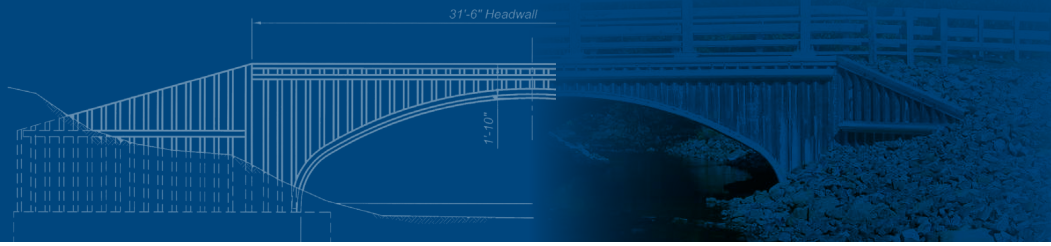

THRUST BEAMS AND TRANSVERSE STIFFENERS FOR LONG-SPAN STRUCTURES

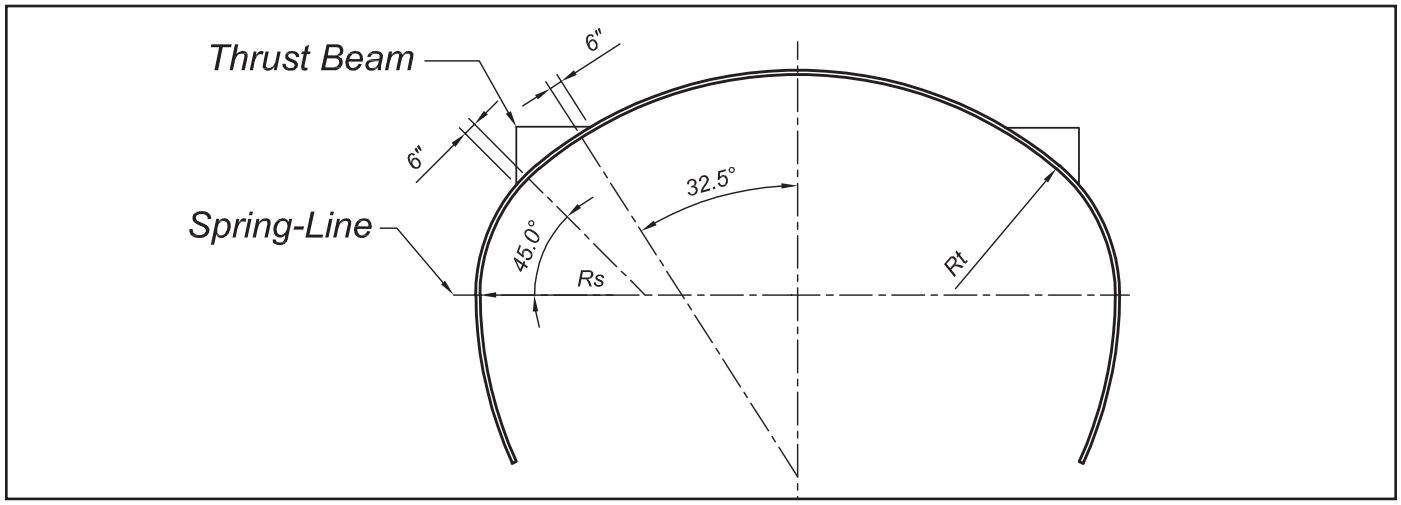

Figure 1 – Graphic layout of thrust beam extents

Thrust Beams

The thrust beams are a critical structural component of long-span structural plate structures. Thrust beams function as part of the structural backfill zone and are not sized as a conventional structural beam which is subjected to bending and shear. Thrust beams are used in the following ways:

Backfill – Thrust beams provide a perfect backfill material in the zone just above the spring line at a tangential radius change. In this zone, it is normally difficult to place and compact granular materials to specified density. The vertical face of the thrust beam provides substantial surface area to develop backfill support.

Fixity – Thrust beams provide a degree of fixity (rotation resistance) which is critical in allowing the large top radius arc to develop ring compression.

Load Distribution – Thrust beams function as a spreader or reaction block to distribute construction loads along the structure as backfill is placed over the large radius top arc.

The extents of the thrust beams are determined geometrically as shown in ***Figure 1***. Longitudinal reinforcing bars (typically #4 or #5) are attached to ¾″ diameter bent rods that are placed in pre-punched longitudinal holes. The bent rods are normally spaced 18 inches apart. The bent rods function as a support to hold the longitudinal bars in place during concrete placement as shown in ***Figure 2***.

Specifications for Thrust Beams

Placement – Thrust beams shall be formed and concrete placed and consolidated conforming to the plan dimensions. Forming and placement shall occur when granular backfill reaches the bottom elevation of the thrust beam.

