

Research Report
KTC-89-45

CONSTRUCTION AND INSPECTION
REPORT ON CORRUGATED
POLYETHYLENE PIPE, N-12

by

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EXECUTIVE SUMMARY

This report documents the installation and performance of N-12 pipe installed during construction of South Forbes Road in Fayette County, KY 54 in Daviess County, and US 62 in McCracken County. The pipe is manufactured by Advanced Drainage Systems, Inc., and is designated as ADS N-12. ADS N-12 is a corrugated high-density polyethylene (HDPE) pipe. The pipe has a corrugated exterior for increased strength and smooth interior to provide maximum flow capacity and rigidity.

The N-12 pipe requires less equipment and fewer personnel than steel or concrete pipe for installation. More care must be exercised in placement and backfilling of N-12 pipe. The crushed No. 9, stone used on Forbes Road and the sand backfill, used in Daviess County appeared to work well for N-12 installations. No deflections were apparent during visual inspections at either site. Several of the pipes on US 62 in McCracken County showed signs of compression after installation. The pipe was inspected some time after backfilling had been completed. It appears the deflections noted within a number of the pipes were due to heavy equipment running over the pipes having minimum soil cover. Some settlement was noticeable in a gravel drive. Future inspections in McCracken County, on US 62, will help clarify if any of the deflections in the entrance pipes could be due to normal traffic loading or due to improper installation.

From visual observations at all three sites, it is apparent the ends of the pipes at the couplings are rarely butted completely together. This permits material to be deposited in this area. Care should be taken during construction not to damage the plastic pipe during transportation.

INTRODUCTION

This report documents the installation and performance of N-12 pipe installed during construction of South Forbes Road in Fayette County, KY 54 in Daviess County, and US 62 in McCracken County. The pipe is manufactured by Advanced Drainage Systems, Inc., and is designated as ADS N-12. ADS N-12 is a corrugated high-density polyethylene (HDPE) pipe. The pipe has a corrugated exterior for increased strength and smooth interior to provide maximum flow capacity and rigidity.

The purpose of the study was to evaluate the performance of the pipe during construction and after placement.

FORBES ROAD INSTALLATION

In November of 1987, the first section of N-12 pipe installed in Kentucky was along Forbes Road in Fayette County. The pipe was installed in two locations. The first was 28 feet right of Station 6+54. The 15-inch N-12 was used as an entrance pipe. The entrance pipe was backfilled with approximately one foot of material. The second location starts at a storm sewer inlet and runs 240 feet north to a manhole; this N-12 is used as a 15-inch culvert. The pipe was backfilled with No. 9 stone to approximately one foot above the top of the pipe. The remainder of the trench was backfilled to grade elevation with excavated material. The maximum fill height was approximately 6 feet.

The pipe was visually inspected on November 19, 1987, and September 21, 1989. Random measurements were taken of the internal diameter of both pipes. The measurements indicated there had been little to no distortion of the pipe diameter since construction.

The pipes also were inspected for chemical or physical deterioration or defects. The inlet, outlet, and manholes were examined and photographed. There were no signs of deterioration or weakening of the N-12 pipe.

Both drainage systems were inspected for potential clogging. No signs of clogging were observed. The entrance pipe had approximately 2 inches of organic material in the first 6 inches of the inlet in 1987. The 1989 inspection revealed leaves and paper products accumulating in the ends of the pipes. The accumulation of material appeared to be due to an improper grade of the ditch at the outlet end.

KY 54, DAVIESS COUNTY

Construction Inspection

During the relocation of KY 54, in Daviess County, approximately 468 feet of 15-inch N-12, and 592 feet of 18-inch N-12 were installed. Table 1 includes the location of each pipe section, length, and pipe size.

Table 1.

