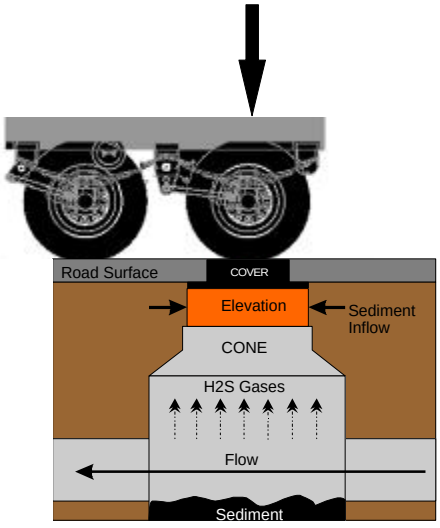
Underground Technologies White Paper – July 2007

Manhole Construction:

The elevation of a manhole frame and cover has been historically a tedious and injury ridden task. The main objectives of elevating a manhole to the adjacent surface are; structural integrity to handle the vehicle weights, eliminate sediment infiltration, create a structure that can hold up to the environmental gases and chemicals, lastly, obtaining a height that is flush with a desired surface. Elevations of manholes are done primarily with brick and concrete doughnuts. These methods present contractors' hurdles such as labor intensity, injury and quality. The focus of this article is to evaluate the elevation objectives and present a system which thinks out of the box and satisfies the requirements.

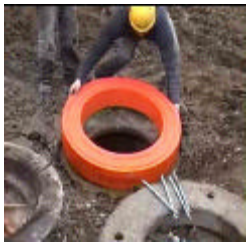
The manhole structure has to withstand vehicle weights as their tire patches pass over the manhole cover. This load is transferred to the exterior pavement, soil and elevation adjustment. Although there are specifications for structural integrity of the frame and cover and concrete makeup, there is no specification for the structural integrity of an adjustment course. The closest specification that pertains to manhole construction is the AASHTO HS-20,25. This specification series is primarily used for shallow depth piping located in a bridge structure. The specification is based on a 50,000 lb. vehicle with a load distribution across the tire patches. Without going into great detail, the maximum static load is 16,000 lbs. The maximum dynamic load is 21,800 lbs based on a wheel drop of 12 inches. Brick and concrete in a purely compressive state has no trouble in handling this weight. In some cases, structurally this could be considered overkill. Degradation of concrete, brick and mortar will change in compressive strength, not by material makeup but by direction of loading and homogeneity of the structure. This degradation can be cause by chemical damage, poor workmanship and poor energy dissipation. The manhole structure will never achieve its full compressive strength unless the construction methods are perfected.

Over a period of time, inflow allows sediment to infiltrate the chimney construction and settle at the base. The collection of sediment impedes flow and if not tended to periodically the collection will settle further back in the flow system. Chemical resistance of the construction limits the life of a manhole chimney. Concrete and Brick construction by its material nature are not impervious to Hydrogen Sulfide (H2S) gases emitted by human waste flowing through the sewer system. H2S gases will pit and deteriorate organic materials limiting the life span of the construction. The third characteristic of manhole construction is elevation quality and precision. The quality affects the smoothness of the road and the durability of the adjacent pavement. Current methods of brick and concrete rely on the skill of the installers and their prediction of the settlement of the mortar. To micro adjust, installers will use sticks, rocks etc. underneath a concrete doughnut which creates a fulcrum. Once weight of a vehicle loads on to the structure, the accelerated deterioration of the construction begins.



The Solution

Underground Technologies is a Troy Michigan based company that has developed a manhole adjustment solution that rids the industry of the current and ineffective methods of brick, mortar and concrete doughnuts. UGT has developed a polymer composite of high density engineered EPS and Polyurea. The UGT system provides many features that allow the contractors to provide a service with long lasting quality!



