

# STATE OF MAINE DEPARTMENT OF TRANSPORTATION



## TRANSPORTATION RESEARCH DIVISION BUREAU OF PLANNING



DATE: JANUARY 2001

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### EXPERIMENTAL CONSTRUCTION 95-05

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#### EXPERIMENTAL USE OF HIGH DENSITY POLYETHYLENE DRAINAGE PIPE AS A CROSS ROADWAY DRAINAGE STRUCTURE

#### Final Report

#### INTRODUCTION

Adequate drainage is one of the most important requirements in the reconstruction of a highway. Often it represents an appreciable expense of construction. In some applications installation costs may be reduced by the use of lighter weight drainage pipes such as aluminum and/or plastics. However the use of lighter weight materials may necessitate increased attention during placement and backfilling operations.

In July 1995, the Maine Department Of Transportation (MDOT) initiated an experimental construction project using plastic cross drainage pipes to gain expertise relative to installation and pipe performance.

#### PROJECT DESCRIPTION/LOCATION

The selected project F-NH-046P(56) is located on Route 9 in the towns of Crawford and Alexander. The scope of this project included reconstruction and it begins in the town of Crawford 4.95 km (3.08 mi) westerly of the Alexander town line and extends easterly 5.06 km (3.15 mi) (see attached location map). The AADT on this section of Route 9 was 3380 in 1993 and is estimated to increase to 6080 in 2013. Truck traffic is estimated to be nine percent of the AADT.

## Experimental Location

The experimental installation consists of two 0.914 m (36 in.) diameter cross roadway drainage pipes located at station 278+75, which is approximately 1.55 km (0.96 mi) east of the beginning of the project. This drainage structure is designed to carry the runoff from a wet area to the southeast under the roadway into Crawford Lake.

## Experimental Pipes

The twin pipes installed at the previously defined location were 0.914 m (36 in.) Annular High Density Polyethylene. The pipe is manufactured by Hancor Inc. located in Waverly, N.Y. The distributor for this product was Burtco Inc., Maine Division, located in Leeds, Maine.

## **INSTALLATION**

The twin pipe installation was completed in two days. On the first day, Thursday, November 16, 1995 approximately 15.2 m (50 ft.) of the twin culverts were installed in 5 1/2 hours. The work was undertaken after a severe rainstorm and the 0.457 m (18 in.) temporary bypass was flowing at about 80 % capacity. It was necessary to cut and install two 3.04 m (10 ft.) lengths after the first 6.08 m (20 ft.) length in order to keep one traffic lane open. However, this process necessitated stopping traffic for about 10 minutes.

The bid price for the pipe was \$50.00/0.304 m (ft) installed which did not include the cost of the gravel backfill.

The sections of pipe were connected with newly designed gasketed slip x slip couplings. They are double bell shaped and the pipe is simply slid into each end.

The initial design called for each culvert to be 21.89 m (72 ft) in length but this had to be modified in order for the ends of the culvert to extend to the toe of the slope. After installation the total length of easterly pipe was 24.72 m (81.3 ft).

The backfill material was bank run gravel, which was recommended by the manufacturer. The large aggregate in the immediate vicinity of the pipes, were removed. A "pogo-stick" was used to pack the material in the haunches. The backfill was then placed in four lifts. Each lift of approximately 0.304 m (1 ft) was compacted with four passes of a vibratory plate. When approximately 0.456 m (18 in) of cover existed over the pipes, a vibratory roller was used. Final cover is approximately 0.61 m (2 ft).