Station	Diameter (inches)	Length (feet)
109+00 RT.	15	28
111+00 LT.	15	196
129+00 LT.	15	76
130+00 LT.	15	96
141+73 86' LT.	15	36
142+08 71' LT.	15	36
111+00 LT.	18	64
126+00 RT.	18	24
128+20 RT.	18	216
128+20 LT.	18	64
137+88 RT.	18	104
142+00	18	92
145+50 RT.	18	28

The project begins at Station 93+81.17 and ends at Station 152+00. The first section of N-12 pipe was placed May 18, 1988, at Station 137+88. Approximately 104 feet of 18-inch N-12 were placed at that location. The trench was backfilled with a coarse, clean sand approximately midway up the pipe, and compacted with a vibratory tamper. The remainder of the trench was backfilled with excavated material (Photo 1).



Photo 1. Compacting sand backfill around 18-inch N-12 pipe in Daviess County.

Prior to installation, it was observed that a number of the pipe sections had been cut during construction. It appeared that the sections had been damaged during transport with a backhoe. The damaged sections were returned to the manufacturer for inspection (Photo 2).

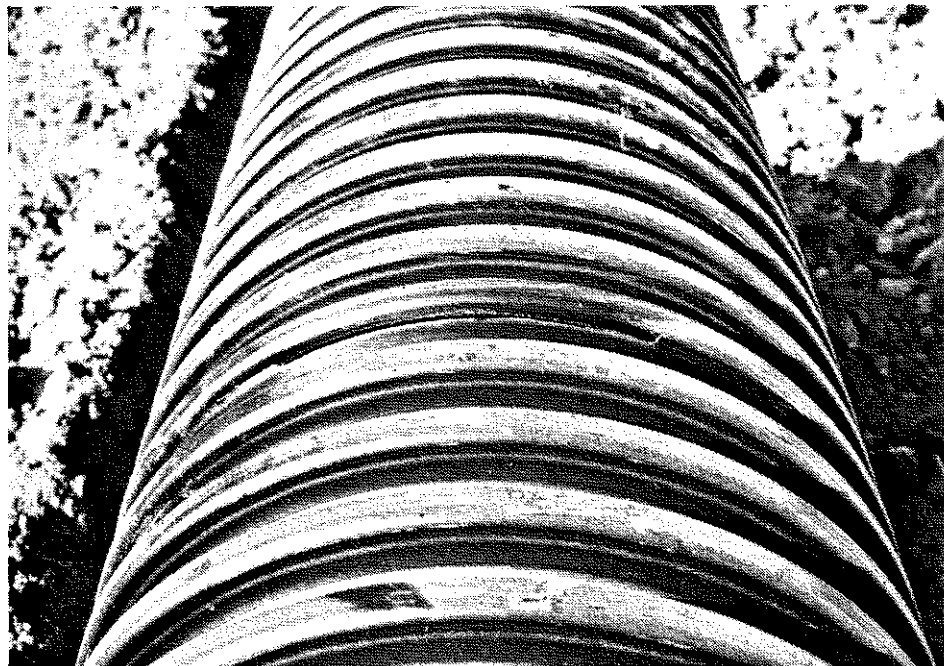


Photo 2. Damaged 18 inch N-12 pipe.

During construction inspection, it was apparent the pipes were becoming clogged due to the time interval between placement of the pipe and the headwall (Photo 3).



Photo 3. Silted pipe in Owensboro.

Monoritoring Points

Two sets of monoritoring points were placed in the pipe at Station 137+88 prior to installation. The monoritoring points were placed at 41 feet and 61 feet from the outlet. The points were monoritored three times in 1988 and on September 18, 1989. Since installation, the interior of the pipe at 61 feet had deflected approximately 0.42 inch, and approximately 0.25 inch at 41 feet (Figures 1 and 2). The fill height above the 61-foot monoritoring point was 6 feet, and the fill height at the 41-foot monoritoring point was 8 feet.

Monoritoring points were also placed at Station 122+50. Since installation, the interior of the 18-inch pipe has deflected 0.34 inch (Figure 3). Eight additional monoritoring points were placed in the pipes prior to installation. Due to water and mud, the monoritoring points could not be accessed during the last inspection.

Visual Inspection

All pipes, including the 18-inch and 15-inch were inspected and photographed. All appeared to be symmetrical. On June 18, 1988 during the inspection of the 104-foot, 18-inch pipe at Station 137+88, a rip or cut was noted in the smooth interior lining of the pipe. The rip follows one of the corrugations and is approximately seven inches in length (Photo 4). The rip was closely inspected again on September 18, 1989. The rip appeared to be approximately the same length and had bulged approximately a one half-inch.

