TEXAS TECH UNIVERSITY
CENTER FOR MULTIDISCIPLINARY RESEARCH IN TRANSPORTATION

Project Summary Report 0-5096-S

Project 0-5096

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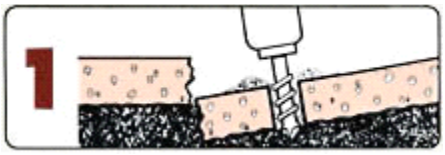
PROJECT SUMMARY REPORT

Water Intrusion in Base/Subgrade Materials at Bridge Ends

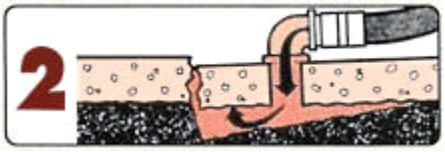
Departments of transportation spend a considerable amount of time and money repairing pavement failures that occur in the base or subgrade materials near bridge ends. Investigations of these failures often reveal saturated base/subgrade materials. The objectives of this research were to determine all possible sources for water intrusion at bridge ends, develop methods to help recognize in-the-field causes of water collection at bridge approaches, and develop new repair methods that can be economically implemented in the field to minimize water intrusion or remove water from soils to maintain a stable foundation without settlement. Research focused on existing bridge approaches and concentrated on maintenance techniques to prevent water intrusion at bridge ends.

What We Did…

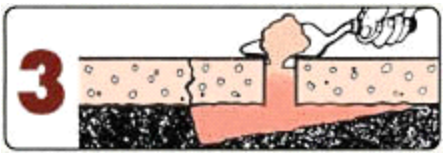
Project 0-5096 research included an extensive literature review to determine all possible sources of water intrusion at bridge ends. Several state departments of transportation were contacted for additional information on design features such as drainage systems and repair techniques. Researchers surveyed each of the 25 Texas Department of Transportation (TxDOT) districts to gather observations about major factors contributing to the problem of water intrusion and settlement at bridge ends. Four TxDOT districts were visited for field investigations of specific bridges, and one bridge was



(a) Drilling 1-5/8 inch holes are drilled through the slab



(b) Pumping grout mixture under the slab



(c) Patching holes using a concrete mixture.

Figure 1. Steps Involved in Slab Jacking
(Courtesy of Concrete Slab Jacking, Inc., Maryland, USA)

selected for thorough field testing to determine sources of water intrusion for a recurring seepage problem.

What We Found…

Based upon information collected, researchers developed a site assessment technique to evaluate the potential of a particular site to incur water intrusion, methods to determine optimum repair strategies. The study collected a number of construction/maintenance items, details and specifications regarding prevention of water intrusion at bridge ends. A checklist is included in the final report to assist maintenance personnel in evaluating bridge sites for water intrusion and repair technique selection. Several recommendations resulted from the study including an implementation project plan to accomplish several repair techniques in field trials for comparison.

The Researchers Recommend...

Based upon the findings of Project 0-5096, the researchers recommend the following:

Adequate surface drainage should be provided to move water from the bridge deck through adequate channels to prevent water from intruding into the embankment fill material. Surface drainage system design should be consistent with local climatic conditions. The observations made in this research suggest that standard drainage provisions may not be adequate in some parts of the state that receive heavy rainfall.

Joints between the approach slab and the bridge, bridge wings, or pavement surface must be properly sealed. It is imperative that the joints be periodically maintained to remove debris and ensure proper sealing. Other preventive maintenance techniques that show considerable promise are: (a) slab stabilization (or undersealing) for controlling void development underneath the approach slab and concrete pavement, and (b) cross-stitching and slot stitching for controlling further development of any cracks that appear in the approach slab and concrete pavement.

Geotextile fabric should be placed beneath joints and other locations beneath pavement surfaces or riprap to prevent the loss of material by erosion.

A detailed design of a repair and installation of an underdrain should be accomplished for the US 83 overpass of Antilley Road in Abilene. The underdrain design should be similar to the detail provided by the Tyler District.

The study evaluated the feasibility of constructing a retrofit underdrain system to remove water that may enter into the fill material through joints and cracks in the approach slab. It was determined that the installation of such an underdrain system without removal of the approach slab will be too difficult and expensive. Furthermore, the drain system will be rendered ineffective if grouting is undertaken in subsequent slab jacking

Figure 2. Poorly Maintained 5-inchWide Joint Between Bridge Deck and Approach Slab.

operations. Therefore, installation of retrofit underdrain systems is not recommended as a part of bridge approach rehabilitation strategy.

