Technical Data : Superspan Structures

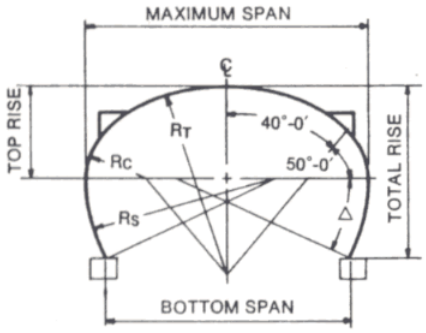
General Specification and Installation Characteristics

SuperSpan design helps solve the two practical problems encountered by very large conventional MultiPlate structures, back-filling loads and buckling. Large circular shapes have relatively high, sensitive sidewalls of large radius, with little effective horizontal thrust at the top provided by the semi-circular crown. In effect, for sizes over 6 metres in diameter, these become high retaining walls that are relatively weak, during backfilling operations.

With SuperSpan, there are two different methods of solving this problem. The wide-span horizontal ellipse shape utilises a compact sidewall of modest radius while the vertical oval shape slopes the sidewall toward the natural soil repose (see diagrams).

In each case the top arc segment is designed to provide a high horizontal thrust to the top of these "retaining walls". This results in a stable sidewall against which equipment can safely place and compact the backfill. Thus installation practicality is achieved through two different principles, each tailored to the same basic shape.