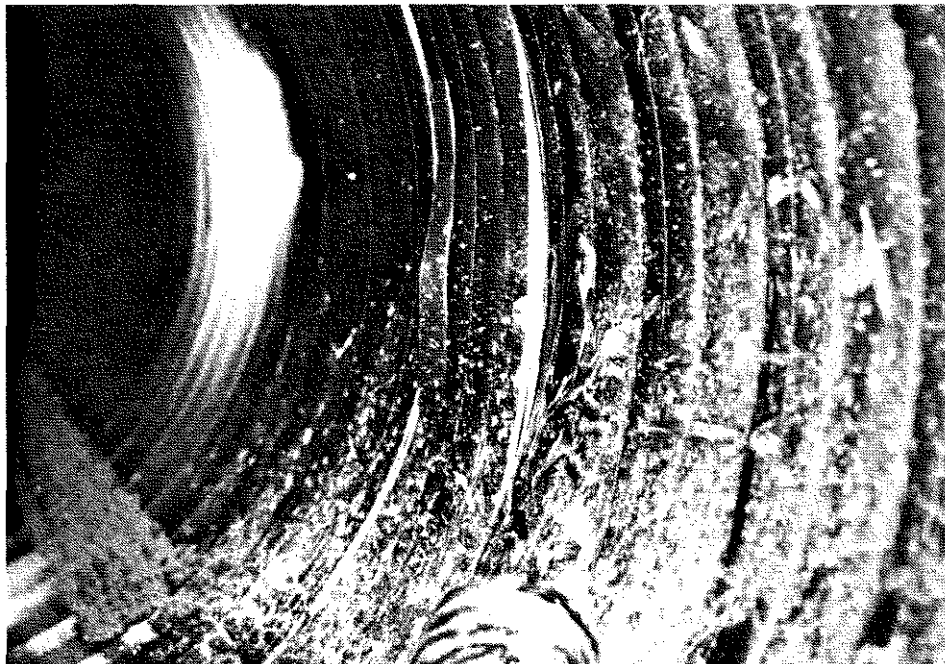


Photo 4. Rip or cut inside an 18 inch pipe.

The interior of a 216-foot 18-inch pipe was inspected in detail on September 19, 1989, from Station 126+00 to 128+20. Each 20-foot section was photographed and visually inspected. The pipe appeared to be clean and symmetrical. A four-inch gap was discovered between the first and second joint south of Station 128+20 (Photo No. 5). It was apparent that the sections were not completely butted together at the time of installation. All other joints were inspected and their conditions were recorded. The next largest separation was one inch. A one half-inch separation was fairly common throughout the pipe section.

