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Proof Testing to Achieve H-20 Load Rating Of Septic Tanks Reinforced With Forta Ferro Macro Fibers

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Abstract

Guardian Concrete paid an engineer to design septic tanks that will be H-20 rated. The engineer presented designs which include substantial steel reinforcing in the top slab, walls and floor of the tank. Using Forta Ferro Macrofibers, it is known that concrete can be effectively reinforced, if used in sufficient dosage. By substituting Forta Ferro, $170.00 in steel costs and 4 man hours are saved.

In this case, a tank was made with six pounds of Forta Ferro per yard of concrete, and no steel whatsoever in the side walls. The floor and roof were steel reinforced exactly as shown by the engineer's design. Another tank was made the same, with nine pounds of Forta Ferro per yard, and no steel in the side walls. A third tank was made according to the engineer's design, with steel in side walls, floor and roof.

The engineer, using ASTM C-1227 as a guide, calculated that to achieve H-20 Load Rating the tanks had to endure without damage, a negative pressure of 12.5 inches of Hg as produced by vacuum testing. This includes, as prescribed in ASTM C-1227, a safety factor of 1.5. 12.5 inches Hg is roughly equivalent to a load of 900 pounds per square foot (PSF)

The tank made with steel reinforcing only, and the one with six pounds per yard, each developed a tiny crack at 10.0 inches of Hg. But it is suspected that a small imperfection in the top slab may have caused that small crack. The one with nine pounds per yard held 12.5 inches Hg with no damage after removing the imperfection in the top slab.

The engineer drew a top slab with a vertical interlocking lip that helped stabilize the side walls during the test process. Guardian chose to make the top slab with a 45 degree bevel which interacted with the sidewalls.

Observations

Each tank was set on a bed of sand, which is thought to better equalize the load sustained by the floor of each tank. It was raining when the test started, so a portable tent was set-up to protect some of the equipment. Guardians boom truck handled the lids which were dry-fit before testing began.

The top slab is poured in a separate adjustable mold. The top of the tank portion is hand finished by one of the workers. The dry fit was pretty good. There were some spots with irregularities, so additional thickness of ConSeal CS-102 butyl gasket was employed to seal the joint.

Since the test procedure applies such a high physical load, most of which, impacts the side walls, it is important to have an interaction between the side walls and the top slab. While the engineer showed a rectan-

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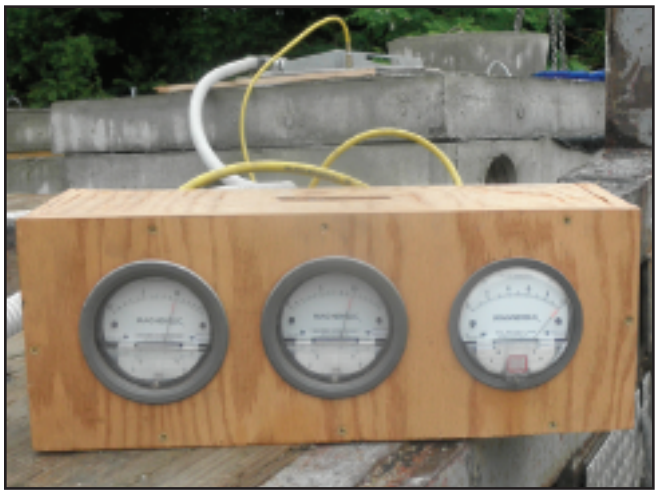
Proof Testing to Achieve H-20 Load Rating of Septic Tanks *(continued from page 1)*



gular portion on the top slab, Guardian chose to produce the bevel, which was easier to assemble. As the vacuum test proceeded, pressure forced downward on the top and inward on the walls. The two beveled edges help each other withstand the forces without damage.

The manhole opening at one end of the tank had to be torch dried. Then it was sprayed with adhesive, which held in place a special gasket from ConSeal, CS-367. CS-367 seals well enough to prevent leaks, but after the test, it easily releases. Regular CS-102 would seal so tightly that it would cause damage to unseal the structure. During the test, the manhole plug was sucked down into the opening. The gray CS-367 prevents leaks, while allowing easy disassembly. JEPCO SALES, LLC provided the test equipment.

One end of the tank was sealed with CS-367 while the other end provided access to the tank for the equipment. Because the 24 inch openings are tapered, the 26 inch diameter test plate would not cover the opening. Plywood with CS-367 under it, and with an opening cut in it helped seal the opening. CS-102 is a black butyl gasket. The weight of the concrete compresses it. Some excess butyl "squeezes out" indicating sufficient gasket material is in the joint to make a water tight seal. Neither water nor air ever passes through the gasket. In case of a leak, water sneaks past the gasket, where compression is insufficient. At least 50% compression is the goal.