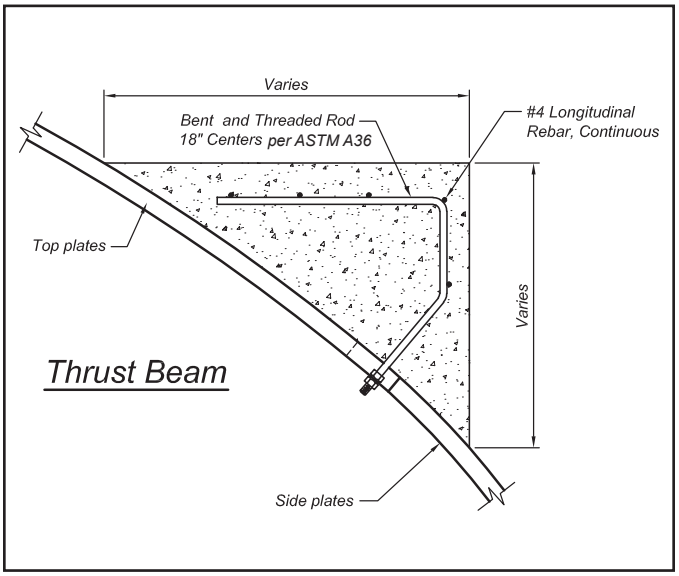

Figure 2 – Thrust beam and bent rod detail

Materials

Reinforcing steel: ASTM A615, Gr. 40 (Fy = 40 ksi min.) size and number of bars per plans.

Concrete: 2400 psi minimum compressive strength and conforming to the requirements of Class B Concrete per AASHTO Standard Specifications for Highway Bridges, Division II – Construction, Section 8 – Concrete Structures. Minimum cure time prior to resuming backfill operation is 36 hours or 24 hours for high-early strength concrete.

Forming, finishing and curing: No special finishing requirements are necessary. A rough surface finish (screed) is satisfactory. For structures exposed to de-icing salts or frequent moisture, a slight slope at the top of the thrust beam is recommended to provide drainage away from the structure. (See Technical Bulletin #7, "Protection from De-Icing Salts and Chemical Exposure")

Transverse Stiffeners

Transverse stiffeners are curved beams or ribs that are attached to the crown plates to provide shape control during placement and compaction of the backfill. These stiffeners are recognized by AASHTO Standard Specifications for Highway Bridges, Section 12.7.2.2 as "special features". These stiffeners are used for special long-span shapes that have a top radius greater than 25 ft.

Ring Beams: are generally fabricated from wide flange structural steel beams, curved to match the top radius of the structure crown. W8x18 grade A36 beams conveniently fit standard 6"x2" steel structural plate corrugations. Typical spacing between ring beams varies between 2 and 6 feet.

Aluminum Ribs: are generally fabricated from extruded aluminum ribs, curved to match the top radius of the structure crown. Ribs conforming to ASTM B-864 are spaced on the crests of 9"x2-1/2" corrugations. Typical spacing between ribs varies between 9 and 54 inches. Spacing and rib type is based on the structure top radius, plate thickness and plastic moment requirements as well as shape control during placement and compaction of backfill. On some structures, additional ribs are placed on the side plate to provide additional shape control stiffness. ***Figure 3*** shows examples of aluminum rib transverse stiffers.

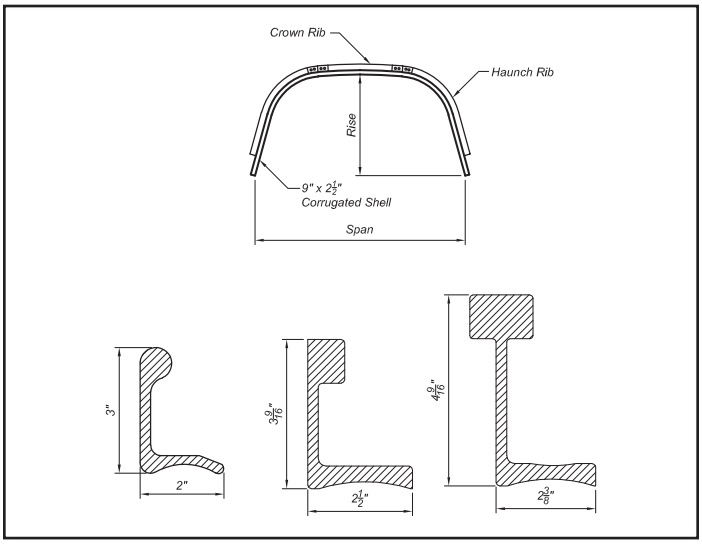

Figure 3 – Examples of aluminum Type II, IV and VI rib transverse stiffeners