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SUMMARY REPORT

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Performance Evaluation of Existing High-Density Polyethylene Pipe

A study has been performed to evaluate the performance of existing High Density Polyethylene (HDPE) pipe used for drainage applications in South Carolina. The study included a literature review and surveys of local, state and federal agencies to evaluate current practice and existing research on the performance of HDPE pipe. Field investigations of 45 HDPE pipes throughout South Carolina were conducted to evaluate both the external and internal pipe conditions. The sites were statistically selected based on geographical location, diameter, use (cross line, sideline, etc) and age. The condition of each pipe was not known prior to selection for inspection. Pipe performance was evaluated with respect to AASHTO specifications, measurements of pipe deflection with a mandrel set to 5% deflection and visual inspections using a video camera. The design and installation techniques, proper storage and handling, service life, and economics of HDPE pipe were also evaluated.

Three surveys were conducted as part of this study. First, a survey of SCDOT maintenance personnel was performed to determine the locations of HDPE pipe placed by their forces in the state of South Carolina. A second survey was sent to the SCDOT resident maintenance engineers to assess their experience in using HDPE pipe. This survey indicated that 57% of the resident maintenance engineers were "very satisfied" with the performance of HDPE pipe and 20% were "moderately satisfied." Only 5% of resident maintenance engineer were "dissatisfied." The survey also indicated that HDPE performs adequately and has a number of desirable properties that make it a good alternative to other types of pipe. The third survey was sent to the 50 state departments of transportation regarding pipe testing and certification.

Field investigations of existing HDPE pipes revealed circumferential cracks in 18% of the pipes, localized

bulges in 20% of the pipes and tears or punctures in 7% of the pipes. End damage was observed in 13% of the pipes. Deflections greater than 5% were observed in 20% of the pipes. Installation problems such as poor preparation of bedding soils, inappropriate backfill material, and inadequate backfill cover appear to be significant in the performance of HDPE pipe in South Carolina. More pipes backfilled with Class IV soils did not pass the mandrel test than those backfilled with Class II or III soils. In addition, cracks were more apparent in Class IV backfilled pipes than they were in pipes backfilled with Class II or Class III soils. Forty-four percent of the pipes had less than the recommended 1 ft of soil cover. Poor preparation of bedding soils resulted in pipes with undulating flow lines. Note that this analysis was independent of loading history and pipe material quality. The effect of these factors on the performance of HDPE pipe would require further study.

This study did not reveal any HDPE pipe installations that have failed such that they need to be removed and replaced. Even with the cracks, localized bulges, etc. observed in this study, the HDPE pipes are still functioning near to the original installation purpose. Overall, the pipes were performing well, maintaining a relatively round shape with limited structural distress. As such, HDPE pipe is worthy of being one of the pipe materials that can be used on SCDOT maintenance and roadway construction projects. Recommendations to improve the performance of HDPE pipe in South Carolina include training maintenance crews in the laying of plastic pipe, following ASTM D-2321 installation procedures, inspecting the pipes after installation, and developing guidelines for HDPE pipe product approval.

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