Vacuum pressures exert a lot of force on a tank. When that happens, more of the butyl gasket squeezes out of the joint. As air is drawn from inside the tank, air pressure on the outside pushes inward on all six sides. The downward pressure is increased enough that we can simulate expected loads. A typical septic tank is buried less than three feet deep in a back yard. These tanks are made to sustain the weight of heavy trucks. They are suited to installations in parking lots and driveways.

At 12.5 inches of Hg on the gauges, the tanks passes the requirements for H-20 loading. Nine pounds of Forta Ferro Macrofiber per yard of concrete was used as the primary reinforcement in the sidewalls of the tank. The floor and roof are reinforced as directed by engineer's design. There is no steel in any of the sidewalls. Septic tanks made with steel reinforced floor and top slab, with nine pounds per yard of Forta Ferro Macrofiber, and no steel whatsoever in the side walls can be rated as H-20 septic tanks. A safety factor of 1.5, as called for in ASTM C-1227 is included in the testing procedure.

A tank made similarly with only six pounds per yard developed a tiny crack at 10.0 inches of Hg on the gauge. Without the safety factor included, this tank also passed the H-20 loading criterion. A slight defect in the lid may have caused the crack. A tank made exactly as shown by engineer's design, with steel reinforcement in top, floor, and sides, developed a tiny crack at 10.0 inches of Hg on the gauge. This tank is H-20 rated by Engineer's Design. The identical tiny crack appears to be related to the irregularity in the lid. The crack was in the same place and of the same size in both cases.

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Oldcastle Precast Provides Heavy Duty, Compact Stormwater Detention System for Nashville Fire Station

To detain stormwater runoff at the Metro Fire Station # 21, the Metropolitan Government of Nashville and Davidson County elected to remove an above ground detention pond and construct an underground stormwater detention system to gain back valuable land for parking during the recent replacement of the facility.

The first design of the new stormwater detention system specified 36" corrugated metal pipe but concerns regarding fire truck traffic loading on the system resulted in a change to 36" reinforced concrete pipe. This in turn could not be used as it would not fit in the required footprint under the facility's driveway.

In the final design, Oldcastle Precast's Storm Capture® stormwater management system was chosen and subsequently constructed under the entrance road, since it reduced the detention system width and overall footprint by over 40%, and easily fit under the fire station roadway.

The final system contained (16) Storm Capture modules at 3' tall, installed on top of (16) base slabs, for a total of 3,700 cubic feet of detention storage. In addition, (5) catch basins/storm structures, 15" & 18" reinforced concrete pipe, and (3) sanitary manholes were provided for the project. The installation of the entire drainage system was completed in (1) one day.

The detention system was a portion of the overall project to construct a new 21,000 square foot Fire Station for Nashville's Fire Department. Fire Station #21 is expected to achieve LEED Silver certification.

The Northeast Precast Products Association clearly explains **Why Precast Concrete Products?**

Strength: The strength of precast concrete gradually increases over time. Other materials can deteriorate.

Durability: Studies have shown that precast concrete can provide a service life in excess of 100 years,

Mass: Precast concrete products can act as effective barriers to vehicular traffic due to their size and weight.

Buoyancy: Precast concrete products resist the buoyant forces associated with below grade construction.

Environmentally Friendly: After water, concrete is the most frequently used material on earth. It is nontoxic, environmentally safe and composed of natural materials.

Watertightness: Precast concrete products produced in a quality-controlled environment and used with high-quality sealants offer a superior solution to water tightness requirements.

Ease of Installation: Although precast concrete is quite heavy, nearly all other competing materials require machinery for handling and installation as well.

Availability: With thousands of manufacturers throughout North America, precast concrete products can be ordered from plants in most cities or regions.

Efficiency: Precast concrete products arrive at the jobsite ready to install.

Low Maintenance: Precast concrete requires little or no maintenance, which makes it an ideal choice for nearly any design solution.

Congratulations to our Professional Members

listed on the ENR Top 20 Design Firms by Sector (4/29/13)

AECOM Technology Corp.: Transportation; Power; Hazardous Waste; Sewer and Waste; International Markets; Pure Designers; Top 500 List

CDM Smith: Transportation; Hazardous Waste; Water; International Markets; Top 500 List

AECOM Technology Corp.: General Building

M + W U.S. Inc: Manufacturing; Top 500 List

Greenman-Pedersen Inc: Pure Designers; Top 500 List

Vanasse Hangen Brustlin Inc: Pure Designers; Top 500 List

Bergmann Associates: Top 500 List

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Barton & Loguidice PC: Top 500 List

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