Effect of Backfill Materials on the performance of Flexible Plastic Pipe

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Abstract

Plastic pipes are being used increasingly in water, waste water and transportation infrastructure applications. However limited information is available on the performance of these pipes under construction and long-term loads. Laboratory tests using testing chambers are being developed to study the parameters affecting the performance of plastic pipes. An attempt is being made to evaluate the performance of the plastic pipe under various backfills. Analysis of the strains revealed that there was a remarkable effect while placing and excavation of backfill, and not much deflection was observed during the dead loads.

1. Introduction

Plastic pipe such as polyvinylchloride (PVC) are being widely employed for infrastructure applications, like highway drainage, municipal sewers, water supply systems, and underground telephone conduit. They offer advantages in durability, application under various aggressive environments, ease of handling, and economics.

In designing these plastic pipes, the following factors are considered: deflection, ring bending moment, ring compression force, and buckling.

In this study soil box are being used to predict the performance of plastic pipe under various type of backfill, while placing and excavation, under dead loads. In the preliminary study the backfill material used was ASTM C33 sand, cemented-sand, Soil slurry and Control Low Strength Material (CLSM) are being developed for application.

2. Testing Program

A 8-in diameter PVC pipe 30-in length, was selected for this study. Parallel plate test was done on the pipe to evaluate the circumference strain on the inner and outside of the pipe under known loads ASTM D2412. Plates with slots were fabricated not to effect the strain gauges.

Ten strain gauges were glued to the plastic pipe. Four on the interior mid section, four on the exterior mid section in the circumference direction and two at the exterior ends in the longitudinal direction were glued using the M-Bond-200 adhesive after surface preparation. The loading was done by tightening a set of four rods on the side of the chamber. The rods were strain gauged and calibrated on the Tinius Olsen Universal Testing Machine. The bolts were tightened to apply the loads. The deflections were monitored at the inner mid section by a Linear Variable Differential Transducer (LVDT). Arraignments were made to hold the LVDT at the mid section. Slots were made on the side of the chamber so that the pipe projects out and instrumentation can be done from outside.

Backfill Materials

In the first attempt ASTM C33 sand was used and was rained into the chamber. The density achieved was 1.83 g / cc.

3. Conclusions

1. The maximum strength achieved by cemented sand in 14 days was 350 psi.

2. An relation between the tensile strength and compressive strength of cemented sand can be established. The compressive strength is 10-11 times the tensile strength.

3. The soil chamber is being further modified to induce additional load to test the behavior of flexible plastic pipe.

References

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