



# SPRING CURVING

D E S I G N   G U I D E



# SPRING CURVING GUIDE

*Factors influencing the design  
of spring-curved roofs. Includes  
spring curving capabilities of  
**Stramit®** profiles.*



## **Important note**

The information contained within this brochure is as far as possible accurate at the date of publication, however, before application in a particular situation, Stramit Building Products recommends that you obtain qualified expert advice confirming the suitability of product(s) and information in question for the application proposed. While Stramit accepts its legal obligations, be aware however that to the extent permitted by law, Stramit disclaims all liability (including liability for negligence) for all loss and damage resulting from the use of the information provided in this brochure.

## Designing a spring-curved roof

This guide provides detailed design guidance on spring curving of **Stramit**<sup>®</sup> roofing profiles.

The following factors are discussed in this guide:

- **Economy**
- **Appearance**
- **Wind resistance**
- **Foot traffic**
- **Water drainage**
- **Thermal expansion**
- **Curving shapes**
- **Radius limits**

Other factors not addressed in this guide that need to be considered include durability and structure.

### Economy

It is beyond the scope of this guide to quantify the costs associated with a spring-curved roof. Spring curving does not necessarily lead to a more costly installation but this is generally the case. Installation of spring curved sheeting will invariably take more time and require more care with alignment.

### Appearance

Appearance is usually the main reason for the use of spring-curved sheeting. The variety of profiles and spring-curved shapes gives considerable scope for innovative architecture.

Designers need to be aware however of some effects that can occur with spring curving that are sometimes seen when viewed close-up.

All metal roofing products are susceptible to faceting. Faceting is the tendency of the sheet to follow a straight line between supports rather than a simple curve. For this reason Stramit recommends that support spacings are reduced significantly for tight radii.

Flat elements in compression can cause small buckles or oil-canning. The lower surfaces of convex curves and the upper surfaces of concave curves are in compression. Generally radii greater than the lowest neutral radius for each profile are free from oil-canning.

Neither faceting nor oil-canning significantly diminish the performance of roofing profiles.

### Wind resistance

Wind resistance capacities for each Stramit profile can be found in individual product technical manuals. Spring curving generally has little effect on these capacities. At very small radii, however, some reduction in capacity may occur. The tables in this publication indicate the extent of this reduction and the circumstances in which they apply.

### Foot traffic

Spring curving can stiffen metal sheeting and hence improve resistance to foot traffic. However, from an aesthetic perspective the consequences of foot traffic are greater; therefore Stramit recommends the same foot traffic limited spans as for flat roofs. Details of these are given in the Stramit Foot Traffic Guide. There are cases detailed later in this guide where sheeting spans should be reduced for reasons other than foot traffic.

Consideration should be given at the design stage to roof safety for fixers and maintenance personnel. Convex radii are steeper near the roof edge and can pose a slip hazard.

### Thermal Expansion

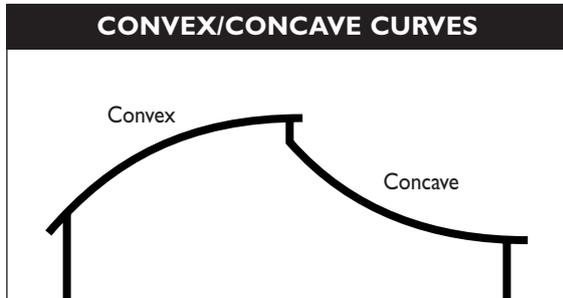
All metal roof sheeting is subject to thermal expansion and, where there is a temperature difference between the sheeting and the structure, this needs to be accommodated. The colour of the sheeting will affect the amount of thermal expansion, and whether the sheet is flat or spring-curved will affect its ability to resist without problems. Sheet lengths should be limited to those shown below.

MAXIMUM SHEET LENGTH			
		sheeting colour	
		light	dark
straight	through-fixed	25	17
	concealed	35	25
spring-curved	through-fixed	20	17
	concealed	30	20

Note – temperature difference assumed to be 50°C for light colours and 75°C for dark.

### Curving shapes

Curves in metal sheeting (along the profile length) are considered as either convex or concave. Some of the limiting factors for spring curving various profiles will be different in each of these cases.



A large roof will comprise a series of roof segments, usually separated by expansion joints. It is possible to use any combination of spring-curved radius (concave or convex) and straight lengths to create a variety of roof shapes. These variations may be within individual sheet lengths if practicalities permit.

### Spring curving limits

A number of factors need to be considered when determining the spring curving radius of **Stramit®** roofing products. These include water drainage, wind and foot traffic resistance, and appearance. The diagram opposite shows which factors influence particular ranges of radii. The ranges for each product are tabulated overleaf.