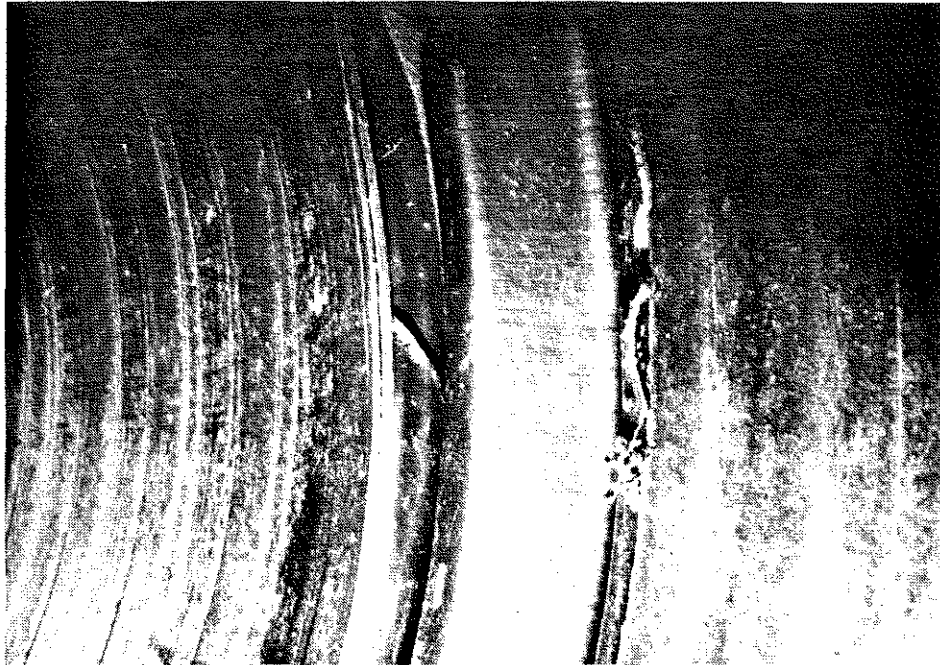


Photo 5. Four-inch separation between the two connecting pipe ends at the coupling.

Large amounts of soil and rock had been deposited in two of the pipes leading to the manhole at Station 137+95. It is apparent the material had entered during construction through the grated inlet adjacent to the manhole . Photo No. 6 and Photo No. 7 shows the two partially clogged pipes.



Photo 6. Partially clogged 18-inch pipe.

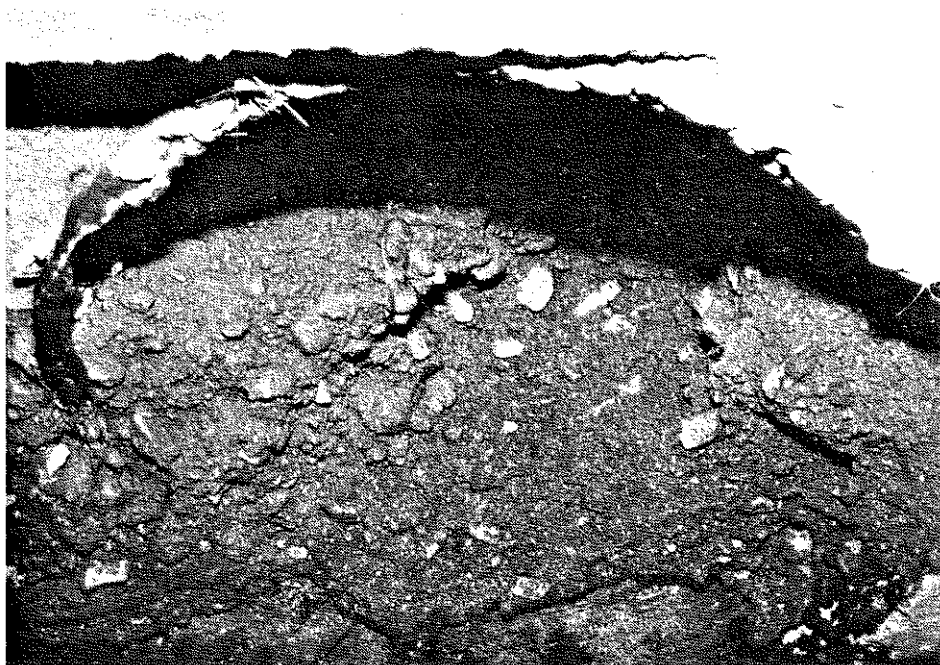


Photo 7. Partially clogged 15-inch pipe.

US 62, McCracken COUNTY

On September 18, 1989, all the entrance and culvert pipes were visually inspected and photographed. The sizes of the pipes installed were 15, 18, 24, and 30 inches. Several of the pipes showed signs of compression. It appears the pipes had been rendered irregular during backfill operations. Appendix A is an inspection log of each pipe. Following is a collection of photographs having captions describing the conditions of the pipe.



Photo 8. Compression in a 24-inch entrance pipe at Station 174+00.



Photo 9. Inloader tracks are present in the thin soil cover above the compressed pipe (Station 167+50).



Photo 10. Pipe deflection at Station 167+50
(18-inch pipe).

