

2.4.1 SUBSTRUCTURES

2.4.1.2 ARCH ELEMENTS

GENERAL DESCRIPTION

Precast arch elements provide a cost-effective design solution for small bridging and tunnel-like applications.

Precast arches are predominantly produced as a single arch unit or as two-piece arch units connected at the crown with either a pin or moment type connection. Arch units are installed on an insitu concrete strip footing and are placed side by side to form the structure width.

Arch structures provide crossings over waterways, railways, roads, cycle and pedestrian thoroughfares. Where large expanses are to be crossed, then multiple arch spans placed one after the other can provide an aesthetically pleasing structure.

The fully-precast arch system includes spandrel walls running parallel to the arch ends and wingwalls to retain the backfill at the ends and sides of the structure.

COMPONENT DETAILS

The arch shape is designed to balance the horizontal and vertical applied loads, and minimise the bending moments in the structural element. Arch elements are designed to support fill permanent actions and vehicle imposed actions, as listed in AS 5100.

Precast arches are designed using a soil/structure interaction model. The arch element is normally designed using a finite-element analysis methodology, although, other simplified design methods such as beam-and-spring analysis may be acceptable. Where arches are designed on a project-specific basis, the arch profile can be designed based on funicular-curve theory, to minimise the moments in the completed structure.

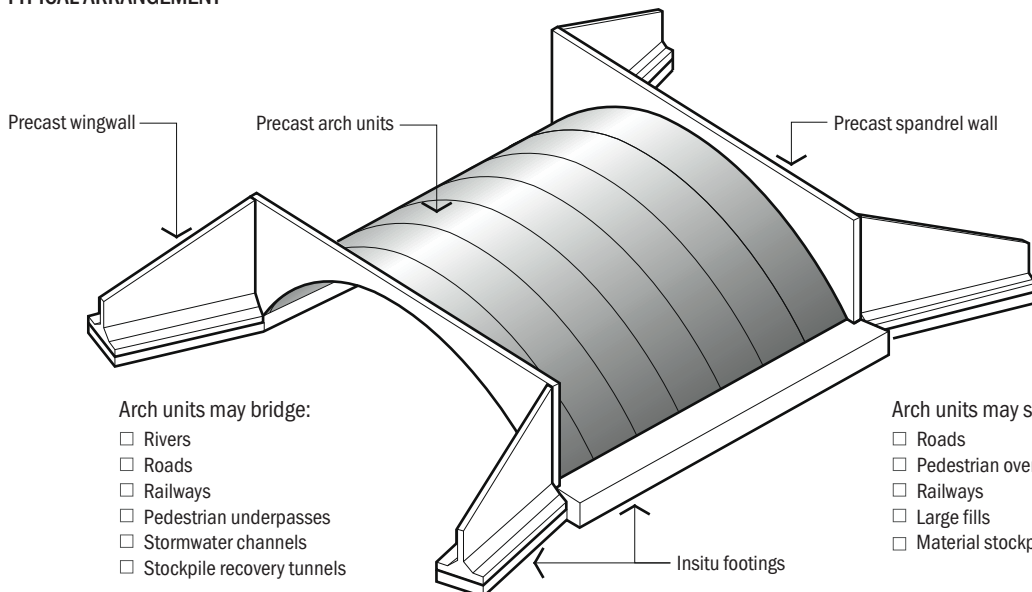
Precast arches have been designed to support in excess of 20 m of fill above the arch crown.

Site-specific designs can be provided for virtually unlimited load and fill-height requirements as precast arches typically can accommodate high compressive stresses.

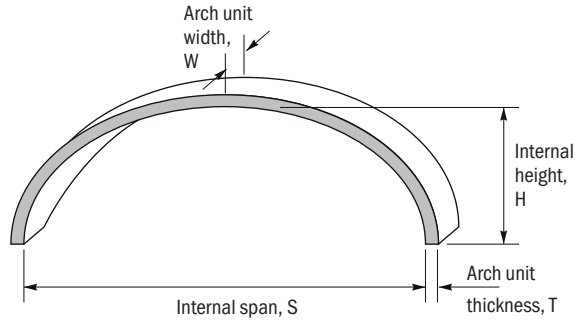
Precast arch units can be provided in standard sizes with spans ranging from 4.5 to 30.0 m and internal heights from 2.6 to 10.0 m. Manufacturers can customise designs for virtually any site configuration to suit project requirements. Transport and site handling capability can determine the limitation of the element span and height dimensions.

For spans over 15 m, it is customary to supply units in two pieces with an insitu joint at the centre.

TYPICAL ARRANGEMENT



TYPICAL ARCH PROPERTIES



Internal span, S (m)	Internal height, H (m)	Arch unit thickness, T (mm)	Arch unit width, W (m)	Half arch unit mass (t)
4.5	2.6	250	2.0	5.0
4.61	5.0	150	2.4	6.1
6.25	3.9	250	2.5	9.0
7.8	2.4	200	1.8	4.5
10.2	2.9	200	1.5	4.7
12.5	6.4	250	1.6	7.8
12.75	4.2	250	1.5	11.9
14.9	6.2	300	1.5	12.4
15.0	4.8	250	1.6	9.8
15.2	6.7	300	1.8	15.9
16.7	7.3	350	1.5	17.2
18.0	5.8	300	1.8	15.8
18.6	7.8	400	1.5	21.6
21.0	7.0	350	1.8	22.5

NOTE: For properties outside the above span range, refer to the precaster.