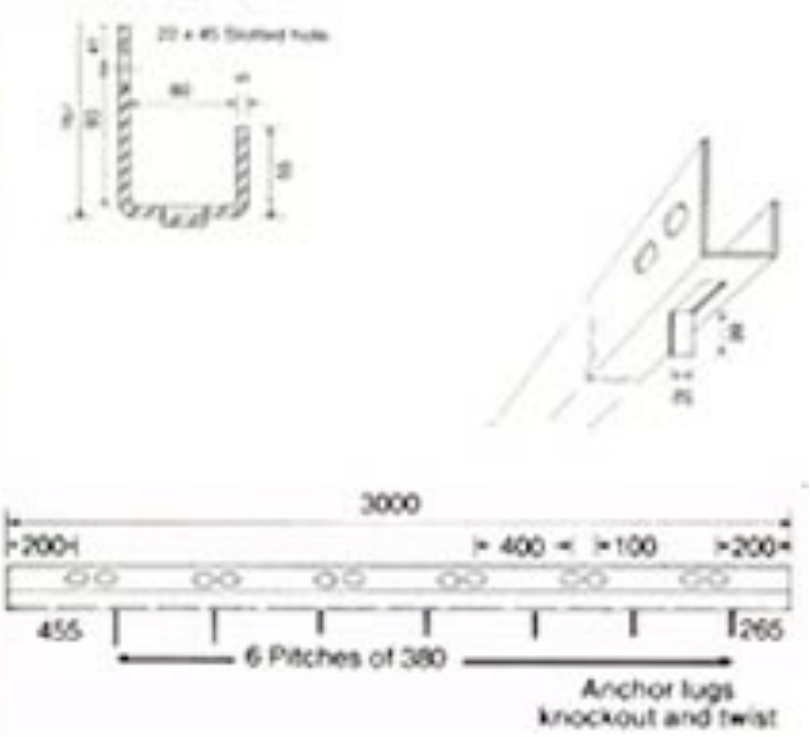
High Profile Superspan Arches



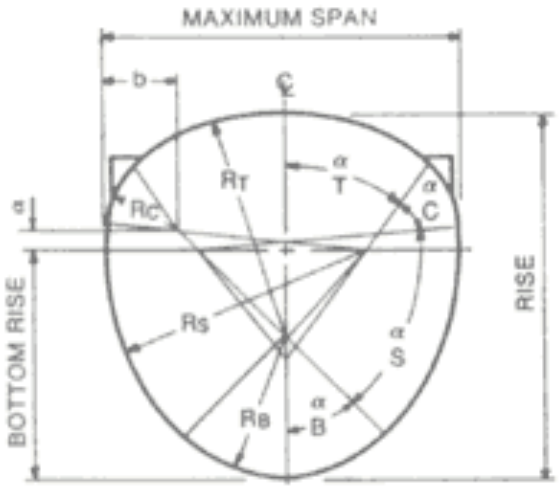
Struct. No.	Max. Span (m)	Bottom Span (m)
24A6.5	6.35	5.97
25A.6	6.56	6.06
26A6.6	6.78	6.29
27A6.6	7.00	6.52
28A6.6	7.21	6.76
30A6.6	7.65	7.22
31A6.6	7.86	7.45
32A6.6	8.08	7.68
33A6.6	8.29	7.91
34A9.8	9.09	8.44
35A9.8	9.31	8.67
36A9.9	9.52	8.75
37A9.8	9.74	9.14
37A9.10	9.74	8.82
38A9.11	9.95	8.88

39A9.12	10.17	8.93
40A9.12	10.39	9.17
41A10.12	10.80	9.61
42A10.12	11.01	9.86
43A10.10	11.23	10.43
44A10.15	11.44	9.74
45A10.15	11.66	10.00

Base Channel Detail

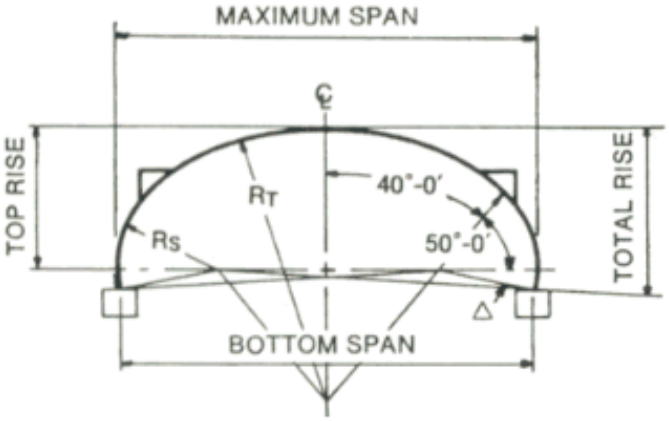


Pear Shape SuperSpans



Struct. No.	Max. Span (m)	Rise (m)	Bottom Rise (m)	Bottom Radius R_b (m)	B	Side Radius R_s (m)	S	Corner Radius R_c (m)	C	Top Radius R_t(m)	T	A (mm)	B (mm)	Approx Area (m^2)
25P5.24.15	6.98	7.53	4.38	2.64	38°12’	4.86	66°33’	80	37°20’	4.44	37°55’	777	1904	41.66
27P5.25.18	7.34	8.17	4.94	2.74	44°12’	5.81	57°54’	]72	39°14’	4.70	38°40’	859	1807	47.59
30P6.26.16	8.22	8.02	5.44	2.84	37°56’	6.14	57°04’	]47	55°00’	6.73	30°00’	407	1487	51.62
28P5.29.12	7.76	8.19	5.21	2.37	34°02’	5.80	67°20’	]44	46°40’	5.90	31°58’	859	1528	50.03