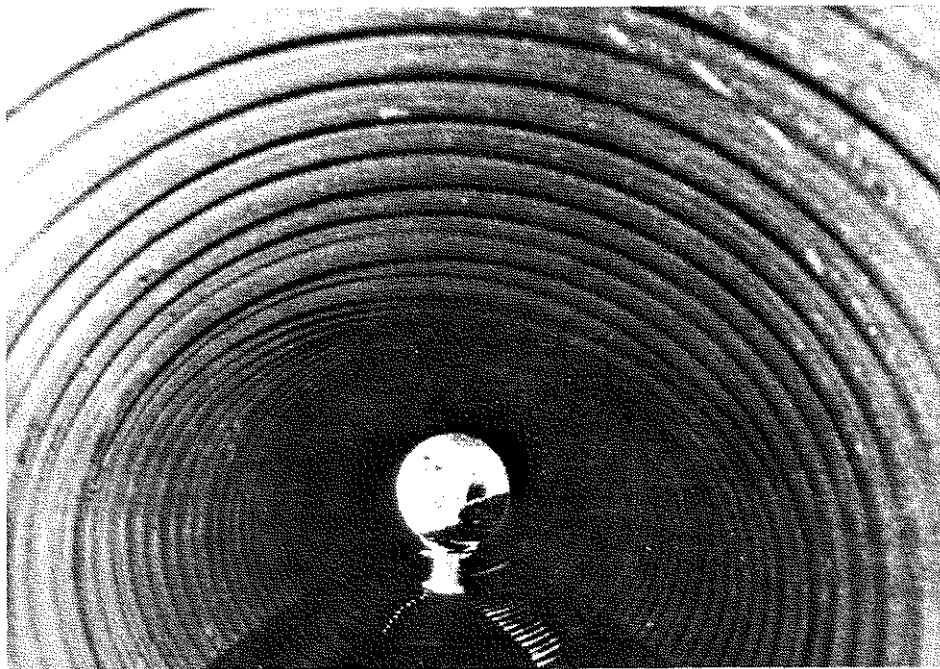


Photo 11. Compression in a 24-inch entrance
pipe at Station 138+50.