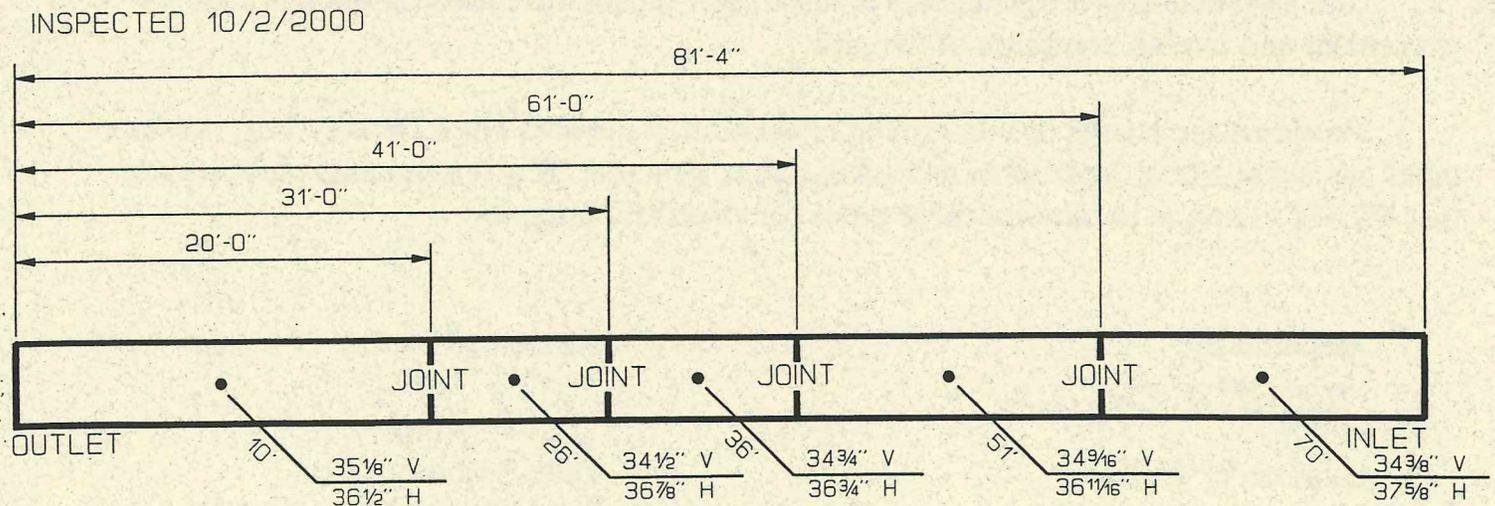
## FINAL FIELD INSPECTION SUMMARY

On Monday October 2, 2000 the final inspection on the twin pipe installation was performed. This inspection was the fifth since an additional 0.47 to 0.608 m (18 to 24 in.) of base material and 0.229 m (9 in.) of bituminous material were placed to complete this project in early October 1996.

Measurements were taken vertically and horizontally in the easterly pipe at the same locations measured in each of the previous inspections (See Figure 1). This inspection marked the fourth year that separations at each of the joints in the easterly pipe were measured and documented. In addition to these separations, some settling of each pipe was again noted. The north (outlet) end of pipe section 5 was also noted to be approximately 25.4 mm (1 in.) above the south (inlet) end of pipe section 4. These conditions are consistent with the initial findings, and are believed to have been present since the completion of the pipe installation.

Both the easterly and westerly culverts were evaluated from the inside for any signs of cracking or deterioration. Both were found to be in satisfactory condition with no cracking present. There was no water flowing through either of the pipes at the time of this inspection.

Table 1 (attached) summarizes the measurements obtained in the six inspections.



EASTERLY PIPE OF TWIN 36" POLYETHYLENE PIPES

Figure I

Joint-separation measurements (north to south), collected during the 2000 evaluation remained the same as measurements taken during each of the previous field inspections (see Figure II).

Joint Location	- 1997 -	- 1998 -	- 1999 -	- 2000 -
Joint #1	2 - 3 in.			
Joint #2	½ - 1 in.			
Joint #3	1 - 2 in.			
Joint #4	1 - 2 in.			

**Figure II**

## SUMMARY/CONCLUSIONS

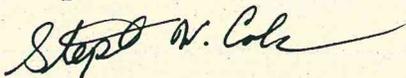
Overall, the two High Density Polyethylene pipes appeared to have performed very well. Variation in the vertical and horizontal measurements varied only slightly from year to year. The largest percent change occurred with the October 2000 evaluation at the 70-foot location. This change was -3.273 percent for the vertical, and 2.99 percent for the horizontal when comparing original measurements with those collected in 2000.

Joint separation measurements did not change from the time of initial readings in 1997. No cracking, distortion, or other visual deficiencies were found in either of the two pipes.

