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Hatches and Top Slabs

By Ronald Thornton, PE

One very common industry practice is to cast access hatches directly into the top slabs of precast vaults. This article discusses the transfer of load from the bearing surface of a hatch frame to the slab itself.

This detail is particularly critical if the hatch is subject to heavy wheel loads and the bearing surface is not directly supported by the wall of the structure as in the left side of Figure 2.

Slabs are typically designed without regard to any access opening. Subsequently, all bars interrupted due to the size and location of an opening are then replaced with additional reinforcing, half of which is placed either side of the opening. This practice adequately addresses the main reinforcing steel in the slab but ignores the ledge that is formed when the hatch is cast flush with the top of the slab, as shown. Our review of the details from several suppliers revealed that the design of nearly all traffic rated access hatches is such that load transfer occurs along this ledge (see Figure 1).

For example, consider an 8" thick roof slab and a 3.5" deep hatch frame, the supporting ledge below the frame is only 4.5". Without adequate reinforcing, this ledge is very likely to shear off under a heavy load. For design purposes, we compared the ledge to the dapped end of a beam and performed an analysis in accordance with PCI Design Handbook, Section 4.6.

Assuming a H20 wheel load of 16 kips plus 30% impact distributed over a width (e) of, say, 4.5' and applying a 2.17 load factor, per AASHTO, we have to resist an ultimate load (P_u) of approximately 10 kips/ft.

There are two (2) modes of failure that can result from this load. The first is flexural due to a bending moment (M) in the ledge. This force needs to be resisted by the bar labeled As (Figure 1). Since the ledge is too small to develop the As bar, either

by length or with a hook, an anchor bar needs to be placed transverse and welded to the As bars as shown.

The second failure mode is from a shear crack emanating from the inside corner of the ledge. The shear force is resisted by the Ash bar (Figure 1). This bar is placed vertically in the slab and hooked at each end for proper development.

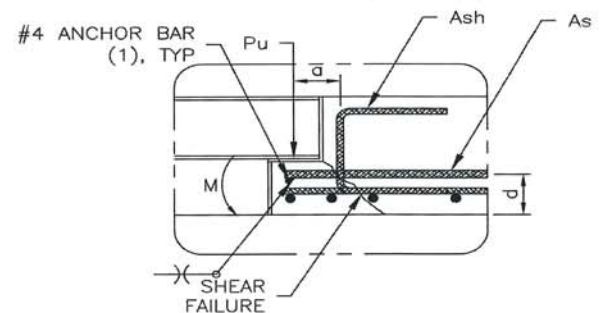


Figure 1

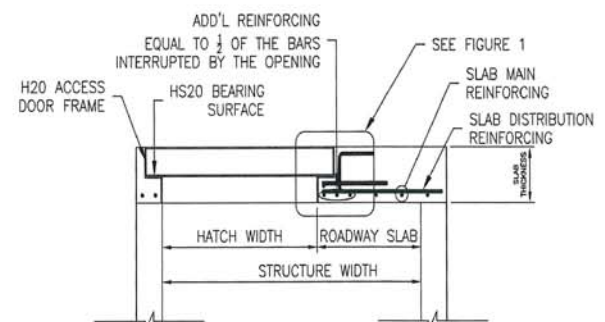


Figure 2

Figure 2 illustrates the proper reinforcing detail for a slab containing an H20 hatch. Please contact Delta for further information and project specific analyses to determine appropriate bar size and spacing.

Happy Holidays

The entire staff at Delta Engineers extends our most sincere wish to all of our clients, colleagues, and friends in the precast industry for a joyous and healthy holiday season. Although the economic outlook for 2009 may not appear too promising, we believe the industry can remain strong by working together to develop creative and innovative precast solutions.

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The Delta Advantage

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Featured Project

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This project included the specialty design of a 10'-2" x 14'-4" x 11'-2" ID precast junction chamber connecting two sections of 120" diameter RCP and one 60" diameter RCP. The contract plans showed this structure to be cast-in-place but allowed for an alternate precast design. The mid-seam construction of this unit made the installation a snap for the contractor.



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