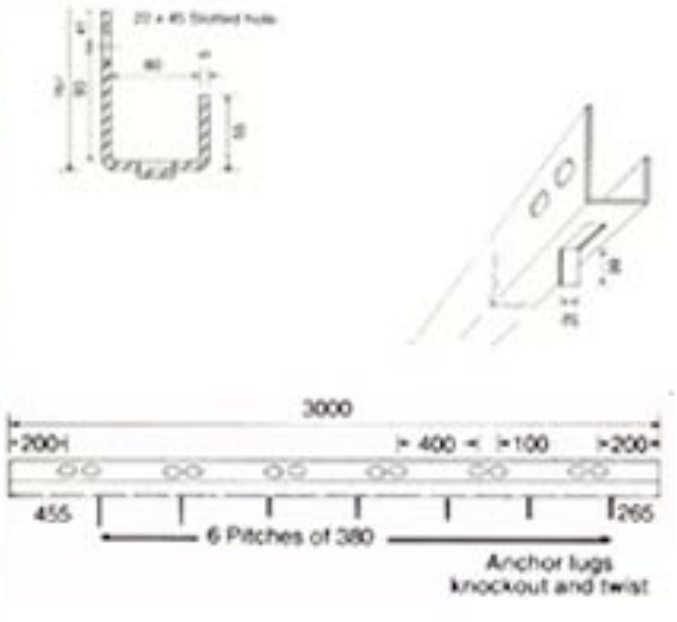
Lower Profile Superspan Arches



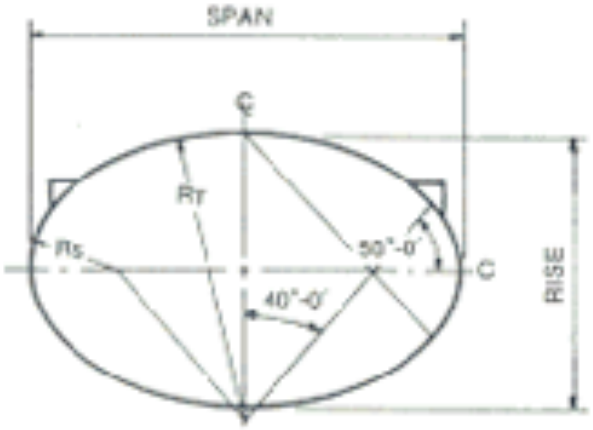
Struct. No.	Max. Span (m)	Bottom Span (m)

27A8	7.12	7.04
29A8	7.34	7.26
29A8	7.56	7.48
30A8	7.77	7.69
31A8	7.99	7.91
32A8	8.20	8.13
33A8	8.42	8.34
34A11	9.10	9.00
35A11	9.32	9.21
36A11	9.54	9.43
37A11	9.75	9.65
38A11	9.97	9.86
39A11	10.18	10.08
40A11	10.40	10.29
41A12	10.77	10.66
42A12	10.99	10.87
43A12	11.21	11.09
44A12	11.42	11.31
45A12	11.64	11.52

Base Channel Detail (dimensions in mm)



Elliptical Superspans



Structure No.	Span (m)	Rise (m)
12E6	3.17	2.18
15E6	3.82	2.42
18E8	4.66	3.07
20E8	5.10	3.22
22E11	5.82	4.00
24E11	6.25	4.16
26E12	6.78	4.52
28E12	7.21	4.68
30E15	7.93	5.45
32E15	8.36	5.61
34E15	8.80	5.77
36E15	9.23	5.93
38E18	9.95	6.70
39E18	10.17	6.78
40E18	10.38	6.86
41E19	10.70	7.15
42E19	10.91	7.22
43E19	11.13	7.30
44E20	11.44	7.59
45E21	11.76	7.88
45E24	12.05	8.49
45E28	12.43	9.32

End Treatments

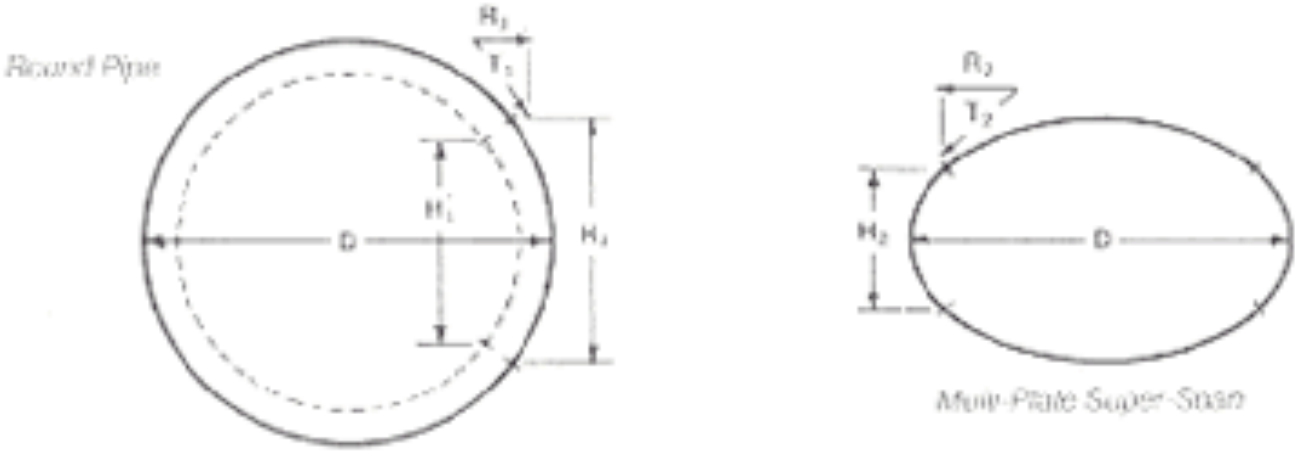
SuperSpan MultiPlate Structures can be manufactured with a variety of end treatments to suit site conditions. Standard end finishes are square ends, step bevels, skews, full bevels and