The installation process appears to have been successful based on the minimal movement and overall condition of the pipe.

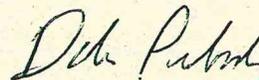
Based on the results of this limited evaluation, it appears High Density Polyethylene pipes can successfully be used as a cross drainage structure. It is recommended, however, that MDOT continue to monitor these pipes for structural integrity.

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Reviewed by:



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Transportation Research Division

Distribution B

Other Documents Available:

Construction Report - January 1996

Interim Report, First Year - December 1996

Interim Report, Second Year - January 1998

Interim Report, Third Year - October 1998

Interim Report, Fourth Year - September 1999

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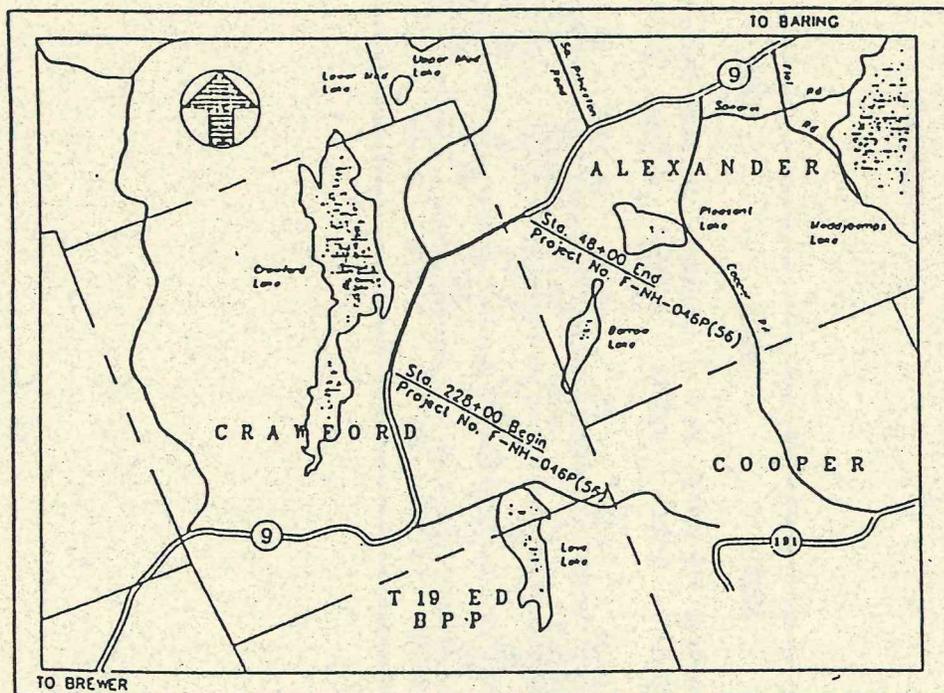
## CRAWFORD—ALEXANDER

WASHINGTON COUNTY

PROJECT NO. F-NH-046P(56)

PROJECT LENGTH : 3.146 MILES

A GRADING, DRAINAGE, BASE & PAVEMENT PROJECT



A PORTION OF WASHINGTON COUNTY

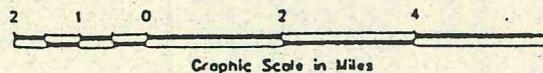


Table I

YEAR	1995		1996		1997		1998		1999		2000 (Final)		Percent Change Initial/Final	
	Vertical Inches	Horizontal Inches	Vertical	Horizontal										
10 Feet	35.25	36.75	35.25	36.75	35	36.25	35.125	36.5	35.375	36.375	35.125	36.5	-0.356	-0.685
26 Feet	35	36.75	34.625	37	34.5	36.75	34.625	37	34.6875	36.875	34.5	36.875	-1.449	0.339
36 Feet	35	37	35	37	34.75	36.75	35	36.75	35	36.625	34.75	36.75	-0.719	-0.680
51 Feet	35.25	36.75	35	37	34.5	36.5	34.75	36.75	34.75	36.5	34.5625	36.6875	-1.989	-0.170
70 Feet	35.5	36.5	34.75	37.125	34.375	37.375	34.25	37.5	34.75	37.5	34.375	37.625	-3.273	2.990