PROJECT SUMMARY

Texas Department of Transportation

# 0-6957: Synthesis on Rapid Repair Methods for Embankment Slope Failure

## Background

Although the majority of slope repairs using common repair approaches show a satisfactory performance, some repair attempts have shown a recurring failure after a period of time. Recurring slope failures happen frequently in Texas, due to the extreme weather and soil conditions. The Texas Department of Transportation (TxDOT) annually spends millions of dollars to repair embankment slope failures along the state roads and highways. Critical examination of existing slope repair methods is needed to recommend appropriate implementation procedures to avoid or reduce recurring failures considering different district conditions. The primary objectives of this research project were to (1) synthesize and critically evaluate existing methods for rapid repair of embankment slope failures, and (2) recommend appropriate implementation procedures to avoid recurring failures considering different district conditions. These methods were evaluated and compared based on various factors, such as (1) long-term performance and applicability to the embankment soil; (2) constructability considering the minimal impact to existing roadway and traffic conditions; and (3) ease of implementation by TxDOT maintenance workforces.

## What the Researchers Did

The research findings were obtained through an extensive literature review, fact-finding surveys, structured follow-up interviews, and case studies. A thorough review of the literature was conducted to identify and critically examine the related research on slope failure repair methods. The findings of the literature review were used to develop a survey questionnaire to capture the current state of practice in repairing embankment slope failures. The survey was distributed among individuals from all 25 TxDOT districts and other states department of transportation (DOT) to gather information from professionals and practitioners on the current slope repair practices being used regionally and nationally. Thirty seven responses were collected from the surveys distributed between professionals from in-state and out-of-state departments of transportation. These include 33 responses from TxDOT districts and four out-of-state responses. Most of the survey respondents were among area engineers and maintenance supervisors who have the most interaction with slope repair projects. Based on the survey responses, structured follow-up interviews were performed with individuals that were more

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experienced in the successful implementation of slope repair projects, in order to identify their best practices and lessons learned from real projects. In total, the research team conducted 10 detailed follow-up interviews. The interview participants were asked to provide detailed information on actual recent repair projects that could be presented as case studies. The application of one or a combination of several slope repair methods have been illustrated in the case studies.

## What They Found

The data collected from literature, survey questionnaire, interviews, and case studies were critically analyzed and synthesized to present the advantages and disadvantages of various slope repair methods along with recommended practices to avoid recurring failures. The results clearly show that there are practices that could reduce the chance of recurring failures of repair methods, even for those methods that are highly prone to failure (e.g., rebuilding and compaction method). These recommended practices representing invaluable collective experience of several TxDOT engineers, supervisors, and maintenance crews are highlighted in this research. Moreover, the results show that repair methods could be combined to prevent recurring failures. For instance, the surface water management (a combination of a curb, flume, and riprap) and vegetation (e.g., cellular fiber mulch seeding and soil retention blankets) could be combined with other methods, such as rebuilding and compaction to prevent recurring failures. Case studies highlighted in this research present excellent examples of these combinations.

## What This Means

The reduction in recurring slope failures could significantly reduce construction operations and maintenance costs. The benefits of reduction in recurring failures go beyond reduced construction and operation costs by enhancing safety, customer satisfaction, infrastructure conditions and service life, environmental sustainability, and transportation system reliability. Moreover, the results of this study could reduce administrative costs, and traffic congestion.


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