skew bevels. Where the skew angle exceeds 20° end plates should be reinforced with a concrete ring beam.

Typical End Details

Technical Data

Large Span Installation Practically



With the same span (D), MultiPlate SuperSpan requires a side 'retaining wall' of almost half the height and of less than half as much radius as the round MultiPlate. The restraining thrust (R) provided at the top of the 'retaining wall' is almost twice that in the round pipe.

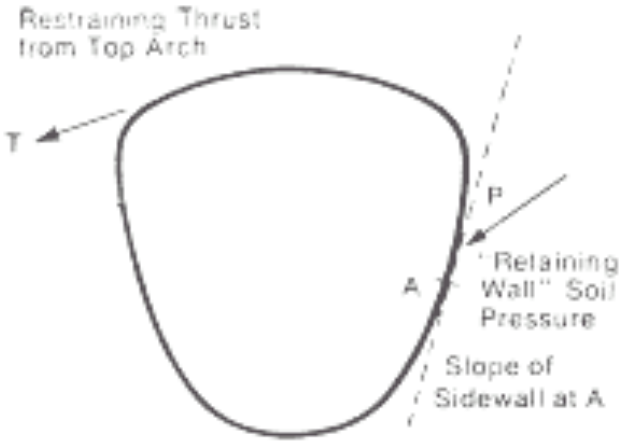
The dotted inner circle shows a round pipe of equal area to the MultiPlate SuperSpan. On this basis of comparison there is a light improvement for the round pipe, but H1 is still much greater than H2.

Shape Factor and Thrust Beam Function

Circular Shape Multi-Plate Super-Span

Backfill at critical ¾ point. Conventional shape on left is difficult to compact well enough to obtain effective horizontal passive resisting thrust (R) without allowing the pipe wall at the ¾ point to move outward significantly. Compare it to MultiPlate SuperSpan on the right. Excellent compaction and a high restraining force (R) are readily obtained against a vertical solid surface. Force (R) acts on the vertical surface to prevent significant horizontal movement of the pipe wall at the ¾ point under the dead and live loads.

High Rise Installation Practicality



Design for high narrow clearances utilises shape factor to provide installation practicality and functional stability of high sidewalls.

Slope of sidewall is maintained favourably for almost its entire height. Soil Pressures (P) act at an acute angle to the sidewall. In conventional vertical ellipsed pipe, soil pressure acts at an unfavourable angle, virtually 90°, on the upper half of the sidewall.

