Summary of Final Report, BC354-53
February 2004

USE OF ACCELERATED FLOWABLE FILL IN PAVEMENT SECTION

PROBLEM STATEMENT

Florida Department of Transportation (FDOT) projects frequently require cutting and backfilling trenches for structure and drainage pipe installation. Often, cutting and backfilling disrupts major traffic arteries. Standard practice for backfilling trenches includes soil being placed in 6-inch lifts and compacted until a minimum specified density is achieved. The use of flowable fill eliminates the time intensive task of compaction, resulting in faster construction and less disruption to the general public. Research is needed in order to verify current FDOT specification requirements and characterize the current use of flowable fill throughout the state of Florida.

OBJECTIVES

The objective of this study was to evaluate the performance of flowable fill in the pavement section using accelerated and non-accelerated mixtures. The evaluation included determination of strength, set time, and flow properties applicable to conditions in Florida.

FINDINGS AND CONCLUSIONS

Two surveys were conducted on Florida counties, municipalities, and FDOT district maintenance offices regarding current uses of flowable fill. The survey results indicated that more than 1000 yd^3 of flowable fill was used around culverts, backfill, manholes, bridge abutments, support walls, sub base, and pipe pluggings. Currently, in Florida, some users follow FDOT specifications, while others use mixes that provide 800 – 1000 psi strength. For short-term testing, the penetrometer test is the one most widely used. Some users suggested that admixtures be used to reduce shrinkage, control bleed, and promote setting. A majority of districts use flowable fill to backfill trenches in pavement. Most users bring flowable fill to the top of subgrade and top of base. Reported trench widths varied from 2-ft to 20-ft. Flowable fill was used in both longitudinal and transverse openings in the pavement, and the majority of users were satisfied with its performance.

Laboratory results indicated that at curing times of 6 hours to 90 days, most of the excavatable mixes exceeded the maximum allowable compressive strength of 100 psi required by FDOT specifications, and the LBR values for the mixes varied from 1.67 to 182. Penetrometer readings for these mixes varied from 112 psi to 3659 psi. The compressive strengths of the excavatable mixes at 28 days varied from 82 psi to 273 psi.

For field samples, strengths after 28 days varied from 1171 psi to 2210 psi. On the other hand, the non-excavatable mixes met or exceeded the minimum FDOT specifications strength of 125 psi.

Researchers found that accelerating admixtures can be used to help reduce the curing time of flowable fill to a definite point. The laboratory data indicated that excavatable flowable fill continues to gain long-term strength beyond the normal 28-day curing period.

Laboratory data was utilized to develop a relationship between Limerock Bearing Ratio (LBR) values and penetrometer readings for each mix type. The results of the analysis indicated a weak correlation between LBR and penetration resistance. It was found that the Proctor penetrometer can be used to measure flowable fill strength to determine project acceptance in the field. The current FDOT flowable fill specification requires flowable fill to be left undisturbed until a strength of 35 psi is developed (as measured by the pocket penetrometer). While the specification does not specify required curing time before testing, it was found that at 6 hours of curing time, penetration resistance generally met or exceeded the 35 psi requirement. A majority of unit weights and compressive strengths of the mixes did not comply with the FDOT specifications. Therefore, further clarification and evaluation of the current flowable fill specification is needed, particularly with regards to 28 day compressive strength, unit weight, and penetration resistance.

BENEFITS

The most significant finding of this research is that LBR analysis can be used to design flowable mixes for the various portions of the roadway (e.g., roadway, embankment). FDOT can now with confidence design a flowable mix that will serve as base, subgrade, or embankment. The use of flowable fill eliminates the entire soil backfill process: the placing of soil in layers and the requirement for Proctor and density testing to ensure necessary compaction has been achieved. Consequently, the ultimate benefits are significantly reduced construction times and a concomitant reduction in the disruption to traffic, both of which translate into cost and time savings.

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