Construction Concerns: Hollow Core Precast Concrete Plank

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Photo 1 shows a close-up of a truckload of hollow-core precast concrete plank being delivered to a construction job site. These plank are 12 inches (30.5 cm) thick and will become part of a floor-ceiling assembly separating two floors of offices. The plank on this truck are of two types: insulated and uninsulated. The insulated plank have their cores filled with expanded polystyrene foam; they will be used at the perimeter of the second floor, which is set back from the first floor, and they will be exposed to outdoor air temperature extremes. The uninsulated plank will be used in the building’s interior. Concrete plank can also be used for roofs.
Each plank has a label showing its manufacturer, its number from the building’s blueprints (2-1970), and its dimensions—48 inches (1.22 m) wide and 27 feet, one inch (8.25 m) long. The other numbers and codes on the label indicate its place, date, and time of manufacture and other information of interest to the manufacturer and installer. Some manufacturers also include on the label the estimated weight of the plank, which is of interest to the crane operator when setting the plank in place (photo 2).
Hollow core precast concrete plank are actually prestressed concrete. In photo 1, the ends of the steel cable tendons are visible as dark dots near the bottom of each plank. Each plank has a slight upward curve when it is shipped after the concrete has cured because of the tension in the tendons. This upward curve straightens out after the concrete plank are grouted together (photo 3) and several inches of concrete topping have been poured (photo 4). Hollow core precast concrete plank are also called “hollowcore”, “precast plank,” “prestressed plank,” and by their manufacturer’s brand names.
Photo 4 shows hollow core precast concrete plank set on steel girders with a small cantilever. The plank were cut out around the steel column in the foreground, and this cut-out was filled with concrete at the time the topping was poured. Precast plank are usually designed to bear on structural steel or walls of reinforced concrete or masonry between four inches (10.2 cm) and 10 inches (25.4 cm), although the bearing can be as little as two inches (5.1 cm) or as great as 12 inches (30.5 cm) depending on the design of the building, the span of the concrete plank, and the load to be imposed on the floor.

As in any type of prestressed concrete, the steel cable tendons in hollowcore precast concrete are under a great amount of tension. Cutting one or more tendons for installation of pipes or ducts or in breaching a concrete plank floor during rescue operations can cause the plank to fail and collapse. Exposed tendons can snap like whips if they are cut improperly or while they are still under tension.

Most concrete plank manufacturers will provide information so that small holes can be cut or core-drilled to install pipes or small ducts at the job site without weakening the plank by cutting too many tendons. For larger openings, the manufacturers will provide the plank in two pieces, with structural steel hangers to support the ends off the adjacent plank. Photo 5 shows a bottom view of the structural steel hangers used to support the cut ends of concrete plank at a duct opening. The wood framing supports the plywood hole cover and provides a curb against which the concrete topping will be poured. Photo 6 shows a top view of the same structural steel hangers, wood curb, and hole cover.
Most hollow core precast concrete plank with concrete topping can achieve a one-hour rating according to NFPA 251, *Methods of Tests of Fire Resistance of Building Construction and Materials* (ASTM E-119 and UL 263 are identical standards with the same title). They can be manufactured to achieve a two-hour rating by increasing the thickness of the concrete that covers the steel tendons in the bottom of the plank as well as by increasing the thickness of the concrete topping. A two-hour rating may also be achieved by spraying the bottom side of the concrete with one or more layers of a rated noncombustible insulation.

Hollow core precast concrete plank are commonly used in noncombustible (Type II) and fire-resistive (Type I) construction including in hospitals and other health care facilities, schools, office buildings, and in residential occupancies including hotels and apartment buildings. The bottom side may be the exposed ceiling as is common in hotels and office buildings. Or, it may be sprayed with acoustical insulation or another type of finish and painted. Or, it can be concealed above a suspended ceiling system.
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