Research Project: ***SP009B4N***
Date: ***March 29, 2013***

RESEARCH SUMMARY

SOIL SLOPE FAILURE INVESTIGATION MANAGEMENT SYSTEM

Problem

Highway slopes are exposed to a variety of environmental and climatic conditions, such as deforestation, cycles of freezing and thawing weather, and heavy storms. Over time, these climatic conditions, in combination with other factors such as geological formations, slope angle and groundwater conditions can influence slope stability. These factors contribute to slope failures that are hazardous to highway structures and to the traveling public. Consequently, it is crucial to have a management system that tracks, records, evaluates, analyzes, and reviews the soil slope failure and remediation data so that cost effective and statistically efficient remedial plans may be developed. The final report presents the framework for developing such a system for the State of Maryland, using a GIS database and a collective overlay of maps to indicate potentially unstable highway slopes through spatial and statistical analysis.

Objective

There were three primary objectives of this study. The first was to gather and evaluate historical data on soil slope failures in Maryland in order to develop the necessary protocols for incorporating that information into a GIS database. The second was to develop a database structure containing information about soil slope failures. Finally, the third was to create a quantitative model in order to both predict the probability of slope failure for Maryland highways and to translate the model into color-coded vulnerability maps.

Description

Using the slope stability management system (SMS) tools, including the failure field sheet and the GIS database, forty-eight slope failure cases occurring between 2008 and 2012 were recorded by SHA engineers. Based on the comprehensive information for the forty-eight slope failures and using spatial analysis tools, certain trends in failure distribution were identified. First, precipitation and poor surface and/or sub-surface drainage conditions are principal factors causing slope failures. Ninety-six percent of the failed slopes occurred along roads with open drainage. Ninety percent of the failures are surficial erosion-type failures, but only 4% of slope failures are deep rotational-type failures. Cross-referencing this information with GIS indicates that 80% of slope failures occurred during or after rainfall.

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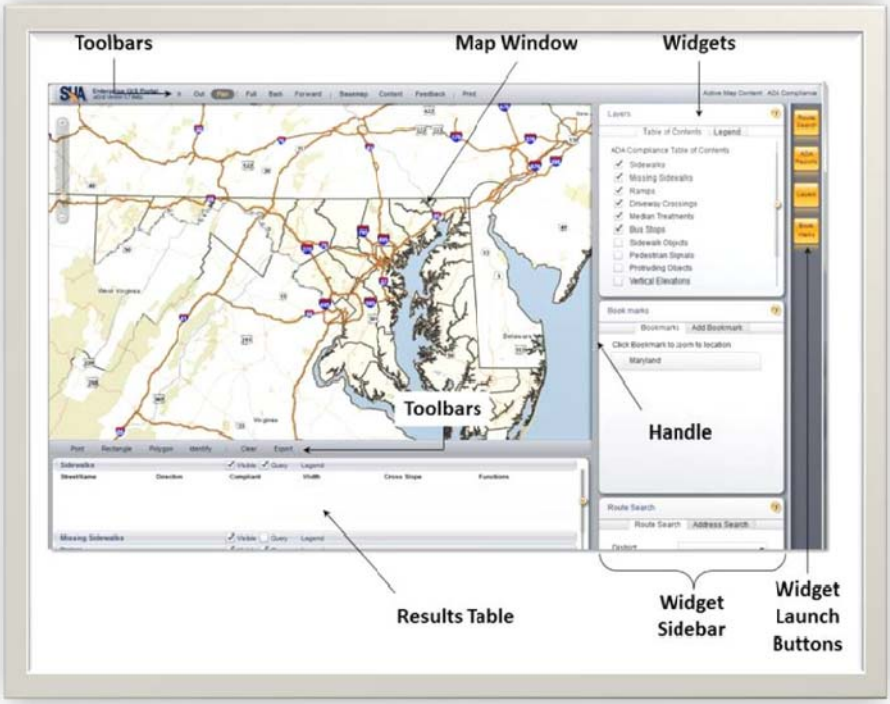
Results

SHA's Data Services Engineering Division (DSED), formerly known as the Highway Information System Division, developed a slope failure content theme in the eGIS application for the project. They completed steps to spatially enable the Access Slope Failure Database (developed by the university research team) and loaded it into Oracle. Three widgets or functions within the eGIS application were developed: Slope Search Widget, Details Widget, and Editor Widget. The completed GIS database was populated with remediation details and maintenance information, and will help engineers select the most cost effective and efficient remediation methods for particular types of failure. An official launch event is being scheduled to roll out the system for the relevant SHA design teams' use.



Report Information

Principal Investigator: Dr. Ahmet Aydilek, Department of Civil and Environmental Engineering, University of Maryland, 1163 Glenn Martin Hall, College Park, MD 20742, Phone: 301-314-2692, Email: aydilek@umd.edu

Link to Full Report

http://www.roads.maryland.gov/OPR_Research/MD-13-SP009B4N_Soil-Slope-Failure-Investigation_Report.pdf