Live and Dead Load Pressures

Live and dead load pressures acting on the horizontal plane at the crown of the structure are assumed as the design load on the steel with no reduction for soil arching action. Theoretical

wall compression is calculated as: design pressure x radius of top arc. Thrust beam effects plus the restriction of the top arc to a central angle of 80 degrees combine to control buckling in the top arc and permit theoretical wall stresses of ordinary sized pipe. Minimum stiffness or flexibility factors are corrected for the partial arc action of SuperSpan. Longitudinal seam strength is checked against NZS/AS 3703.2:1989

Height of Cover

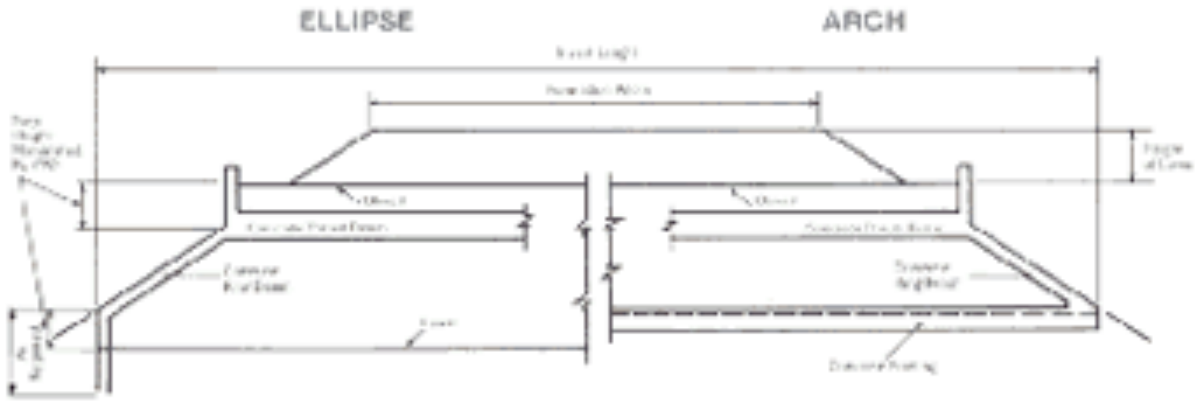
Research indicates that very significant earth arching occurs, perhaps even on relatively low fills. Presently this load reduction serves as an added safety factor, but it may permit future SuperSpan structures to be under very high fills. However, for now the full pressure in the fill at crown level is assumed to be acting on, and carried by, the steel. This limits the routine application of most shapes to approximately 12 metres of overfill.

Minimum cover on large structures is largely a matter of experience. The following table represents approximate minimums for HN-HO-72 design loading. Heights of cover are to the top of rigid pavements or the bottom of flexible pavements. The table assumes a granular backfill, over the crown of the structure compacted to 95% of maximum dry density, in accordance with AS 1289 E1.1, or E1.2.

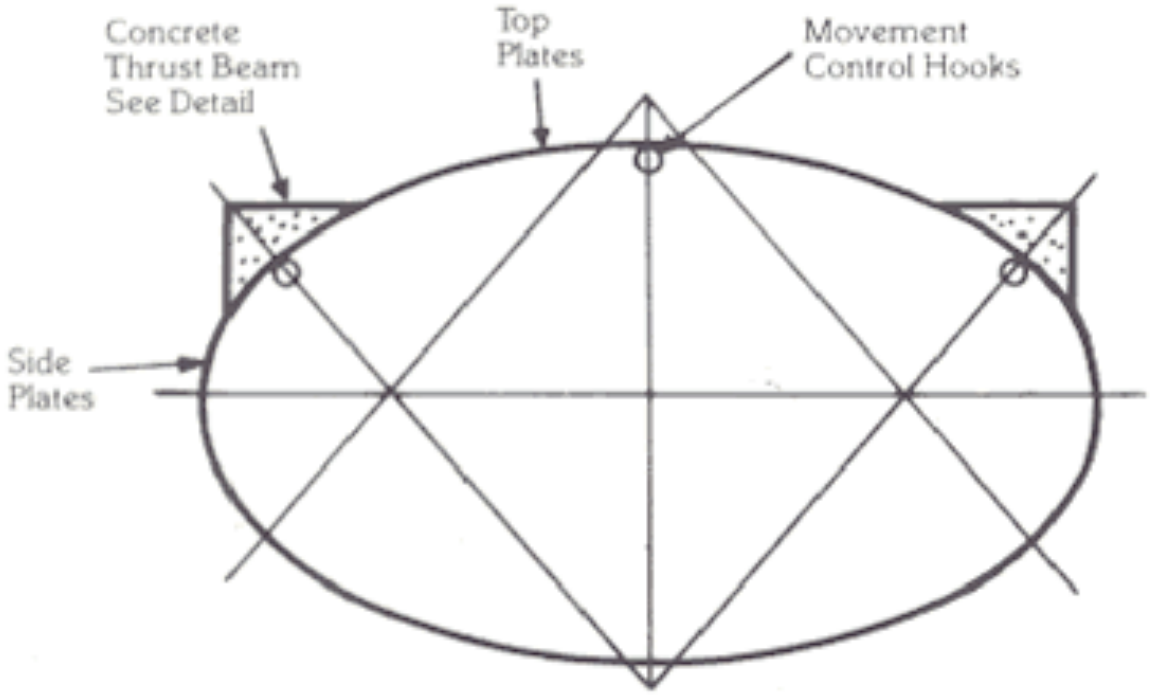
Top Radius (m)	Height Cover Minimum (m)
4.5	0.8
5.0	0.9
6.0	0.9
7.5	1.0

