

## 3D printed thermoplastic composite diffusers for culvert rehabilitation

Author: Sunil Bhandari,

Faculty Mentor: Dr. Roberto Lopez-Anido,

Department of Civil and Environmental Engineering

### **Abstract**

Deteriorating and failing culverts across the country has prompted highway engineers to seek various solutions to replace or rehabilitate the culverts. Slip-lining culvert outlets with performance enhanced diffusers that have a hydraulically optimized geometry can extend the useful life of culverts, without reducing the culvert capacity. Large scale 3D printing technology enables manufacturing of the optimized diffusers for different culverts at considerably lower prices compared to other methods currently available.

The designs for optimized culvert diffuser designed for Thorndike, Maine were used for this study. The 102-inch-long diffuser was designed to replace the existing fiberglass diffuser section. A finite element analysis was carried out to verify whether the designed section can withstand the backfill loads and avoid buckling. Segmental construction was adopted to enable manufacturing of diffusers longer than build envelope of the 3D printer.

The four segments of the diffuser are expected to be printed in the last week of September. The segments will be joined using an epoxy-based adhesive to form the diffuser. Initial cost estimates show that the cost of a 3D printed culvert diffuser is considerably lower compared to the cost of the existing fiberglass diffuser. The diffuser will be slip-lined with the existing culvert at the site in early October. Monitoring the performance of the segmentally printed optimized diffuser would allow us to design longer and more efficient culvert diffusers in the future.



Fig: Fiberglass culvert diffuser at Thorndike Maine.  
(courtesy of Alexander Mann, PE, MaineDOT)

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### **References**

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