Figure No. 1: 18-Inch N-12 Ky 54, Daviess County, Station 137+88

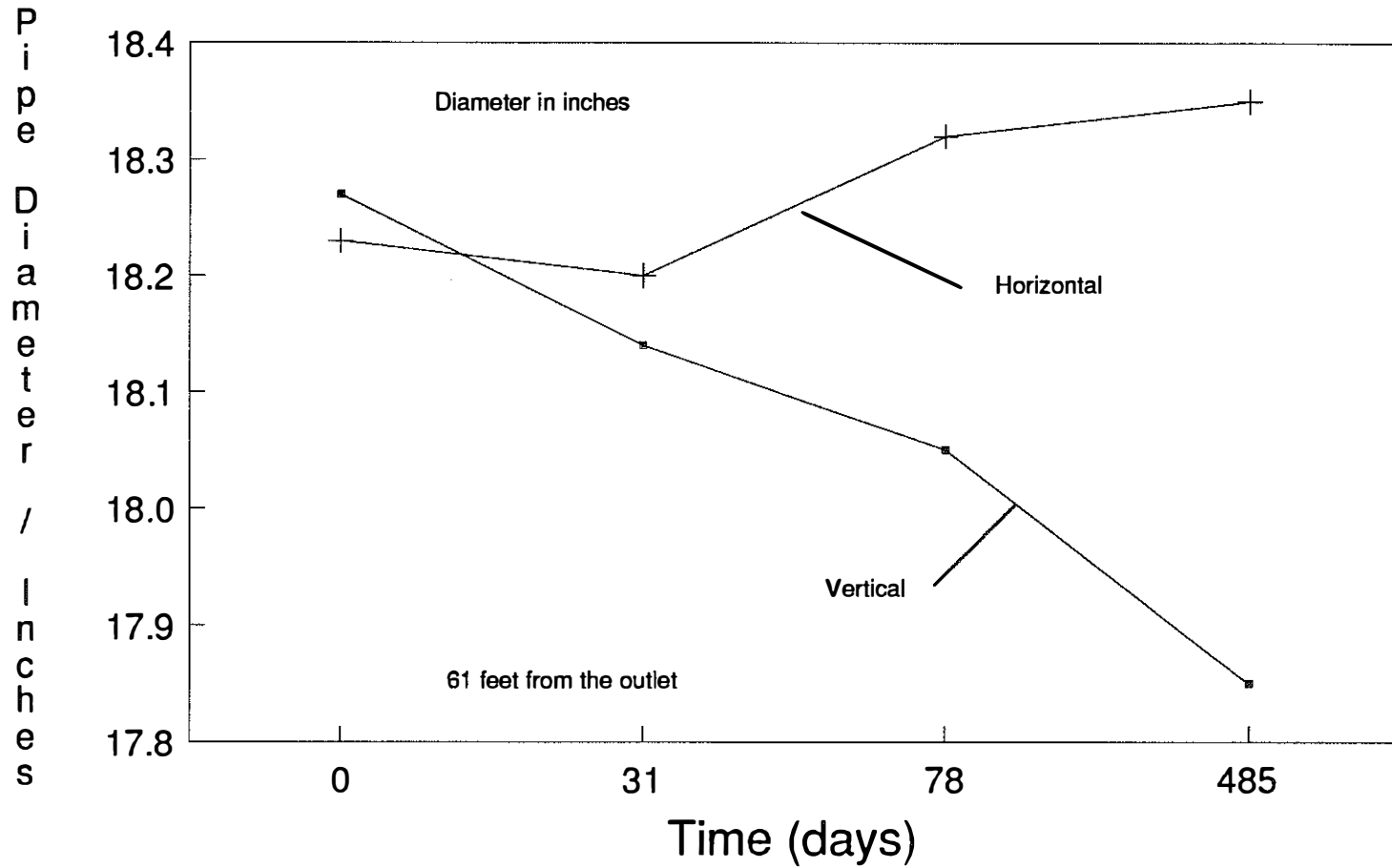


Figure No. 2: 18-Inch N-12 Pipe

