model, you can select some specific Type required for your project or you can select all the available types.

Joist Length Validation

While the joist is being created, the joist length is validated according to the minimum and the maximum length values for the selected type. If the Joist Length is outside the min-max range, a Revit Error will be displayed "Can't make type".

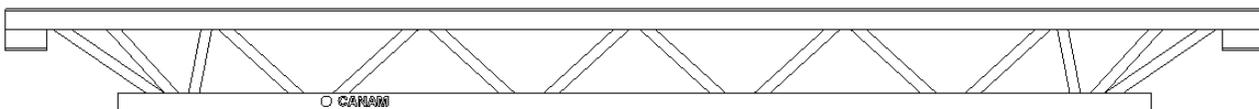


Special Type

These Standard Joist families also contain a type where the Joist depth is set to zero. When using this special type, the joist depth will automatically adjust to a suggested depth based on the joist length. Ex: For Canadian Joist families, this type is named: "Joist", for K Series, this type is named: "K Joist ", for DLH Series, this type is named: "DLH Joist ", etc.

Standard Joist Families do NOT allow for an inclined Bottom Chord (when Top Chord is not parallel to the Bottom Chord or when the Start Depth value is not identical to the End Depth value). All other common parameters apply, as previously described.

The Canam-Joist-Standard Shape Families are also available as Families that include the Joist Panels (webs).

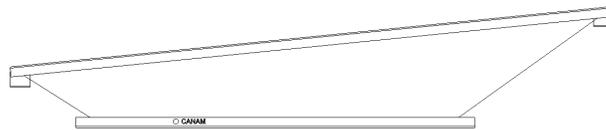


2.2 Canam Joist Non-Standard Shape Families

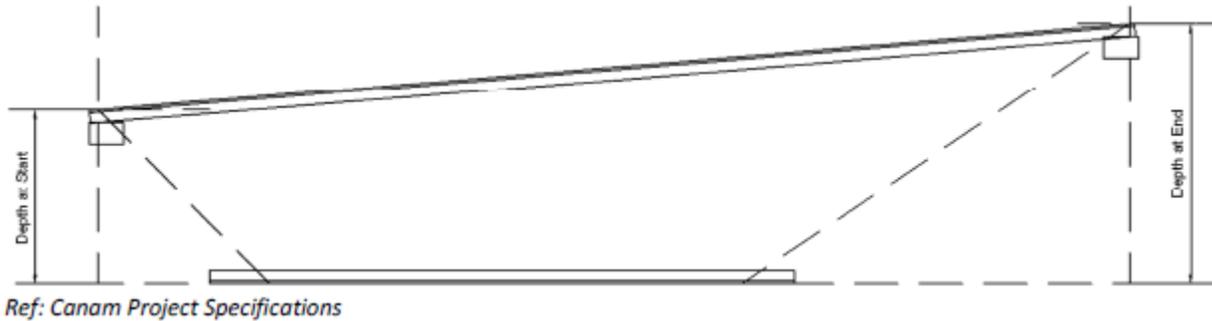
These Families can be used for both imperial or metric and Canadian or American projects. The Non Standard Shape Families don't have any length validation, and they don't have a Type Catalog file.

Note: The Non Standard Shape Families are not available "with Webs"

2.2.1 Canam-Joist-1Slope



The Canam-Joist-1Slope family is very similar to the standard joist except for the fact that it allows for an inclined Bottom Chord (when the Start Depth parameter value is different from End Depth value). By inputting the correct Joist Elevation value at one end, the Bottom Chord will become horizontal and the Top Chord will be sloped.

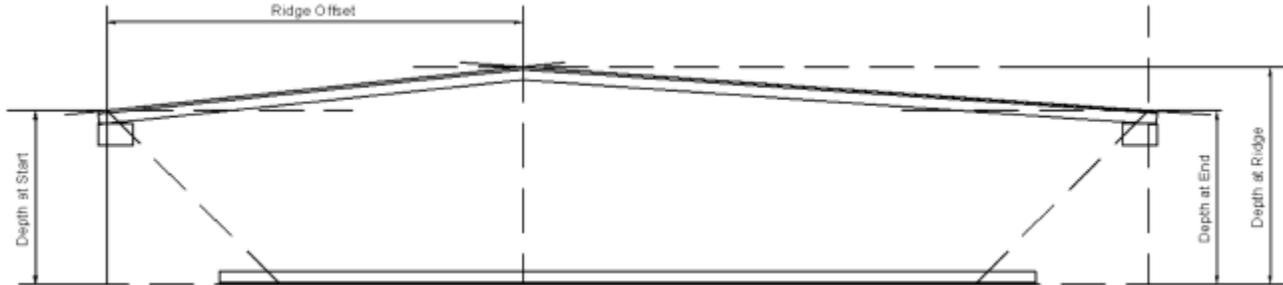


2.2.2 Canam-Joist-2Slope



The Canam-Joist-2Slope family allows for the creation of one (1) Top Chord ridge. The Ridge Depth distance is calculated from the Bottom Chord (parallel to the BC). The Ridge Offset distance is calculated from the Joist Start position. When the Ridge Offset parameter is set to 0", the Ridge Offset distance is located in the middle of the joist length.

