PVC PIPE news

Urban Myths Die Hard

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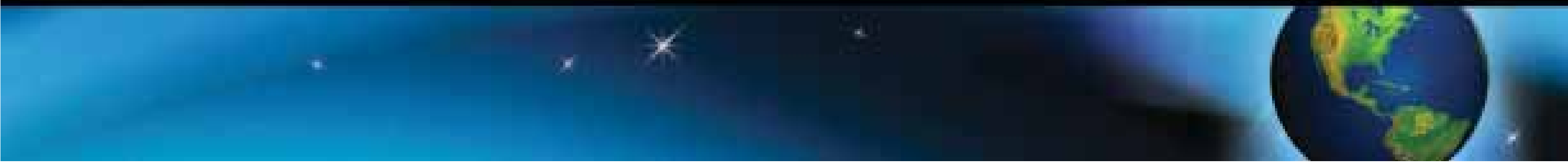
We all have heard about them; the giant albino alligators that lurk in the sewers of our cities. It doesn't matter that anyone has yet to actually see one; we "know" that they are there.

Even within the engineering community, myths prosper. One of the more persistent and least justified of the engineering myths claims that "PVC pipe can not be installed below xx feet deep". A simple analysis using well established engineering design methods show this "myth" is simply that, a myth.

Professor Anson Marston, of Iowa State University published the first study of soil-induced loads on buried pipe in 1913. M. G. Spangler, a student of Professor Marston, noted that flexible pipes may provide little inherent strength in comparison to rigid pipes, yet when buried, have a significant ability to support vertical loads due to passive pressures that develop as the sides of the pipe move outward against the earth. Spangler's work resulted in the publication of the Iowa Formula in 1941.

Iowa State University's contributions to flexible pipe design and installation continued when R. K. Watkins, a graduate student under Dr. Spangler, recognized the "modulus of soil reaction" or E'. This work resulted in the Modified Iowa Formula which is widely used for burial calculations today. Watkins also noted that model testing is not an effective method to establish values for E'. Many researchers have quantified values of E' by measuring deflections for pipes under which other conditions were known, followed by back-calculation through the Modified Iowa Formula. The most often cited work to develop appropriate values of E' was conducted by Amster K. Howard of the United States Bureau of Reclamation. Howard reviewed both laboratory and field data from many sources. Using information from over 100 laboratory and field tests, he compiled a table of average E' values for various soil types and densities. The data used in this study was taken from tests on PVC, steel, reinforced plastic mortar, and other types of pipe. Howard's study provides designers of all flexible pipes realistic guidance on E' values that can be achieved under field conditions.

When Watkins' and Howard's work is combined with ASTM/ANSI Standard D 2321, "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow

