

INTRODUCTION

Highway drainage pipes are built using metal, clay, concrete or plastic. Since the early 1930's, MoDOT has continued to conduct various studies to monitor and evaluate the durability and performance of culvert pipe materials used in Missouri. Metal pipes are considered highly susceptible to corrosion, and a majority of the metal or steel pipe failures can be attributed to corrosion. Concrete pipes are susceptible to corrosion due to exposure to a low PH or the presence of sulfates in soil or water. High-density polyethylene (HDPE) is being used as drainage pipe because it is lightweight, corrosion resistant, easy to install, and has a low maintenance cost. However, as a newer material, the long-term performance of HDPE pipe is still under evaluation.

STATEMENT OF PROBLEM/SCOPE OF WORK

Polyethylene pipe has been installed in Missouri since 1983 and continues to perform. In 1999, the first 60" (1500mm) N-12 HC[®] HDPE pipe was installed in St. Clair County, MO. Before this, the HDPE pipes being installed had smaller diameters because there is no AASHTO designation for plastic pipes with diameters larger than 48". One year later, another 60" HDPE pipe was installed in Franklin County, MO.

These two 60" HDPE pipes were installed as crossroad culverts to evaluate their performances. For such large diameter flexible pipe, one main concern is its wall stability. This study approached this issue by monitoring the pipe deflections and joint separations.



Figure 1. 60" (1500mm) N-12 HC[®] HDPE Pipe

CURRENT RESEARCH RESULTS

MoDOT District 7 maintenance crews installed the first pipe (referred to as Pipe 1) in June of 1999 on Route B, St. Clair County. The second 60" pipe (referred to as Pipe 2) was installed in August 2000 on Route FF, Franklin County by Krupp Construction.

RDT personnel observed both installations. Since the installations, pipe deflections have been monitored. Based on field observations and data analysis, this study concludes that Pipe 2 is performing better than Pipe 1. The most distinguishable factor, which may contribute to this performance difference, is the different compactions these two pipes experienced during the installations. Pipe 2 had much better compaction than Pipe 1 both in bedding and backfilling procedures.

AASHTO Section 30(Installation) now recommends the deflection be less than 5% of the actual inside diameter 30 days after installation. MoDOT Standard Specifications 730.7 specifies that the internal diameter of the pipe should not be reduced by more than 5% of its base inside diameter when measured not less than 30 days following completion of installation. 42 days after installation Pipe 1 had a maximum deflection of 7.3%, exceeding AASHTO Section 30 recommendations and MoDOT specifications, which is not acceptable. Two years and four months after the installation, the maximum deflection was measured as 8.4%, which is not acceptable, either. Since excessive deflection may lead to pipe cracking, Pipe 1 may require maintenance or replacement sooner than Pipe 2 due to installation procedures, and most likely not due to the actual material or manufacturing of the pipe itself.



Figure 2. Pipe 1 Bedding Compaction



Figure 3. Pipe 2 Bedding Compaction

Pipe 2 did not get a perfect installation, but it is performing well. The two-week-after-installation deflection was rather small. One year after the installation, the maximum deflection was 5%, and the deflections at other points were considerably lower.

Both pipes have joint separations. Pipe 1 had a maximum of 1 3/8" two years after installation, while Pipe 2 had a 2" maximum one year after its installation. But considering the bell overlaps the spigot by 9.57", there may be no threat of leaking. Existence of long-term undermining is not known at this time.

RECOMMENDATIONS

Both pipes should be inspected yearly to monitor their performances and be documented accordingly. Any immediate repairs necessary will then be forwarded to the appropriate maintenance personnel. If there are other large size HDPE pipes to be installed in Missouri, this study recommends proper installation procedures be followed.