Ky 54, Daviess County, Station 137+88

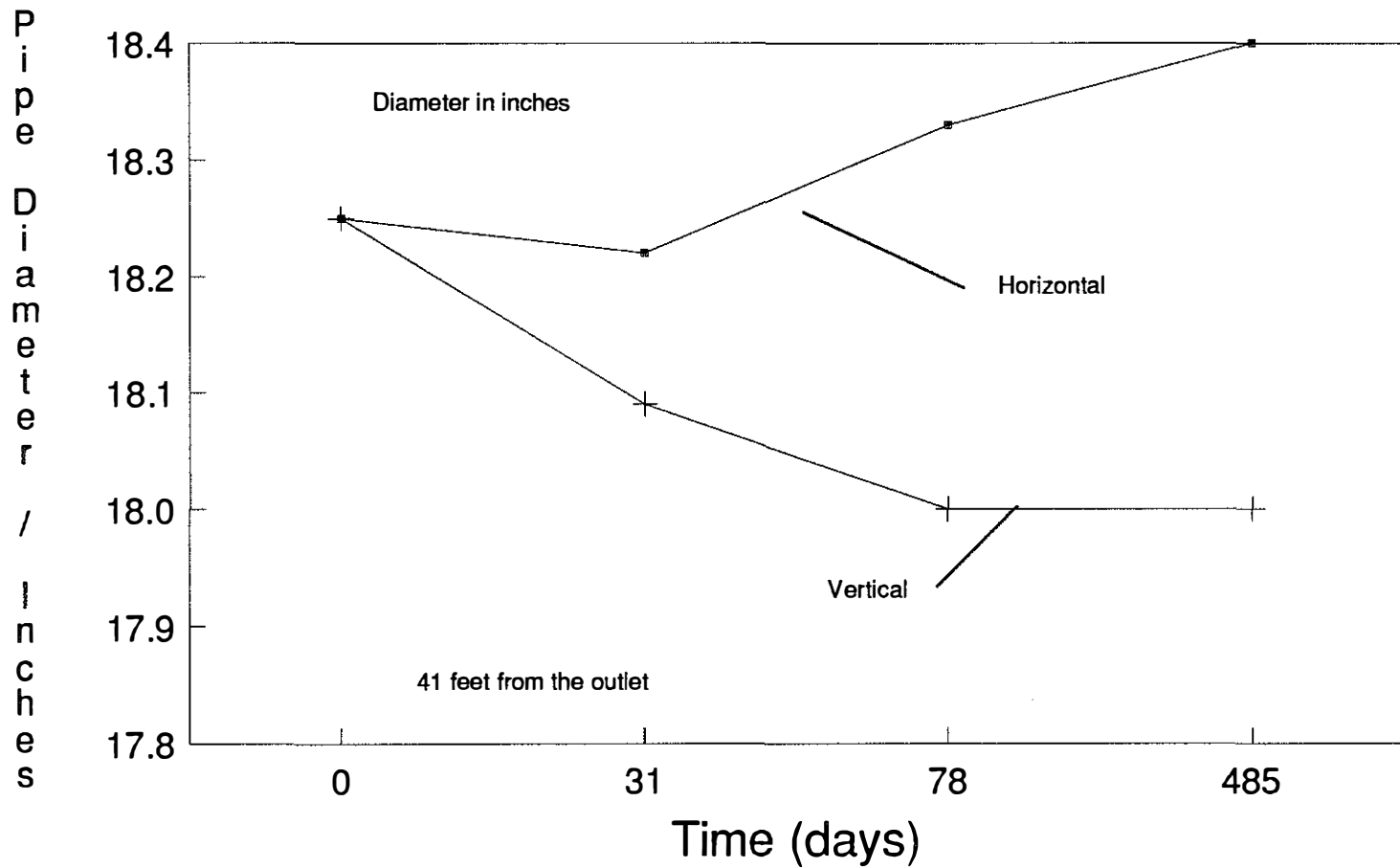
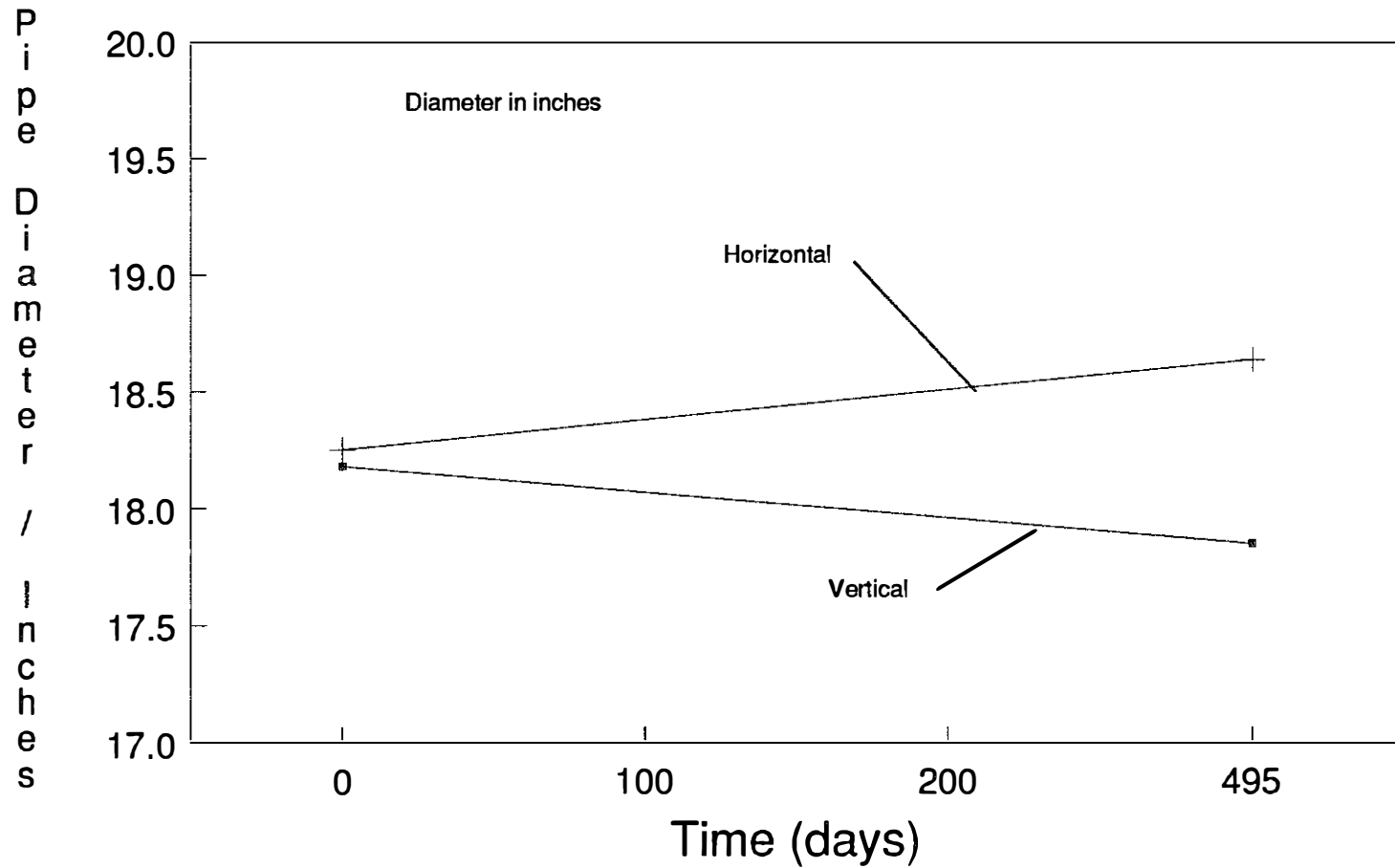