Typical Longitudinal Section

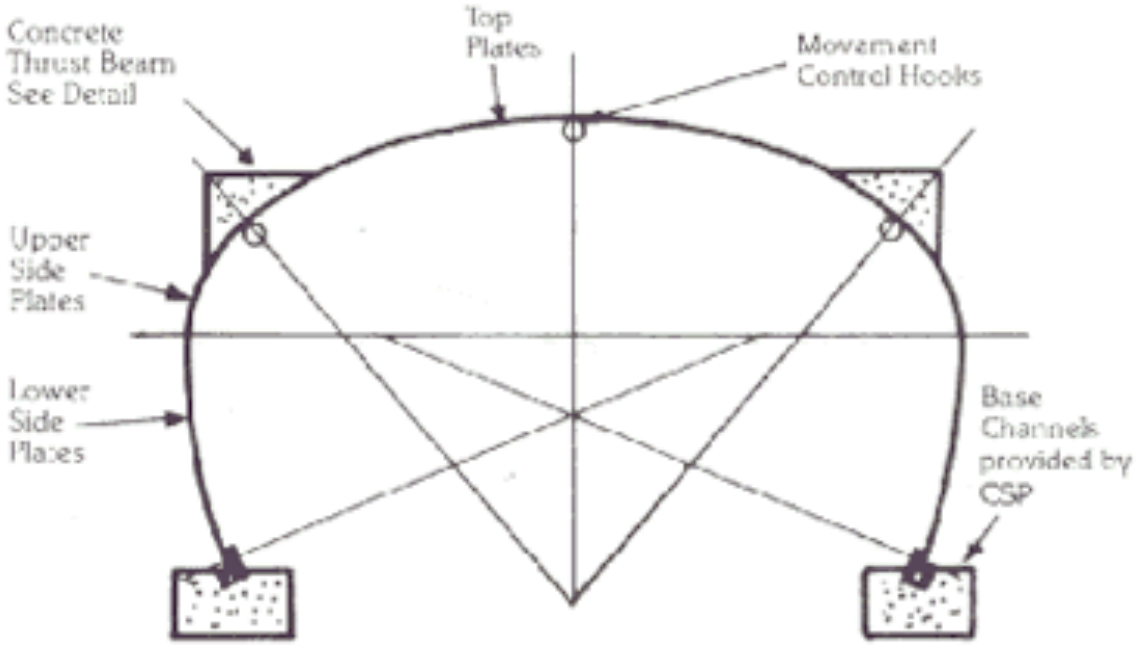
Concrete thrust beams are to be poured in a manner, which will ensure balanced loading while concrete is being placed.



