July 28, 2010 — Leave a Comment

An Open Letter to Professional Engineers, Architects and Specifiers

Will a thicker top slab added to a normal-duty grease interceptor or septic tank be durable enough for heavy loads?

By Eric Barger

What's in a name? Everything – when it's your name. Your name accompanied by your professional seal attests to the quality of your design. A professional engineering stamp assures your client that your design is compliant with all applicable codes, standards and regulations – and further that it incorporates accepted engineering practices. In essence, you are saying: "I guarantee it!"

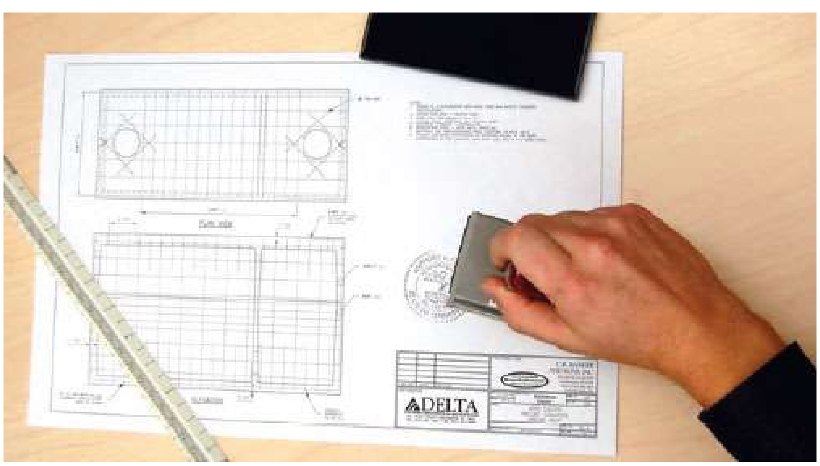
Often it is necessary to install a precast concrete grease interceptor or septic tank in a vehicular traffic area. The temptation for any tank manufacturer is to use existing molds to produce the tank. This temptation is very real, because investment in new molds specifically for traffic-rated applications is costly. Many factors add to the expense of a new traffic-rated product, and new molds are just the beginning of problems and extra cost relating to traffic-rated tanks.

Heavier traffic-rated precast structures have different requirements

Tanks designed to handle traffic-rated loads have thicker side walls and bottom and top slabs, and require larger equipment to handle their additional weight. Often the weight of a same-sized capacity tank can double when going from non-traffic-rated to a traffic-rated application. A new truck, boom and rigging may be required to handle and deliver the larger and heavier traffic-rated tank.

Many tank manufacturers do not have overhead cranes to strip products out of the molds, and if they do, the cranes are generally sized at the limit of their heaviest product. Consequently, introducing a new, much heavier product to the production line could also mean costly infrastructure upgrades to existing plants. Traffic-rated product requirements call for more than potential equipment upgrades.

An increase in concrete and a mix design with more portland cement for stronger 28-day ultimate strength are required for traffic-rated design specifications. Rebar must be cut and bent and placed precisely to ensure performance, adding man-hours and material cost to the product. Additional engineering is required to make sure the tank design is of sound quality to address any liability concerns. For a manufacturer, it can be an overwhelming feeling to consider the additional requirements of a new product, especially one that varies greatly from anything produced in the past.



order to forgo the additional expenses of adding a new tank to the product line. In this scenario, a tank with a thicker top slab is delivered and put in traffic-rated service without any further thought.

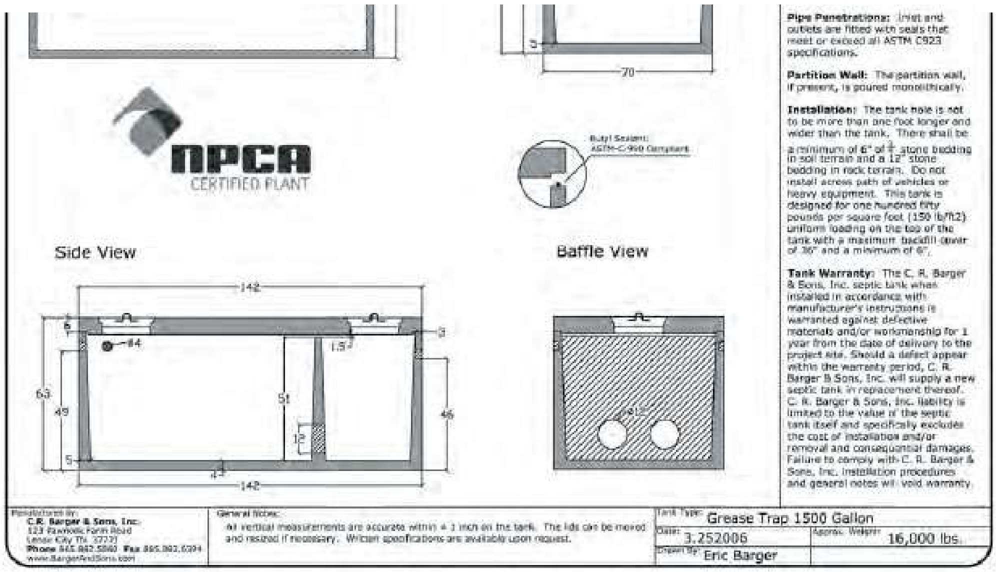
For every manufacturer watching their bottom line, holding investment cost down by not having a traffic-rated mold for every non-traffic-rated mold on the production floor may seem economically prudent. Many manufacturers fear losing a sale to a competitor because an engineered traffic-rated tank may be as much as two-and-one-half times the cost of a non-traffic-rated tank offered by a competitor who does not follow responsible industry practices.

