

New Jersey Department of Transportation  
Bureau of Research

## Technical Brief



### In Place Rehabilitation of Pipes Using Polymer Composites

*NJDOT maintains a large number of culverts that have clay pipes for drainage under roadways. An in place repair would extend the useful life of these clay pipe culverts until an opportunity arose to replace them. The ideal repair would be economical and easy to implement in place in a typical drainage pipe field location. This project examines the feasibility of using polymer composites to repair a twin clay pipe culvert in place in the field.*

### Background

Two 24-inch diameter, 50-foot long clay pipes, that were about 50 years old, were chosen for the demonstration project. The pipes are located under NJ Route 322 in Harrison Township.

The pipes were built in 2-foot segments and there were some misalignments between the segments due to settlement. The site was selected because: (a) the structure was easily accessible on both ends; (b) the length was reasonable, (c) traffic safety was not needed and (d) space was available next to the site for preparation of rehabilitation materials.

Based on a detailed evaluation of the condition of both pipes it was decided that the rehabilitation should be done in two stages. Unfortunately, since the ownership of the pipes changed from NJDOT to Gloucester County after the initiation of the research project, the second stage of the repair work was unable to be conducted, monitored and evaluated for durability during a full winter season.

The pipes were fitted with new plastic pipe liners after they were damaged by utility relocation construction work. At this point, it was decided that more work could not be done at this site. Since an alternative site could not be found within a timely manner, the research work was concluded at this site.



### Research Objectives and Approach

The primary objective of this project was to formulate an economical method for repairing deteriorated clay pipes. New Jersey Department of Transportation maintains a large number of culverts that have clay pipes for flow of water under roadways. These pipes are typically 24 inches in diameter and manufactured in 3 foot lengths. An effective method to repair damages to the pipes in-place would be very useful for maintenance.

A two stage repair method, of the twin culverts selected, was determined to be the most cost effective means of rehabilitation. In the first stage of rehabilitation, the misaligned joints and the broken segments were fixed with fiber reinforced rapid set composite that has minimum or no shrinkage. This composite had to be applied with various thicknesses and therefore a Portland based system was chosen. High strength composites are very efficient for application where thin coatings are suitable.

Once the first stage repair was successfully completed, the second stage repair of high strength polymer coating was to be applied to the insides of these pipes. The fiber reinforced polymer coating would have both strengthened the pipes and also would have improved the flow of water inside the pipes by lowering the abrasion resistance.

## Findings

Evaluation after the winter 2009-2010 season showed that the initial composite repair work, which was not damaged by the utility construction work, was successful. The composite material remained adhered to the clay pipe surface and did not shrink or crack. Laboratory applications of the second stage, the inorganic polymer coating, were successfully carried out using clay pots. The research team planned on repairing the construction damage and performing the second stage polymer coating, however, various factors made it impossible for the research team to perform the final work, monitoring and evaluation.

The following findings from this project are:

- Fiber reinforced-rapid wet-set cement composites can be effectively used for repairing small breaks and dislocated joints in the pipe culverts.
- Inorganic polymer-carbon composites can be used as a coating material for clay surfaces. This conclusion is based on the laboratory study.
- In the case of culverts in service, it is difficult to acquire a dry condition to apply the polymer composite. Therefore, a repair system that can be applied in wet conditions is advantageous for these kinds of applications.
- Application of the composite and polymer coating, as performed in this particular study, may not be practical or safe for a typical NJDOT maintenance crew member to replicate under typical field conditions.
- Identification of more than two NJDOT owned drainage structures would be advisable for future in place pipe research projects so that alternatives are available in case of a change in ownership, utility work damage and possible field restrictions, such as constant dampness.

## For More Information Contact:

NJDOT Project Manager:	Stefanie Potapa
	609-530-2861
	Stefanie.Potapa@dot.state.nj.us
Principal Investigator:	Dr. Perumalsamy Balaguru
	Rutgers, The State University of New Jersey
	732-445-0579 Extension 126
	balaguru@rci.rutgers.edu

A final report is available online at: <http://www.state.nj.us/transportation/refdata/research/>. If you would like a copy of the full report, send an e-mail to: [Research.Bureau@dot.state.nj.us](mailto:Research.Bureau@dot.state.nj.us).

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