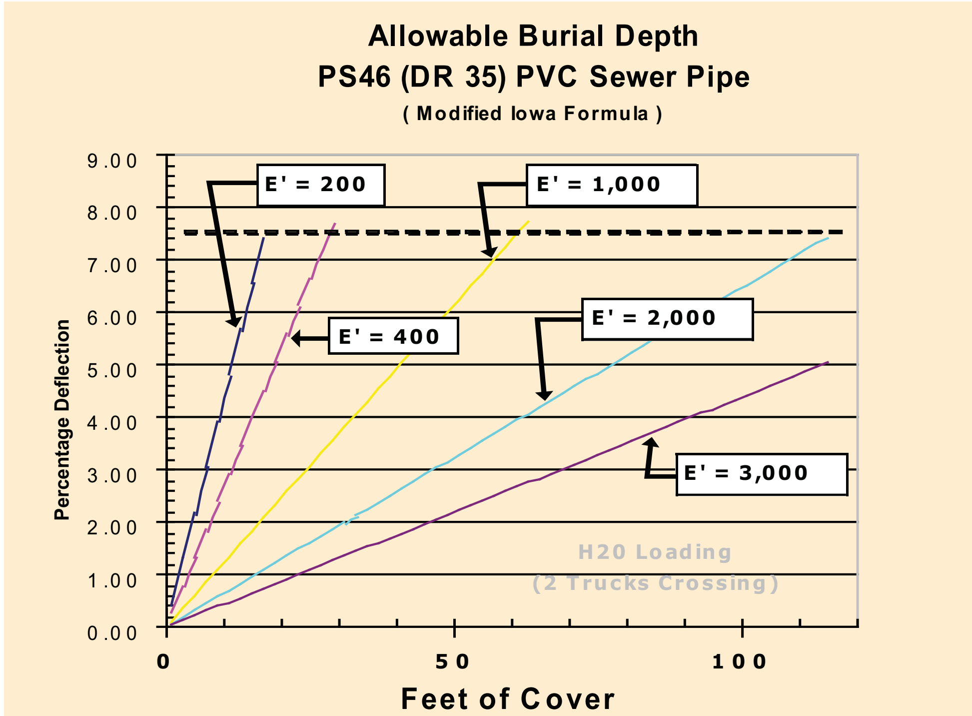


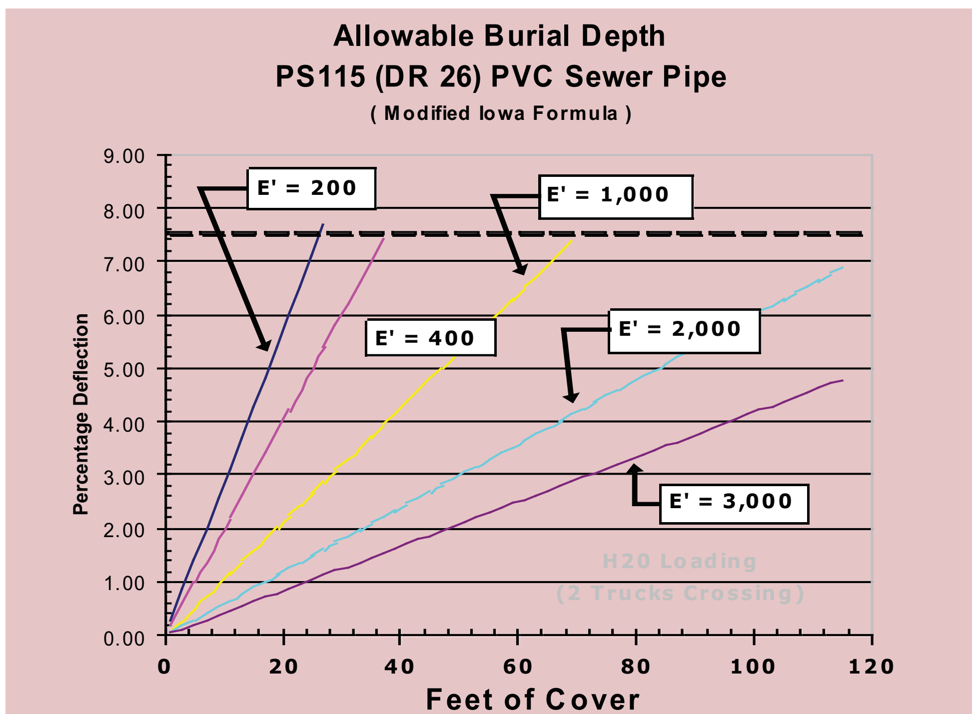
Applications" the design engineer has the necessary information to properly identify and specify embedment materials. D 2321 identifies soil types I through IV and provides detailed descriptions for each type material when used as pipe embedment and backfill. If a more detailed analysis of proposed embedment material is desired ASTM/ANSI D2487-06 "Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)" and ASTM/ANSI D2488-00 "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)" can be used.

Uni-Bell's "Handbook of PVC Pipe: Design and Construction" and technical publication "Deflection: The Pipe / Soil Mechanism" applies the conclusions of Watkins and Howard specifically to PVC products. In addition, Uni-Bell provides "External Load Design for Flexible Conduits Design" as free downloadable software at: www.uni-bell.org. This program allows the design engineer to easily solve the Modified Iowa Formula using the conditions appropriate to their specific project.

MOREOVER, PVC PS 46 (DR 35) PIPES HAVE BEEN SUCCESSFULLY INSTALLED TO DEPTHS GREATER THAN 50 FEET. THAT LEAVES ONE LESS MYTH TO WORRY ABOUT.

When the Modified Iowa Formula is solved for varying values of E', the relationship between the soil modulus and the in-situ ring deflection of PVC pipe is apparent. Many engineers feel that the use of "heavy wall", i.e. PS115 (DR 26), is required when specifying pipe for deeper applications. The following charts show that PS115 (DR 26) can be buried slightly deeper than PS46 (DR 35) under the same installation conditions. The charts also reveal that the E' value of the embedment is a much more significant variable than pipe stiffness for controlling PVC pipe deflection.





E' values of 2,000 psi and 3,000 psi are not required to limit the deflection of deep buried PVC pipe to the ASTM standard of 7.5 percent. When an E' of 1,000 psi is achieved around the pipe, PVC PS 46 (DR 35) pipe can be installed to depths greater than 50 feet. An E' value of 1,000 psi is easily achieved by placing a graded aggregate material, typically #57 crushed stone or equivalent, around the pipe and to the pipe's springline or above. If higher E' values are needed, these can generally be achieved by the additional application of slight to moderate compaction.

The alligators are still there. We all "know" that they are and someone will see one soon but the myth that you can not bury PVC pipe deeply will not withstand review using established and accepted engineering analysis. Moreover, PVC PS 46 (DR 35) pipes have been successfully installed to depths greater than 50 feet. That leaves one less myth to worry about.