An implementation project should be initiated to demonstrate the effectiveness of the repair and maintenance procedures recommended from this project. Several bridges with different approach designs should be selected, repaired as necessary, and monitored for five years to determine the effect of recommended maintenance practices on the decrease of water intrusion at bridge ends and resulting decrease in repair costs.

Figure 3. Water Seepage at the US-83 Overpass Bridge Departure Over Antilley Road in Abilene District.

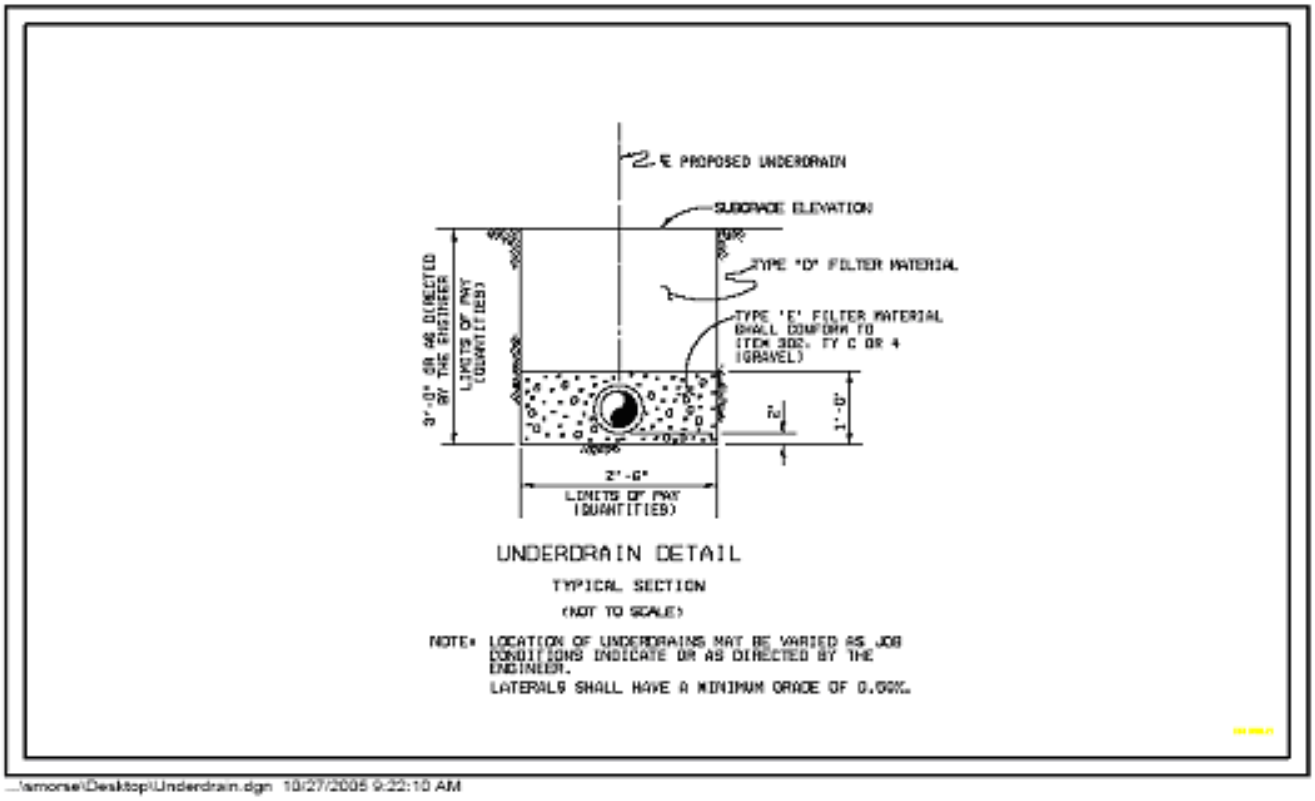


Figure 4. Tyler District Underdrain Detail.

For More Details…

The research is documented in the following reports:

Report No. - 5096-1 - Water Intrusion in Base/Subgrade Materials at Bridge Ends

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