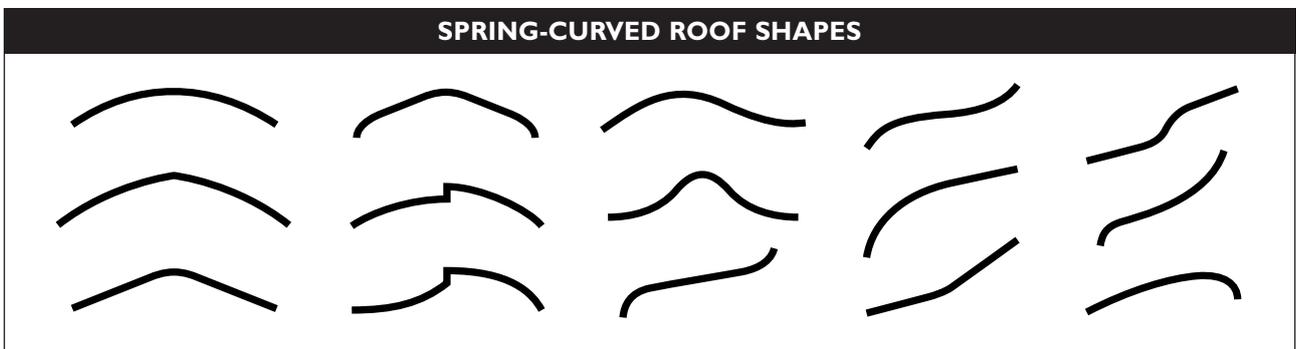
### Practical hints

#### Design

For best spring curving results use thicker material, short spans and insulation blanket. Make provision for maintenance traffic to avoid foot traffic marking.

#### Installation

Adjacent sheets should be installed in alternate directions to avoid creep. Fasteners should be installed with care to avoid rib bruising.



QUICK SELECTION CONVEX RADIUS CHART	
sheeting/decking	approximate radius (m)
	10 20 30 40 60 80 100 150 200 250 300 500
Stramit® Corrugated	Restrictions apply to radii from 10 to 100m; Unrestricted radii from 100m to 500m.
Stramit Longspan®	Restrictions apply to radii from 10 to 200m; Unrestricted radii from 200m to 500m.
Stramit Megaclad®	Restrictions apply to radii from 10 to 80m; Unrestricted radii from 80m to 300m.
Stramit Monoclad®	Restrictions apply to radii from 10 to 250m; Unrestricted radii from 250m to 500m.
Stramit Speed Deck® 500	Restrictions apply to radii from 10 to 180m; Unrestricted radii from 180m to 500m.
Stramit Speed Deck Ultra®	Restrictions apply to radii from 10 to 120m; Unrestricted radii from 120m to 500m.
Stramit Snaptite™	Restrictions apply to radii from 10 to 150m; Unrestricted radii from 150m to 500m.

Restrictions apply to these radii    Unrestricted radii

Not all profiles are available in all locations – contact your nearest Stramit location, refer to the Stramit Roof Slope Guide.

## SPRING CURVING LIMITS

### Convex

#### LARGE RADII

##### Use Table A

Large convex radii are limited by water drainage. Table A gives radius limits for the range of rainfall intensities encountered in Australia.

#### MID-RANGE RADII

##### Use Table B

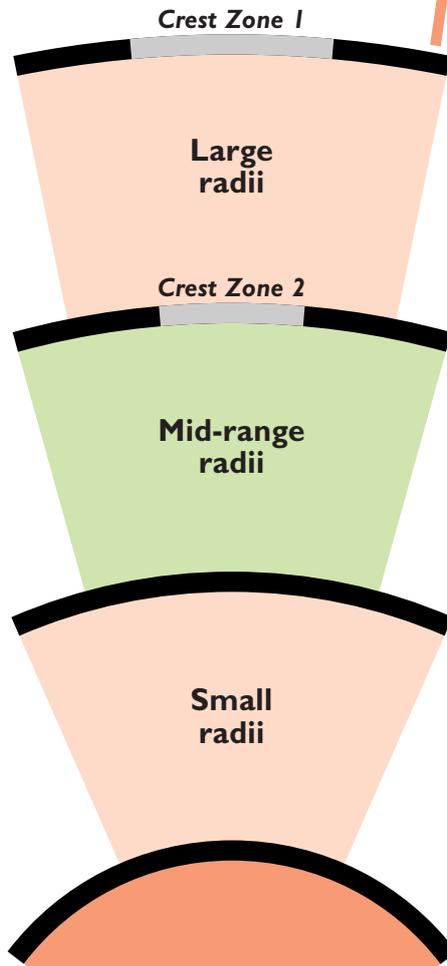
Mid-range convex radii have no design restrictions and are considered "neutral". However, it is still necessary to check the crest zone for possible support spacing reductions.

