Stramit®

SPRING CURVING

DESIGN GUIDE

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***® 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

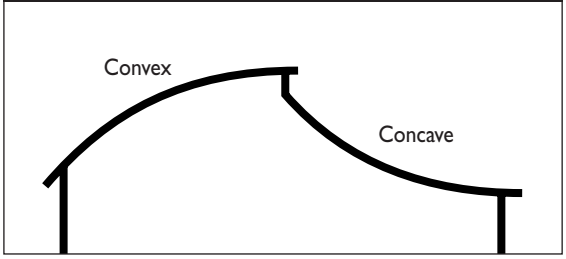
		sheeting colour	
		light	dark
straight	through-fixed	25	17
	concealed	35	25
spring-curved	through-fixed	20	17
	concealed	30	20

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.

CONVEX/CONCAVE CURVES



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

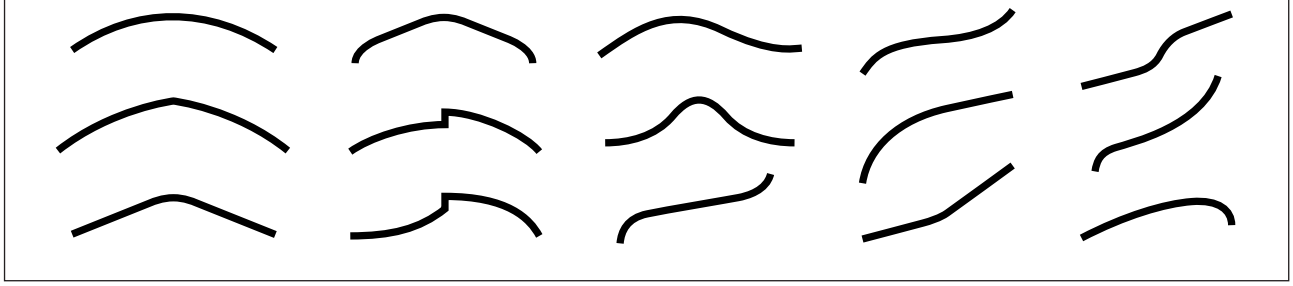
Design

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

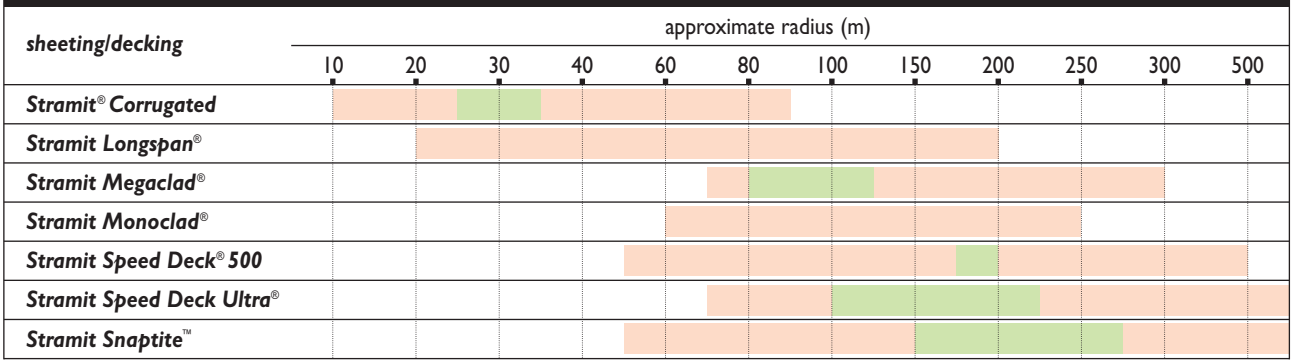
Installation

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

SPRING-CURVED ROOF SHAPES



QUICK SELECTION CONVEX RADIUS CHART



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

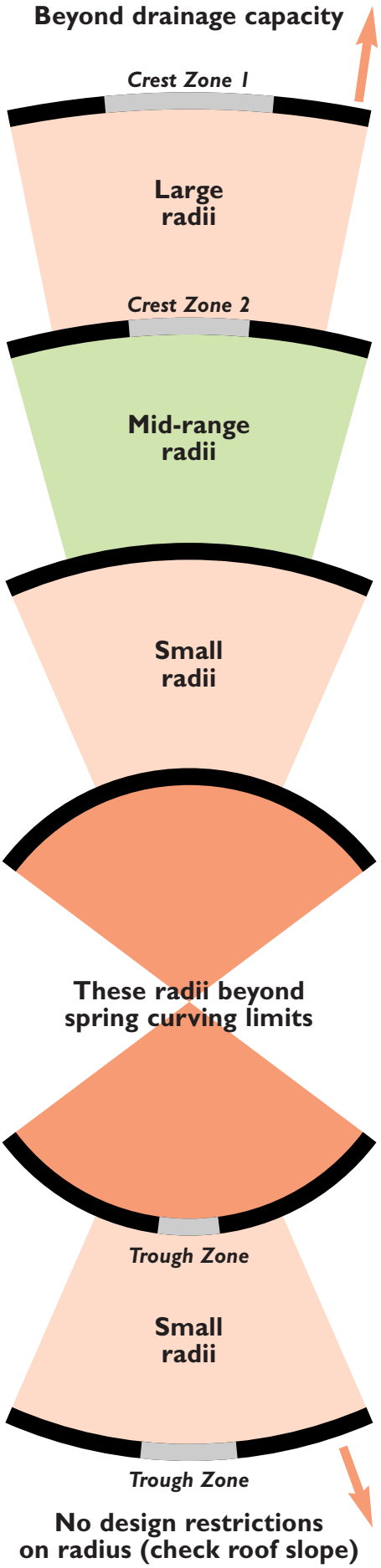
Use Table B

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.



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.

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.

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
Stramit® Corrugated	92	69	63	57	49	40	37
Stramit Longspan®	192	144	131	120	103	84	78
Stramit Megaclad®	334	250	228	209	179	147	135
Stramit Monoclad®	259	194	177	162	139	114	105
Stramit Speed Deck® 500	> 500	390	354	325	278	229	210
Stramit Speed Deck Ultra®	> 500	419	380	349	299	246	225
Stramit Snaptite™	> 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
Stramit® Corrugated	0.42	25	37
	0.48	25	37
	0.60	26	37
Stramit Longspan®	0.42	no unrestricted radii	
	0.48		
Stramit Megaclad®	0.42	70	135
	0.48	80	135
Stramit Monoclad®	0.42	no unrestricted radii	
	0.48		
Stramit Speed Deck® 500	0.42	198	210
	0.48	159	210
Stramit Speed Deck Ultra®	0.42	99	225
	0.48	99	225
Stramit Snaptite™	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: minimum radius (m)	maximum span (mm)	% strength reduction	% serviceability reduction	at lowest neutral radius: radius (m)	normal span (mm)