UGT products range from different diameters for storm and waste construction, as well as different heights which make elevation adjustment easy and accurate. UGT also provides angle rings which accommodate road and surface falloff. Using the UGT system, achieving height elevation can be accomplished in a matter of minutes with one person. The UGT lightweight can also make installation in hard to get to locations a breeze. The tools to install a manhole get minimized to a tape measure, trowel and a can of UGT's NEO Seal. No heavy duty equipment required!

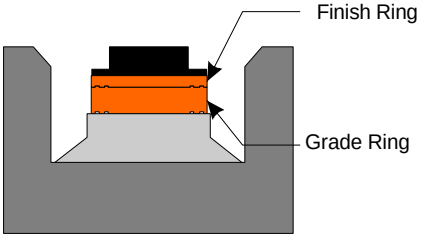
The design and materials of the UGT product, eliminates inflow by providing interlocking grooves to seal off between the stacked layers. NEO-Seal can be used between the first course and the cone, as well as the top surface and the frame. The additional seal, although not required will help the contractor maintain position when back filling and take up the voids of the top surface of the cone.

The proper material selection of the grade ring is part of UGT's solution. The engineered high density expanded polystyrene brings structural strength in compression as well as in tension. Its weight in nature allows the installer to concentrate on alignment and quality instead of the dread of moving a concrete doughnut or materials. The polyurea brings two items to the table; one is the coefficient of thermal expansion, and the second is chemical resistance.

The UGT ring has a combined coefficient of thermal expansion equal to steel. This material feature eliminates the effects of freeze thaw cycles. The product can withstand many freeze thaw cycles without the material cracking from expansion and contraction.

The second feature of polyurea is chemical resistance. The UGT Ring's coating is resistance to most chemicals such as gasoline, oils and most important, H2S or Hydrogen Sulfide Gas. This is the gas created from human waste in a sewer system. UGT's test sites included a manhole with primary access to Chattanooga Tennessee's treatment plant where exposure to H2S or Hydrogen Sulfide gas is extreme. The pictures show the intensity and the damage to the concrete structure. The UGT ring in this test site discolored but the structural and feature integrity remained intact.

Adjustment Capability



Achieving the correct height is unparalleled with other competing products. The UGT system uses grade and finishing rings to achieve the correct adjustment. The grade rings are used to take up most of the height while the finish rings do the fine adjustments. No more will the installers have to find sticks, rocks or additional mortar to get the right height. UGT provides a system which will elevate a manhole up to 9 inches to the quarter inch with just two rings. The interlocking features allow the installer to stack multiple grade rings for deep adjustments. The finish rings can be used for micro adjustments and achieving a flush installation with an angled surface. The time and labor to get the correct height is about 5 to 10 minutes with one person.

Structural Strength

The structural performance of the UGT manhole elevation system is revolutionary and counter intuitive. The largest ring, with a height of 7.5 inches weighs 13 lbs and can handle the weight of traffic and heavy duty vehicles. Product has been tested in the field and in the laboratory to show compliance to the AASHTO HS-25 specification. The picture indicates the compression strength of the UGT system. The excavator weight is 65,000 lbs. with negligible deflection.

Outer Veil

UGT also provides other products which eliminate inflow. NEO-Seal and Veil Safe provide solutions which replaces exterior encapsulation methods of mortaring or expensive and time consuming wraps. Each product provides the contractors an easy and efficient way of application and gives the customer a long term solution to stop inflow. With an application time of 10 minutes, the product will allow the back fill and surfacing within the same day which creates productivity and customer satisfaction.

Underground Technologies has been working on the development of products since 2005. The UGT 40 inch OD series was released at the beginning of 2007. The UGT 36 inch OD version will be released in the 4th quarter of 2007. Although this is a relatively young company, UGT has received state approvals in Michigan, Wisconsin, Alabama, and Tennessee. Additional states and municipalities are just on the cusp of approval. Underground Technologies is continuing to develop products for in-ground and underground use; stay tuned.