The user can specify the Ridge Offset distance by inputting a value in the Ridge Offset parameter. This Joist family also allows the Bottom Chord to be inclined.



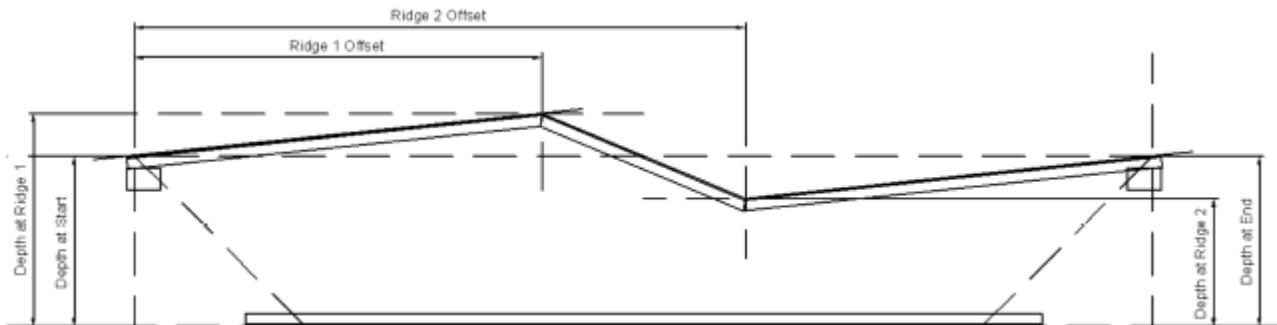
Ref: Canam Project Specifications

2.2.3 Canam-Joist-3Slope



The Canam-Joist-3Slope family allows for the creation of two (2) Top Chord ridges. The Ridges Depth distances are calculated from the Bottom Chord (parallel to the BC). When the Ridge Offset parameter is set to 0", the Ridge Offset distance is calculated as 1/3 of the joist length for the Ridge1 Offset and as 2/3 of the joist length for the Ridge2 Offset. The user can specify the Ridge Offset distance by inputting a value in the Ridge Offset parameters. In this case, the user must make sure that the Ridge2 Offset is greater than the Ridge1 Offset, to avoid an error message.

This Joist family also allows the Bottom Chord to be inclined.



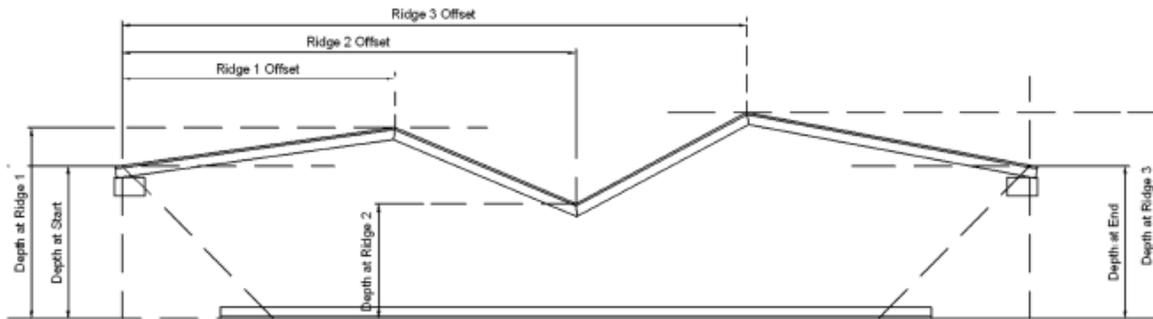
Ref: Canam Project Specifications

2.2.4 Canam-Joist-4Slope



The Canam-Joist-4Slope family allows for the creation of three (3) Top Chord ridges. The Ridges Depth distances are calculated from the Bottom Chord (parallel to the BC). When the Ridge Offset parameter is set to 0”, the Ridge Offset distance is calculated as 1/4 of the joist length for the Ridge1 Offset, as 1/2 of the joist length for the Ridge2 Offset and as 3/4 of the joist length for the Ridge3 Offset. The user can specify the Ridge Offset distance by inputting a value in the Ridge Offset parameters. In this case, the user must make sure that Ridge2 Offset is greater than the Ridge1 Offset value, to avoid an error message. The same validation applies between Ridge2 Offset and Ridge3 Offset values.

