I – Problem Statement Title (04-GS040)

Reducing Shrinkage Cracking in Concrete Bridge Decks

II – Research Problem Statement

Question: How can shrinkage cracking in concrete bridge decks be reduced/minimized to improve their durability and reduce maintenance costs and traffic impacts?

Cracking due to drying and autogenous shrinkage of bridge decks continues to be a concern of Caltrans. Cracked bridge decks require sealing which lead to higher maintenance cost which could potentially be avoided if shrinkage is reduced. This problem could be attributed to many variables that may include, but not limited to, concrete mix, environmental conditions at time of concrete placement, the length of placement, restraints in the bridge system, and the curing process.

III – Objective

The objective of this research is to evaluate various methods to alleviate shrinkage cracking in concrete bridge decks. The cost effectiveness of successful methods/admixtures will be evaluated as well. The evaluation is to be used to provide Caltrans with guidelines/methods that could be implemented in the construction of concrete bridge decks to minimize shrinkage induced cracking.

IV – Background

Caltrans is performing inspection and maintenance on more than 12,300 state highway bridges with an estimated deck area of 5,715.769 m^2. Bridge deck cracking is the most common type of deck distress observed on California bridges. Millions of dollars are spent annually to seal/maintain State owned structures. Also, cracking of bridge decks results in inconvenience of traveling public and reduction of deck service life.

V – Statement of Urgency and Benefits

A. Support of the Department's Mission/Goals:
(Improving Mobility: Safety, Reliability and Productivity) Shrinkage cracking in bridge decks continues to be a problem that requires cracks to be sealed frequently leading to higher maintenance costs. Having crack free bridge decks will reduce the need for frequent sealing of the concrete while increasing the overall service life. Reducing shrinkage cracking of concrete will mitigate some of the above concerns making this research urgent.

B. Return on Investment:

To maintain and rehabilitate/replace bridge deck is costly; millions of dollars are spent annually maintaining and rehabilitating bridge decks in California. Alleviating shrinkage cracking in bridge decks through the use of additives and/or mix proportioning could reduce the life-cycle cost and increase service life of the decks.

VI – Related Research

- *"Reducing Shrinkage Cracking of Structural Concrete Through the Use of Admixtures"*, Sponsored by Wisconsin DOT.
- *"Development of Portland Cement Concrete Shrinkage Performance Specifications"* by David Wayne Mokarem, Virginia Transportation Research Council and Richard Edwin Weyers, Virginia Polytechnic Institute and State University D. Stephen Lane, Virginia Transportation Research Council.

VII – Deployment Potential

This research will result in a listing of materials/procedures which have shown through mix proportioning and test data to have reduced shrinkage cracking of concrete. Guidelines including material selection and cost effectiveness will be provided in the final report.