#### SMALL RADII

##### Use Table C

Small convex radii put additional stresses on the sheeting. These radii require a reduction in support spacing and are also reduced in performance. The reductions shown in Table C are for the smallest radii. Linear interpolation may be used to calculate reductions at intermediate radii.

Beyond drainage capacity



#### CREST ZONE

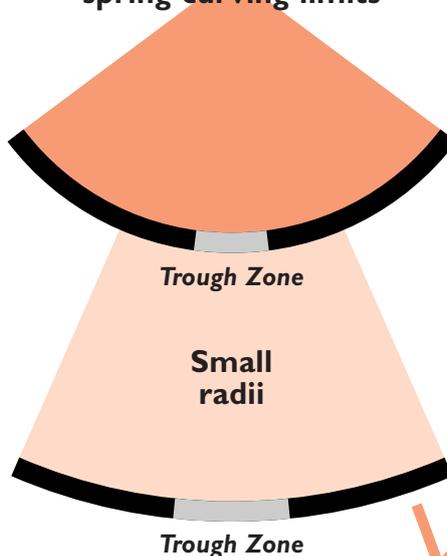
##### Use Table D

Shows the length of sheeting either side of the crest that will be below the minimum slope for each product. The following restrictions are needed to ensure satisfactory drainage:

**Crest Zone 1:** Sealing of sheet edges is required as this region is beyond the maximum drainage capacity of the sheeting. Care must be taken however to ensure that the sheets anti-capillary drain is not blocked. Support spacing must also be reduced to the maximum span shown to reduce ponding.

**Crest Zone 2:** Support spacing must be reduced to the maximum spans shown to reduce ponding.

These radii beyond spring curving limits



#### BEYOND THE LIMITS

Radii tighter than the tabulated minima have been used successfully on some projects. For large projects, Stramit will assist in the assessment of specific designs.

### Concave

#### SMALL RADII

##### Use Table E

Small concave radii put additional stress on the sheeting. These radii require a reduction in support spacing and are also reduced in performance. The reductions shown in Table E are for the smallest recommended radius. Linear interpolation may be used to calculate reductions at intermediate radii.

#### TROUGH ZONE

The lowest edge of concave curves must have sufficient slope for drainage. Use the Stramit Roof Slope Guide to find the minimum slope for the roof run length and rainfall intensity at the intended location. The trough zone must freely drain to an eaves or box gutter.

No design restrictions on radius (check roof slope)

**TABLE A – LARGE CONVEX RADII**

maximum convex radii (m) at the rainfall intensities shown							
sheeting/decking	rainfall intensity (mm/hr)						
	150	200	220	240	280	340	370
<b>Stramit® Corrugated</b>	92	69	63	57	49	40	37
<b>Stramit Longspan®</b>	192	144	131	120	103	84	78
<b>Stramit Megaclad®</b>	334	250	228	209	179	147	135
<b>Stramit Monoclad®</b>	259	194	177	162	139	114	105
<b>Stramit Speed Deck® 500</b>	> 500	390	354	325	278	229	210
<b>Stramit Speed Deck Ultra®</b>	> 500	419	380	349	299	246	225
<b>Stramit Snaptite™</b>	> 500	> 500	474	435	373	307	280

**How to use**



**Convex curves that extend up to or over the roof crest (arches):**

Use Tables A, B or C, and D.



**Convex curves on which the highest point is steeper than the product's required slope for drainage:**

Use Tables B or C and also check D.



**Concave curves:**

Use Table E and, (for the lowest edge) the Stramit Roof Slope Guide.



**Straight sections:**

Use the Stramit Roof Slope Guide.

**TABLE B – MID-RANGE CONVEX RADII**

sheeting/decking	thickness (mm)	neutral radii (m)	
		lowest	highest
<b>Stramit® Corrugated</b>	0.42	25	37
	0.48	25	37
	0.60	26	37
<b>Stramit Longspan®</b>	0.42	no unrestricted radii	
	0.48	no unrestricted radii	
<b>Stramit Megaclad®</b>	0.42	70	135
	0.48	80	135
<b>Stramit Monoclad®</b>	0.42	no unrestricted radii	
	0.48	no unrestricted radii	
<b>Stramit Speed Deck® 500</b>	0.42	198	210
	0.48	159	210
<b>Stramit Speed Deck Ultra®</b>	0.42	99	225
	0.48	99	225
<b>Stramit Snaptite™</b>	0.55	142	280

See Table D for reduced span range at roof crest.

