

**I – Problem Statement Title (04-GS070)**

**Development of a Maintenance Monitoring Program  
for Earth Retaining Systems**

**II – Research Problem Statement**

**Question: What information can be synthesized to develop a state of the art maintenance monitoring program for Earth Retaining Systems?**

This synthesis project would report on current knowledge and national practice on monitoring programs for Earth Retaining Systems(ERS).

**III – Objective**

The objectives of the synthesis are: 1) to identify existing and ongoing research on ERS and the associated deterioration and failure modes, 2) to identify guidelines for prioritizing maintenance inspections of ERS with respect to wall type, condition of the structure, age of structure, potential affects on public safety, and other factors that may affect the performance of the ERS, 3) to compile the current practice of state DOT's in terms of specific management policies and procedures and engineering/physical techniques used to inspect ERS; 4) to identify the major inspection problems that remain largely unresolved; 5) to assemble case histories on ERS failures. The synthesis report will be used to determine the direction of the California maintenance monitoring program for ERS to ensure the Departmental goals of safety, reliability flexibility and performance.

**IV – Background**

Since the 1970's, California has utilized ERS consisting of mechanically stabilized embankment (MSE), soil nail and tieback structures to provide cost-effective and reduced land impact solutions. The Department has historically not kept statewide records for soil nail and tieback structures. However, based on historical project delivery numbers, potentially 1500 structures exist within the state right-of-way and the number is increasing linearly. The Department has kept some data on MSE structures, which contain approximately 500 records, but other unaccounted structures may exist.

The Department has not employed a maintenance monitoring program for soil nail and tieback structures but in 1986, Caltrans did established procedures and responsibilities for monitoring, sampling, testing, and recording data for only the MSE structures. The inspection procedures for MSE entailed exhuming and testing the inspection wires on 5-10 year intervals to determine corrosion and section loss, which could be detrimental to the stability of the structure. The Office of Structure Maintenance and Investigations and Office of Transportation Testing Laboratory performed this activity until budgetary constraints eliminated program in 1997. Since then, only a handful of mandated structures are inspected by SM&I on a regular basis.

In August 2003, the Division of Engineering Services, Materials Engineering and Testing Services - Corrosion Technology Branch issued a report entitled "Needs Assessment for a Maintenance Monitoring Program for Mechanically Stabilized Embankment Structures" which addresses California's MSE structure history along with laboratory and testing results. The report clearly identifies the need to revise and reinstate the 1986 MSE Maintenance Monitoring Program.

**V – Statement of Urgency and Benefits**

**A. Support of the Departments Mission/Goals:**

**(Improving Mobility: Safety, Reliability, and Performance)** Structural wall inspections can identify weak elements, help avert potential failures, and prevent future maintenance problems. All of the reasons support public safety, help improve structural reliability.

**B. Return on Investment:**

The number of ERS on the State Highway System is rapidly increasing due to the cost effectiveness of the systems over traditional means as well as increasing right-of-way constraints. A wall failure in an urban environment will effect traffic flow, and even loss of life. Many walls in the rural areas are to keep an important route from sliding. A failure can cause months of road closures and long alternate route delays. The cost of road closures is measured by millions of dollars. A 2003 sampling of MSE testing wires by the Lab showed advanced corrosion in a relatively short period of time. These and other structures need to be identified and put on a priority inspection list. Caltrans does not want or need a disaster to justify a public safety program. The Department should consider a proactive approach to maintenance monitoring of the fastest growing structure type on our infrastructure inventory.

**VI – Related Research**

"Needs Assessment for a Maintenance Monitoring Program for Mechanically Stabilized Embankment Structures", California Department of Transportation, 2003  
Various TRB research papers on the use of ERS.

**VII – Deployment Potential**

Immediate deployment. The synthesis will provide information for decision makers on the feasibility of reinstating the MSE inspection program and initiating an inspection program for all ERS.