Stramit® Corrugated*	0.42	12	900	7	14	25	1200
	0.48	10	900	7	14	25	1600
	0.60	8	900	7	14	26	1200
Stramit Longspan®	0.42	30	1200	7	14	88	2100
	0.48	20	1200	7	14	113	2700
Stramit Megaclad®	0.42	70	1200	0	0	70	1500
	0.48	70	1200	7	14	80	1800
Stramit Monoclad®	0.42	70	1200	7	14	132	1700
	0.48	60	1200	7	14	132	2300
Stramit Speed Deck® 500	0.42	70	1200	7	14	198	1500
	0.48	50	1200	7	14	159	2100
Stramit Speed Deck Ultra®	0.42	90	1200	7	14	99	2100
	0.48	70	1200	7	14	99	2700
Stramit Snaptite™	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
Stramit® Corrugated	5	900	0.9	1.8	4.4	8.7	13	18	22	26	35	44
Stramit Longspan®	1.5	1200	0.3	0.5	1.3	2.6	3.9	5.2	6.5	7.9	10	13
Stramit Megaclad®	2	1200	0.4	0.7	1.8	3.5	5.2	7.0	8.7	11	14	18
Stramit Monoclad®	2	1200	0.4	0.7	1.8	3.5	5.2	7.0	8.7	11	14	18
Stramit Speed Deck® 500	1	1200	0.2	0.4	0.9	1.8	2.6	3.5	4.4	5.2	7.0	8.7
Stramit Speed Deck Ultra®	1	1200	0.2	0.4	0.9	1.8	2.6	3.5	4.4	5.2	7.0	8.7
Stramit Snaptite™	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: minimum radius (m)	maximum span (mm)	% strength reduction	% serviceability reduction	at lowest neutral radius: radius (m)	normal span (mm)
Stramit® Corrugated	0.42	12	900	7	14	25	1200
	0.48	10	900	7	14	25	1600
	0.60	8	900	7	14	26	1200
Stramit Longspan®	0.42	20	1200	7	14	88	2100
	0.48	20	1200	7	14	113	2700
Stramit Megaclad®	0.42	20	900	7	14	61	1500
	0.48	20	900	7	14	72	1800
Stramit Monoclad®	0.42	20	900	7	14	132	1700
	0.48	20	900	7	14	132	2300
Stramit Speed Deck® 500	0.42	70	1200	7	14	198	1500
	0.48	50	1200	7	14	159	2100
Stramit Speed Deck Ultra®	0.42	90	1200	7	14	99	2100
	0.48	70	1200	7	14	99	2700
Stramit Snaptite™	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.

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The Stramit web page can be found at:
www.stramit.com.au
Details of many ***Stramit***® products can also be seen on the AIA site 'Product Selector' at:
www.selector.com.au

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