Can existing molds designed to produce structures for non-vehicular loads be engineered to accommodate H20 traffic loads? Is this a safe and responsible practice, or is having separate product molds designed specifically for traffic-rated loads even necessary?

Entire precast structure carries the wheel load

What is HS20? HS20 loading is defined by the American Association of Highway and Transportation Officials (AASHTO) as a vehicle with an 8,000-pound (3,630 kg) front axle and one or more rear axles weighing 32,000 pounds (14,500 kg) each and spaced at least 14 feet (4.3 m) apart. Since the axle spacing is greater than the tank width, HS20 and H20 may be used interchangeably.

The entire precast tank is affected by the live wheel load and not just the top slab. Wheels adjacent to the tank result in a lateral surcharge force in addition to normal soil loads, and the upward bearing pressure applied to the bottom slab is the reaction in response to all of the downward forces combined, including the tank self-weight, soil loads above the tank lid, and all live loads.



A typical 1,500 gallon (5,680 L) non-traffic-rated tank with monolithic partition wall was chosen as the test subject for analyzing how non-traffic-rated tanks perform under live vehicle loading (Figure 1). This example is an actual precast concrete tank design that has been in use for more than 15 years as a non-traffic-rated tank. The lid thickness is 6 inches (150 mm) with an average wall thickness of 4 inches (100 mm) and a bottom slab thickness of 4 inches.

When the original design in Figure 1 was made, the thought of placing the tank in traffic areas was not an issue. But as land becomes more valuable and space utilized for parking becomes increasingly larger, the need to install a grease interceptor under a parking space or vehicular traffic area becomes greater. The liability aspect alone is enough to deter some manufacturers from producing a tank that can handle such loads altogether. It is a fact that tanks have collapsed in commercial drive-through lanes, private yards and parking lots where vehicular traffic was present but where the underground tank was not engineered or built for such live load applications.

Can non-traffic-rated tanks be successfully modified?

Engineering analysis demonstrates the tank design shown in Figure 1, initially designed for non-traffic use, can be made into a HS20 traffic-rated tank with careful engineering and many preconditions. Delta Engineers, Architects & Surveyors of Endwell, N.Y., performed the engineering analysis. The eight conditions are as follows:

1. 1 to 2 feet (0.3 to 0.6 m) of soil shall be over the top of the tank.
2. No more than one axle or two wheels shall be over

thicknesses cannot be modified.
5. The tank contains a monolithic compartment wall.
6. The water table shall be at least 3 feet (0.9 m) below grade when the tank is empty.
7. The walls are supported at the roof by an interlocking recess that is cast into the top slab.
8. Reinforcing bar size, spacing and location shall be installed per Professional Engineer recommendation.

Who is responsible when site use changes?

With a maximum burial depth of 2 feet (0.6 m), it is clear that the versatility of the tank in this analysis would be useful only in a narrow range of applications. There is a concern when burying a tank in a traffic area that the site may be razed in the future and/or the use may change. A business changing from a gas station to a truck stop would be an example of a drastic change that could cause the listed preconditions to be invalidated and the tank design to be inadequate in that situation. Designing for the worst-case scenario is not practical from an engineering or economics perspective.

Manufacturers today must address failures and costly litigation when an underground tank collapses or is damaged. For the future, specifying thicker side walls and bottom and top slabs will enable engineers to design a traffic-rated tank such that everyone can rest easy. When site conditions change years after today's tank is installed, will you be willing to accept the responsibility and possible litigation that would follow a structural failure?

When specifying traffic-rated tanks, many factors come in to play, and the last thing the industry needs is for a tank not designed for HS20 traffic ratings to be installed below a fast-food drive-through. A design that incorporates HS20 traffic loading along with the appropriate overburden depth and riser concentrated loads has to be taken into account when approving tanks for installation. Each of the eight assumptions listed are critical to the satisfactory performance of the modified traffic-rated tank when subjected to the loading conditions as described. Remember, the only way to verify that a tank is traffic-rated is to see the structural design stamped and signed by a licensed Professional Engineer in good standing that states the maximum design capacity in writing.

Eric Barger is president of Barger & Sons Inc. (www.BargerAndSons.com), a precast concrete manufacturer based in Lenoir City, Tenn. He currently serves on NPCA's board of directors as well as NPCA's Educational Foundation.