**TABLE C – SMALL CONVEX RADII**

sheeting/decking	thickness (mm)	at minimum radius				at lowest neutral radius	
		minimum radius (m)	maximum span (mm)	% strength reduction	% serviceability reduction	radius (m)	normal span (mm)
<b>Stramit® Corrugated*</b>	0.42	12	900	7	14	25	1200
	0.48	10	900	7	14	25	1600
	0.60	8	900	7	14	26	1200
<b>Stramit Longspan®</b>	0.42	30	1200	7	14	88	2100
	0.48	20	1200	7	14	113	2700
<b>Stramit Megaclad®</b>	0.42	70	1200	0	0	70	1500
	0.48	70	1200	7	14	80	1800
<b>Stramit Monoclad®</b>	0.42	70	1200	7	14	132	1700
	0.48	60	1200	7	14	132	2300
<b>Stramit Speed Deck® 500</b>	0.42	70	1200	7	14	198	1500
	0.48	50	1200	7	14	159	2100
<b>Stramit Speed Deck Ultra®</b>	0.42	90	1200	7	14	99	2100
	0.48	70	1200	7	14	99	2700
<b>Stramit Snaptite™</b>	0.55	50	900	7	14	142	1900

All spans shown are subject to checking for wind pressure. \* **Stramit® Corrugated** sheeting can be permanently roll curved to tighter radii.

■ Shaded values are subject to water drainage check – see Table A.

**TABLE D – ROOF CREST SPANS**

length of roof (m) either side of crest requiring reduced spans and sealing at the radii shown

sheeting/decking	minimum slope (°)	maximum span (mm)	spring-curved radius (m)									
			10	20	50	100	150	200	250	300	400	500
<b>Stramit® Corrugated</b>	5	900	0.9	1.8	4.4	8.7	13	18	22	26	35	44
<b>Stramit Longspan®</b>	3	1200	0.3	0.5	1.3	2.6	3.9	5.2	6.5	7.9	10	13
<b>Stramit Megaclad®</b>	2	1200	0.4	0.7	1.8	3.5	5.2	7.0	8.7	11	14	18
<b>Stramit Monoclad®</b>	2	1200	0.4	0.7	1.8	3.5	5.2	7.0	8.7	11	14	18
<b>Stramit Speed Deck® 500</b>	1	1200	0.2	0.4	0.9	1.8	2.6	3.5	4.4	5.2	7.0	8.7
<b>Stramit Speed Deck Ultra®</b>	1	1200	0.2	0.4	0.9	1.8	2.6	3.5	4.4	5.2	7.0	8.7
<b>Stramit Snaptite™</b>	1	900	0.2	0.4	0.9	1.8	2.6	3.5	4.4	5.2	7.0	8.7

Intermediate values can be obtained by addition – e.g. **Stramit Megaclad®** sheeting at 70m radius = values for 50 + 20 = 2.5m.

■ Values in yellow shaded area for reference only.

**TABLE E – CONCAVE RADII**

sheeting/decking	thickness (mm)	at minimum radius				at lowest neutral radius	
		minimum radius (m)	maximum span (mm)	% strength reduction	% serviceability reduction	radius (m)	normal span (mm)
<b>Stramit® Corrugated</b>	0.42	12	900	7	14	25	1200
	0.48	10	900	7	14	25	1600
	0.60	8	900	7	14	26	1200
<b>Stramit Longspan®</b>	0.42	20	1200	7	14	88	2100
	0.48	20	1200	7	14	113	2700
<b>Stramit Megaclad®</b>	0.42	20	900	7	14	61	1500
	0.48	20	900	7	14	72	1800
<b>Stramit Monoclad®</b>	0.42	20	900	7	14	132	1700
	0.48	20	900	7	14	132	2300
<b>Stramit Speed Deck® 500</b>	0.42	70	1200	7	14	198	1500
	0.48	50	1200	7	14	159	2100
<b>Stramit Speed Deck Ultra®</b>	0.42	90	1200	7	14	99	2100
	0.48	70	1200	7	14	99	2700
<b>Stramit Snaptite™</b>	0.55	50	900	7	14	142	1900

## Other useful Stramit guides

As well as the standard range of Technical Product Manuals, Installation Leaflets, Case Studies and other promotional literature, Stramit has a series of Design Guides to aid architects, engineers and specifiers.

