POLYMER CONCRETE PRODUCTS FOR UNDERGROUND CONSTRUCTION

CDR™ Enclosures and H-20 Applications

This technical bulletin is to help protect product specifiers and their firms from the high cost and liability associated with either over or under specifying underground utility boxes and covers. Very simply, if the application being specified is in a roadway or expected to see full deliberate vehicular traffic the ASTM-A16 or AASHTO H-20 designation should be specified. If the application requires a heavy duty cover because it may see – occasional or non-deliberate vehicular traffic, Tier 15 or Tier 22 boxes and covers should be specified.

The published test load for a Tier 15 cover is 22,500 lbs. over a 10" x 10" area. The published test load for a Tier 22 cover is 33,750 lbs. over a 20" x 20" area. When installed in combination with CDR™ underground boxes, these enclosures provide some of the highest performance levels available from composite materials today. While these test loads appear to exceed the ASTM A-16 and AASHTO H-20 requirements, they do not.

The live load specifications of the AASHTO H-20 and ASTM A-16 are for materials with codes that govern the design stresses. In today's composite industry, there are no such codes, and that is why we use test loads as proof of performance.

In the underground construction industry, confusion exists concerning AASHTO H-20 and ASTM A-16 load ratings. AASHTO "H" loads were developed to design bridges that are expected to experience full deliberate vehicular traffic. Any composite utility box and cover, whether it is a CDR™ product or that of another manufacturer, is well outside this framework.

The H-20 and A-16 load ratings are equivalent. This holds true for H-10/A-8 and H-15/A-12 as well. The intent of any of these designations is full deliberate vehicular traffic, such as in roadways.

A tremendous misunderstanding has been that if a product tested in excess of the design load, it was thought to be an acceptable product for the intended application. This is a gross oversight. There could be very minimal safety factors and what does a 1, 10, or 1000 cycle test indicate? A false sense of security could lead to personal injury and/or equipment damage.

In reviewing the design load process, a design load must be determined by adding all dead and live loads. A stress analysis is performed to determine the actual stress developed from the corresponding load and is compared to an allowable stress. This is where challenges arise in the composite industry. There are no recognized design codes for composites to provide allowable stress values. A better approach is to use a solid performance specification with intended usage of product as "non-deliberate vehicular traffic." This approach eliminates misunderstandings and still provides the end user with a satisfactory product, regardless of its composition or manufacturer.

CDR™ Tier 15 and Tier 22 covers are excellent products intended for use in areas subjected to "non-deliberate vehicular traffic." They are heavy duty covers that, when installed within these guidelines, will perform as well or better than any other on the market today.

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A number of polymer composite utility enclosures are available with a manufacturer's rating of H-20 or A-16 for in-the-road deliberate traffic applications. This paper will attempt to explain the flaw of extending specifications and tests for Portland Cement concrete to polymer composites, specifically polymer concrete.

The "H" ratings were developed by AASHTO in 1944 for the design of bridges. The number following the H represents the maximum expected truck weight in tons, i.e., H-15 is a 15 ton truck with 40% of its weight on each side of a single axle (15 tons x 2,000 lb/ton x 40% = 12,000 pounds).

ASTM uses the same vehicle loads, adjusted for the number of tire to pavement contacts for its "A" designations. A-12 means 12,000 pounds per rear wheel, the same as an H-15 truck. ASTM C-857 spells out the "design loading for underground precast concrete utility structures." ASTM C-478 is the actual "specification for precast reinforced concrete manhole sections." Section 13 of C-478 concerns flat slab tops like those found on utility enclosures.

ASTM C-478 Section 13.2 allows for acceptance based on a proof-of-design test. This is a static test of 130% of the dead load (rock, soil, and pavement) on the cover plus 217% of the sum of the live load plus impact load. This is satisfactory for reinforced concrete since the materials and steel reinforcement layout are outlined earlier in the specification to meet the requirements of ACI 318. This specification alone is not satisfactory for other materials such as steel, aluminum, unreinforced concrete or polymer composites, since it does not address deflection or fatigue issues, among others.

AASHTO M-199 agrees with ASTM C-478 on this topic. Section 5 allows for a proof-of-design test in accordance with AASHTO T-280 test methods. T-280 calls for the same static load as C-478. However, M-199 Section 5 also requires covers to meet the provisions of M-199, Section 7. Subsection 7.12 requires a minimum thickness of 6 inches for small covers and 8 inches for large covers.

Provisions are provided to accept covers outside these requirements. On a case-by-case basis, the owner or end user may approve other designs provided the designs meet or exceed the manufacturing requirements of M-199 Section 10. Section 10 requires a water/cement ratio of 0.53 or better and states the concrete shall consist of cement, aggregate and water with embedded steel.

The bottom line is that ASTM and AASHTO can set test loads and methods based on the narrow focus (precast reinforced concrete) of the specifications. These documents have been studied extensively and found to be well written with no loopholes to allow them to apply to materials other than reinforced concrete.

When the stakes are as high as they are in traffic situations, it is irresponsible to apply a specification designed for one very definite, well known material to a very different, less standardized substance. The safety of the general public should be paramount in the application of any material with public accessibility.

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