This Joist family also allows the Bottom Chord to be inclined.



Ref: Canam Project Specifications

2.3 Canam Joist Special Shape Families

These Families can be used for both imperial or metric and Canadian or American projects. The Special Shape Families do not have any length validation and they don't have Type Catalog file.

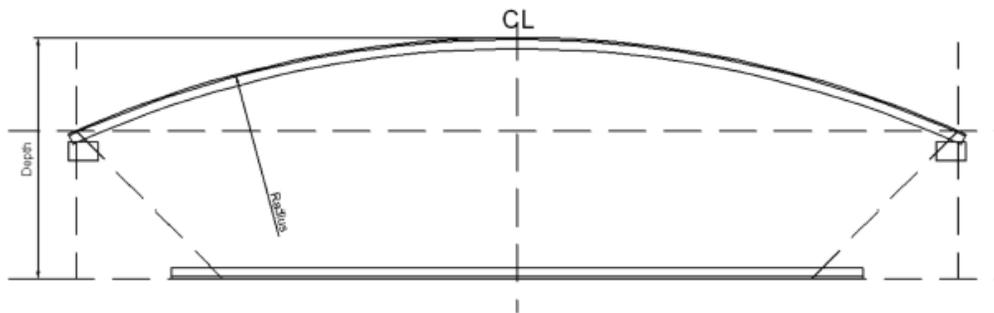
Note: The Special Shape Families are not available "with Webs".

2.3.1 Canam-Joist-Bowstring



The Canam-Joist-Bowstring family allows for the creation of an arched Top Chord. The TC Radius is always calculated perpendicular to the plane that passes through the Joist "Working Points" (Placement Points). The user can specify the Top Chord Radius distance by inputting a value in the TC Radius parameter.

This Joist family also allows the Bottom Chord to be inclined.

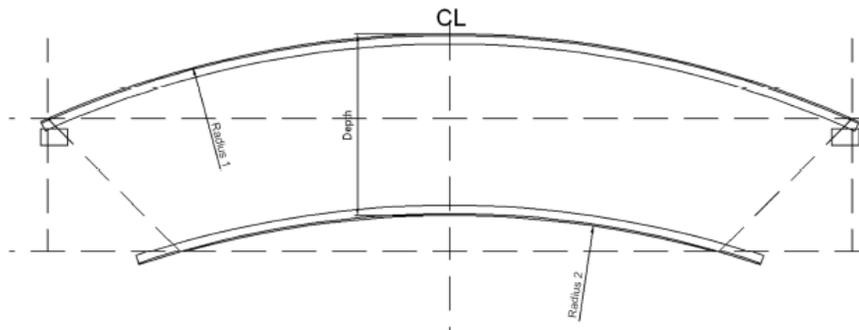


Ref: Canam Project Specifications

2.3.2 Canam-Joist-Barrel



The Canam-Joist-Barrel family allows for the creation of an arched Top Chord & arched Bottom Chord. The TC Radius is always calculated perpendicular to the plane that passes through the Joist "Working Points" (Placement Points). The user can specify the Top Chord Radius distance by inputting a value in the TC Radius parameter. The BC Radius value is calculated using the Joist Depth and TC Radius value as a reference. The TC and BC Radius always share the same center point. This Joist family does not allow the Bottom Chord to be inclined.