### These include

- Concealed Fixed Decking Guide
- Foot Traffic Guide
- Bullnosing, Curving and Crimping
- Acoustic Panels
- Cyclonic Areas
- Roof System Selection Guide
- Roof Slope Guide

Please contact your nearest Stramit location for any of these guides, or other literature.



The Stramit web page can be found at:

[www.stramit.com.au](http://www.stramit.com.au)

Details of many **Stramit**® products can also be seen on the AIA site 'Product Selector' at:  
[www.selector.com.au](http://www.selector.com.au)

## Building Products

		prices	availability	general	technical
contact numbers for information			products coating colours	other	advice product data
<b>SYDNEY</b> 33-83 Quarry Road, Erskine Park NSW 2759	phone fax	(02) 9834 0909 (02) 9834 0988		(02) 9834 0900 (02) 9834 0988	
<b>CANBERRA</b> 4 Bass Street, Queanbeyan NSW 2620	phone fax		(02) 6297 3533 (02) 6297 8089		
<b>COFFS HARBOUR</b> 6 Mansbridge Drive, Coffs Harbour NSW 2450	phone fax		(02) 6652 6333 (02) 6651 3395		(02) 4954 5033 (02) 4954 5856
<b>NEWCASTLE</b> 17 Nelson Road, Cardiff NSW 2285	phone fax		(02) 4954 5033 (02) 4954 5856		
<b>ORANGE</b> 51 Leewood Drive, Orange NSW 2800	phone fax		(02) 6361 0444 (02) 6361 9814		
<b>MELBOURNE</b> 2/1464 Ferntree Gully Road, Knoxfield VIC 3180	phone fax	(03) 9237 6300 (03) 9237 6399		(03) 9237 6200 (03) 9237 6299	
<b>ALBURY</b> 18 Ariel Drive, Albury NSW 2640	phone fax		(02) 6041 7600 (02) 6041 7666		
<b>BENDIGO</b> Ramsay Court, Kangaroo Flat VIC 3555	phone fax		(03) 5447 8455 (03) 5447 9677		
<b>HOBART</b> 57 Crooked Billett Drive, Brighton TAS 7030	phone fax		(03) 6263 5536 (03) 6263 6950		(03) 6263 5536 (03) 6263 6950
<b>LAUNCESTON</b> 289 Hobart Road, Kings Meadows TAS 7249	phone fax		(03) 6343 7390 (03) 6343 7381		
<b>ADELAIDE</b> 11 Stock Road, Cavan SA 5094	phone fax		(08) 8262 4444 (08) 8262 6333		(08) 8262 4444 (08) 8262 6333
<b>BRISBANE</b> 57-71 Platinum Street, Crestmead QLD 4132	phone fax		(07) 3803 9999 (07) 3803 1499		
<b>TOWNSVILLE</b> 402-408 Bayswater Road, Garbutt QLD 4814	phone fax		(07) 4779 0844 (07) 4775 7155		
<b>CAIRNS</b> Vickers Street, Edmonton QLD 4869	phone fax		(07) 4045 3069 (07) 4045 4762		
<b>MACKAY</b> Brickworks Court, Glenella QLD 4740	phone fax		(07) 4942 3488 (07) 4942 2343		(07) 3803 9999 (07) 3803 1499
<b>MARYBOROUGH</b> 10 Activity St, Maryborough QLD 4650	phone fax		(07) 4121 2433 (07) 4123 3139		
<b>ROCKHAMPTON</b> 41 Johnson St, Parkhurst QLD 4702	phone fax		(07) 4936 2577 (07) 4936 4603		
<b>SUNSHINE COAST</b> Unit 1, 5 Kerry St, Kunda Park QLD 4556	phone fax		(07) 5456 4083 (07) 5456 4862		
<b>MURWILLUMBAH</b> 6 Kay Street, Murwillumbah NSW 2484	phone fax		(02) 6672 8542 (02) 6672 6798		
<b>DARWIN</b> 55 Albatross Street, Winnellie NT 0820	phone fax		(08) 8947 0780 (08) 8947 1577		
<b>PERTH</b> 605-615 Bickley Road, Maddington WA 6109	phone fax		(08) 9493 8800 (08) 9493 8899		
<b>BUNBURY</b> 25 Proffit Street, Bunbury WA 6230	phone fax		(08) 9721 8046 (08) 9721 8017		

® Registered trademarks of Stramit Corporation Pty Limited. ABN 57 005 010 195 trading as Stramit Building Products

A member of the Fletcher Building Group

COLORBOND® and ZINCALUME® are registered trademarks of BlueScope Steel Limited

© Stramit Corporation Pty. Limited September 2009.