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CULVERT RENEWAL

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16. Abstract (Limit: 200 words)

The Minnesota Department of Transportation is investigating alternative means of culvert renewal in lieu of removal and replacement. Several state of the art renewal techniques were selected for trial on I-35 near Hinckley, Minnesota in an effort to find an inexpensive and less disruptive alternative to removal and replacement of deteriorated culverts.

Seven different reliners were placed in concrete and metal pipe, and five joint repair options were placed in concrete pipe. These reliners and repairs were compared using costs, skills and resources required, time, culvert preparation, traffic disruption, work area requirements, placement problems, and grouting procedures. Field performance of the reliners and joint repairs was checked visually after one year to evaluate the short term effects of climate. At this point in time all reliners appeared to be performing adequately.

Relining and joint repair should be considered as an inexpensive, time saving, and minimally disruptive alternative to removal and replacement of deteriorated culverts. Smooth reliners are inexpensive, flexible, easy to install and perform better hydraulicly than corrugated or ribbed reliners. Savings can be significant in both money and time with very little disruption to the driving public.

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CULVERT RENEWAL

Final Report
March 1992

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I. BACKGROUND

The replacement of a deteriorated culvert under a roadway is an expensive proposition. The work required to remove and replace (r & r) such a structure is both disruptive to the driving public and to the structural integrity of the existing pavement. Finding an inexpensive and less disruptive alternative would be very desireable.

Minnesota Department of Transportation (Mn/DOT) Maintenance Area 1A based in Duluth was particularly interested in this problem since their area of operations included soil and moisture conditions conducive to the deterioration of corrugated metal culverts. This situation was not identified until 1969 in the Final Report of Minnesota Department of Highways Investigation Number 116, "Serviceability of Corrugated Metal Culverts". Area roadways designed before 1969 included corrugated metal culverts that are now experiencing high deterioration rates.

II. PURPOSE

The objectives of this research project was to investigate alternative means of culvert renewal in lieu of total replacement, to apply several state of the art renewal techniques, and to collect and evaluate the experiences of performing alternative methods of correcting culvert deterioration problems. These alternatives were to be compared using the following criteria:

Cost
Skills and resources required
Time required
Old culvert preparation
Traffic disruption
Work area requirements
Placement problems
Grouting procedures

Also we wanted to review the field performance of the alternatives after one year in place to evaluate the short term effects of climate.

It was hoped that this research project would lead the department to accept one or more of the alternatives as a less expensive and less disruptive method than culvert replacement, whether done by contract or Mn/DOT maintenance forces. This project should also serve as a basis for evaluating any future culvert renewal products.

III. APPROACH

The following steps outline the approach taken by Mn/DOT in this research project:

1. Evaluate various culvert repair and relining methods and select some viable renewal alternatives.

2. Inspect and identify deteriorated culverts as possible candidates for repair, relining, or replacement.

3. Match the candidate deteriorated culverts to the selected renewal alternatives.

4. Develop plans and special provisions for a culvert renewal project.

5. Observe and evaluate the execution of the culvert renewal contract.

6. Perform post construction evaluation of renewal methods and materials.

7. Write a research report.

A task force met in 1988 and 1989 to identify, evaluate, and specify various proprietary products that would be used in a demonstration culvert renewal project. This Mn/DOT task force represented:

Central and District Maintenance
Central and District Hydraulics
Central and District Design
District Construction
District Materials
Research Administration and Development
Physical Research
Standards
FHWA

Relining pipe materials that were considered included polyethylene, fiberglass, steel, polyvinyl chloride, and a cured resin impregnated felt tube. Since no long term historical experience with relining was available, the task force felt that the reliners should meet the strength requirements of a new installation, if possible. The task force considered methods of repairing concrete pipe joints and of overlaying the deteriorated bottom of a culvert with a concrete overlay. The intent was that these renewal methods would keep traffic disruption to a minimum. In addition, the task force wanted to include a culvert removal and replacement site on the project to provide a basis for comparisons.

On October 18th, 1988 Mn/DOT staff from the Hydraulics Section, Physical Research Section, and District 1A inspected 59 culverts between Reference Posts 165 and 235 on Interstate 35 between Duluth and the Twin Cities. This stretch of I-35 was constructed between 1962 and 1967, thus predating a recommendation not to use corrugated metal culverts in this area. The purpose of this inspection was to identify deteriorated culverts that might be considered for joint repair, relining, or replacement. A summary of that inspection are in Appendix A. The following photographs show examples of deterioration encountered during the inspection:

Joint seperation in a concrete culvert.