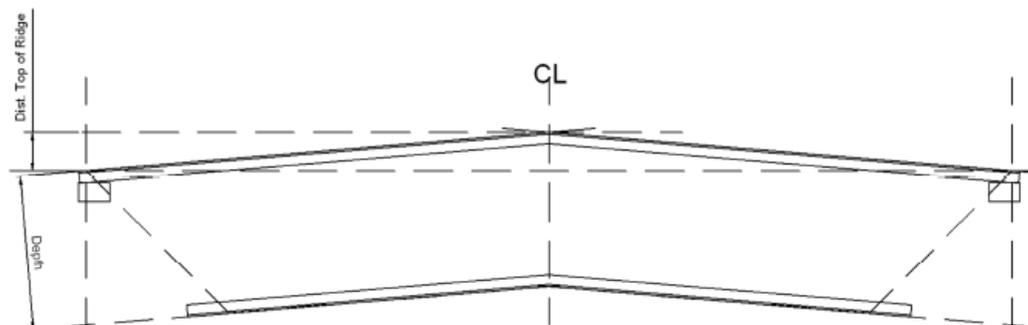


Ref: Canam Project Specifications

2.3.3 Canam-Joist-Scissor



The Canam-Joist-Scissor family allows for the creation of one (1) Ridge Top Chord and one (1) Ridge Bottom Chord. The Distance to Top of Ridge is always calculated perpendicular to the plane that passes through the Joist "Working Points" (Placement Points). The user can specify the Distance to Top of Ridge by inputting a value in the Distance to Top of Ridge parameter. The Ridge Offset distance is always calculated as half the joist length. The Bottom Chord Ridge value is calculated automatically using the Joist Depth and the Distance to Top of Ridge value as a reference. The Bottom Chords are always parallel to the Top Chords.



Ref: Canam Project Specifications

3. Best Practices for Canam Parametric Joist

Here are some of the Best Practices & Tips on how to use the Canam Parametric Joists.

3.1 When to Use the Canam Parametric Joist Family "without web " vs. "with webs"

- When it is time to add the Canam Parametric Joists in your Revit project, we strongly suggest specifying the joists using the appropriate Joist Family "without web".
- The families "without web" are lighter than the corresponding family "with webs".
- Note: Only the "Standard Shape" Joist families (Top Chord & Bottom Chord parallel) are available "with webs". The families available with webs" are: Canadian (imperial & metrics) and SJI (K, KCS, KSP, LH, DLH & LHSP).
- We suggest to use the Family "without web" as a placeholder for the joists in your 3D Model and to adjust the parameters that define the Joist envelope and the seats (extensions, offset, depth, etc.)
- When adjustments are done to the joists, you can then switch Joists for the corresponding family "with webs". To do so, proceed the same way you would switch a Beam from a "W-Wide Flange" to a "C-Channel" family.

- Note: All the adjustments made in a Joist "without web" will be transferred to the Joist when you switch it for the corresponding family "with webs".
- It is still possible to modify the adjustments in the joists when they are specified with a family "with webs" but the modification takes more time to process since the joist web geometry will have to be recalculated.

3.2 The Type Catalog file of the Standard Shape Families

- Every Canam Joist Parametric "Standard Shape" families are provided with a Type Catalog (.txt) file. This txt file contain the Type names (ex: Joist 8", Joist 10", etc.) and some values associated to the type (ex: Depth, Min Length, Max Length, etc.)
- Revit uses this file when you load the family in your model to generate the different Joist Type using the Names and the values specified in the txt file. This allows you to select the Joist Type you wish to load in your model without having to load all type.

3.3 The Special Joist Type That Suggests an Economical Joist Depth Based on the Joist Length

- We have also added a special Joist type in every Standard Joist family with the Depth value set to zero.

For Canadian Joist families, this type is named "Joist".

Types:

Type	Depth	MinLength	MinLength Econo	MaxLength Econo	MaxLength
	(tous) ▾	(tous) ▾	(tous) ▾	(tous) ▾	(tous) ▾
Joist	0' 0"	8' 0"	10' 0"	152' 0"	250' 0"
Joist 8"	0' 8"	8' 0"	10' 0"	14' 0"	19' 8"
Joist 10"	0' 10"	8' 0"	10' 0"	17' 0"	24' 7"

For US Joists - LH Series family, this special type is named "LH Joist".
 For K Series family, this special type is named "K Joist", etc.

Types:

Type	Depth	Wt	MinLength	MinLength Econo	MaxLength Econo	MaxLength
	(tous) ▾	(tous) ▾	(tous) ▾	(tous) ▾	(tous) ▾	(tous) ▾
LH Joist	0' 0"	0	21' 0"	21' 0"	96' 0"	96' 0"
18LH02	1' 6"	10	21' 0"	21' 0"	36' 0"	36' 0"
18LH03	1' 6"	11	21' 0"	21' 0"	36' 0"	36' 0"

- When this special type is selected to create a joist or if you change an existing Joist type (ex: 18LH02) for the "LH Joist" special type, the Joist depth will be adjusted automatically depending on the Joist Length. This allows creating many joists that will have different depths with the same family type (ex: when you are using Beam Systems, with skewed boundaries).

- This special type is more permissive than the other Joist type of the family for the MinLength & MaxLength values. This special type will allow creating all available lengths for the family compared to the other types of the family that have the Depth value already defined and that have the MinLength & MaxLength values set for a specific Joist Depth.
- When the joists are created and positioned, you can then change the Joist Type from the special type to the specific types that have been specified by the engineer.