Figure No. 3: 18-Inch N-12 Ky 54, Daviess County, Station 126+00



Discussion

The N-12 pipe requires less equipment and fewer personnel than steel or concrete pipe for installation. More care must be exercised in placement and backfilling of N-12 pipe. The crushed No. 9, stone used on Forbes Road and the sand backfill, used in Daviess County appeared to work well for N-12 installations. No deflections were apparent during visual inspections at either site. Several of the pipes on US 62 in McCracken County showed signs of compression after installation. The pipe was inspected some time after backfilling had been completed. It appears the deflections noted within a number of the pipes were due to heavy equipment running over the pipes having minimum soil cover (for example, Station 167+50). Some settlement was noticeable in a gravel drive at Station 174. Future inspections in McCracken County, on US 62, will help clarify if any of the deflections in the entrance pipes could be due to normal traffic loading or due to improper installation.

From visual observations at all three sites, it is apparent the ends of the pipes at the couplings are rarely butted completely together. This permits material to be deposited in this area. Care should be taken during construction not to damage the plastic pipe during transportation.

APPENDIX A
US 62 N-12 PIPE INSPECTION

SITE	DESCRIPTION
No. 1	18-inch entrance pipe slightly irregular
No. 2	24-inch entrance pipe (Station 174+00). Approximately 2.3 inches of deflection at the pipe connection. Some settlement is observed in the gravel drive above the pipe. Approximately 1.5 feet of cover at the south end of the pipe, south side of the gravel drive. The pipe sections are not completely connected.
No. 3	18-inch entrance pipe (Station 167+50). The pipe has approximately 3 inches of cover at 6 feet north of the south end. Approximately 2 inches of compression is noticeable at this point. Inloader tracks are also present on the surface at this point.
No. 4	18-inch entrance pipe (Station 161+50). Slight bow is present at the joint in the pipe. Overall installation looks good. Asphalt surface has been placed within 1 to 2 inches of the top of the pipe.
No. 5	18-inch entrance pipe (Station 151+00-Highland Road). The installation is in good condition.
No. 6	24-inch entrance pipe (Station 138+50). Approximately 2 inches of compression on the south end. Approximately 4 to 4.5 feet of fill. Pipe does not appear to be bedded on sand or crushed stone.
No. 7	24-inch culvert pipe (Station 134+50). Good installation.
No. 8	30-inch culvert pipe (Station 124+50). Slight vertical deflection approximately 25 inches from the east end. Fairly good shape.
No. 9	15-inch entrance pipe (Station 121+00). Truck entrance for Turner Dairy. Half full of soil. Not much deflection.
No. 10	15-inch entrance pipe (Station 111+00). Half full of soil. Little to no deflection.