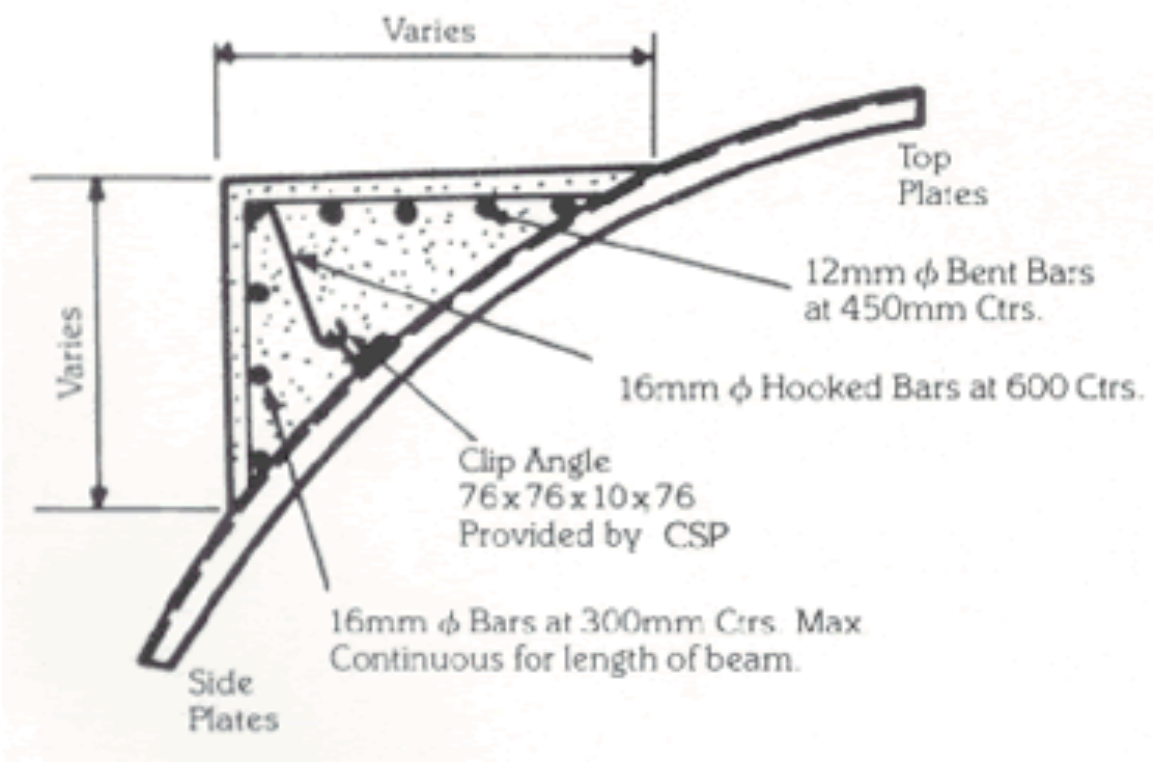
Typical Section Through Ellipse



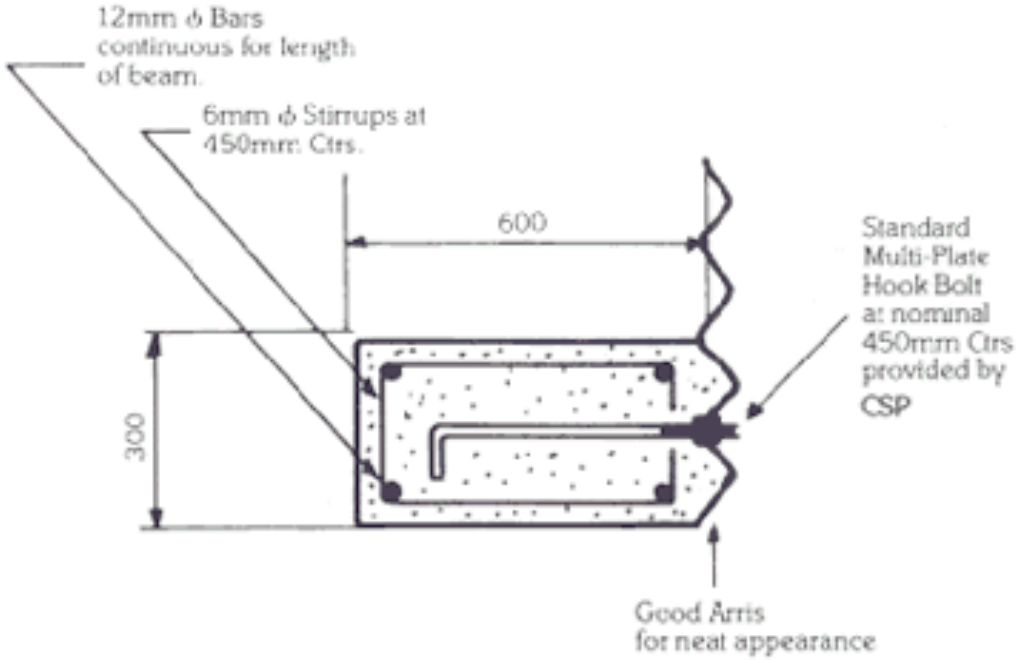
Typical Section Through Arch



Typical Thrust Beam Detail

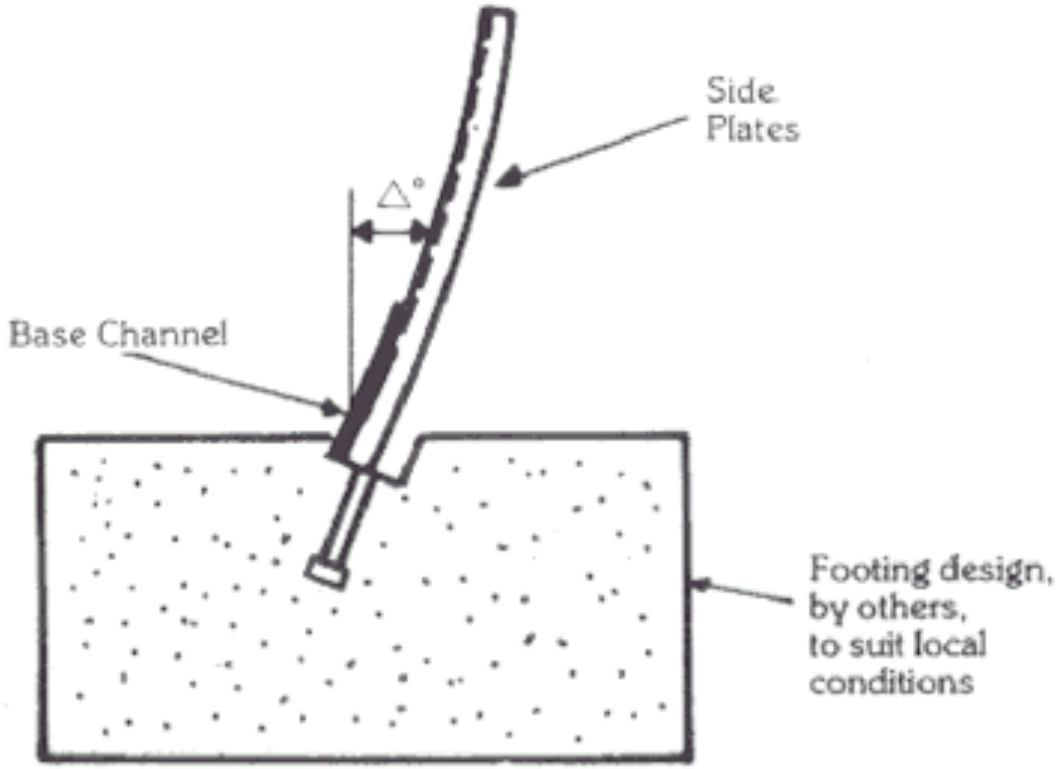


Typical Ring Beam Detail



Typical Footing Detail

Base channels to be cast into footing. Location and angle nominated by CSP Pacific.



Standards and Approvals

A SuperSpan structure is inherently a major engineering combination of steel and soil. CSP Pacific regards each installation as a unique project. CSP Pacific engineers check every SuperSpan structure with the analysis based on NZS