DRISI
Caltrans Division of Research,
Innovation and System Information

Research Results

Determination of In-Situ Precast Concrete Girder Compressive Strength

To compare the compressive strength of in-situ precast concrete girders with their design strengths in order to aid in the load rating process.

Maintenance

MAY 2019

Project Title:
Determination of In-Situ Precast Concrete Girder Compressive Strength

Task Number: 2748

Start Date: March 1, 2016

Completion Date: December 31, 2017

Task Manager:
Larry Baumeister
Transportation Engineer (Electrical)
larry.baumeister@dot.ca.gov

WHAT IS THE NEED?

Caltrans has approximately 1,200 precast/post-stress I girder bridges in their current inventory. The only information available to evaluate these structures for load carrying capacity is the original concrete design compressive strength values listed on the project plan sheets. Based on investigations and industry practice, the minimum concrete strength specified in the design plans is typically achieved within a few days after the concrete is placed. The 28-day strengths and beyond have been found to be significantly higher than design strengths based on surveys of manufacturer's data. An evaluation of representative samples for in-situ compressive strength of these bridges can help Caltrans to identify the reserve in strength capacity for future expansion and to check their design with the new modified codes of practice for safety considerations.

WHAT WAS OUR GOAL?

The goal of this research was to field test fifty-two existing precast/post-stress I girder bridges in California for in-situ concrete compressive strength. Field testing data would be taken with four different nondestructive testing methodologies utilized to establish the existing concrete compressive strength. The resulting data would be analyzed, calibrated, and then used to create a model to predict the in-situ concrete compressive strength of other bridges in the State.

WHAT DID WE DO?

Researchers at San Jose State University in consultation with Caltrans selected 52 bridges in seven counties in the state of California for testing to determine the compressive strength of the bridge girders. Different non-destructive test (NDT) methods

Caltrans

Caltrans provides a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability.

ADA Notice: For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 654-8899 or 711 TTY or write Caltrans Division of Research, Innovation and System Information, P.O. Box 942873, Sacramento, CA 94273-0001.

were performed on the bridges. Utilizing more than one technique ensured higher quality and reduced uncertainty in determining the in-situ concrete compressive strength.

Concrete cylinders, slabs, and retaining walls were constructed at San Jose State University to calibrate the NDT equipment. The data collected from all the laboratory testing in combination with data supplied by the manufacturer of the NDT equipment were utilized to develop strength prediction charts for the different bridge girders.

Concrete cores from five selected bridges in Santa Clara County and San Bernardino County were taken, and compressive strength and NDT tests were performed and analyzed. Results obtained from these cores were compared to the data from the lab testing to verify accuracy of the compressive strength predictions.

WHAT WAS THE OUTCOME?

The outcome of this research is a safe method for Caltrans to increase the capacity of existing precast/pre-stressed I girder bridges across the State. Without predicted in-situ concrete compressive strength determinations, it is anticipated that the majority of the State's precast girder bridges will be downgraded for capacity and subsequently require strengthening or replacement, resulting in millions of dollars of unnecessary upgrades.

WHAT IS THE BENEFIT?

This research benefits Caltrans by providing a process to increase concrete compressive strength for analysis of precast pre-stressed concrete girders. This process will provide more accurate estimates of concrete compressive strengths that are needed to increase capacity, and lessen the need for costly and unnecessary upgrades. The potential cost savings to the State is millions to hundreds of millions of dollars.

IMAGES

Image 1: Bridge Core in Lab

Image 2: Bridge Core after Testing

The contents of this document reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the California Department of Transportation, the State of California, or the Federal Highway Administration. This document does not constitute a standard, specification, or regulation. No part of this publication should be construed as an endorsement for a commercial product, manufacturer, contractor, or consultant. Any trade names or photos of commercial products appearing in this document are for clarity only.

© Copyright 2019 California Department of Transportation
ALL RIGHTS RESERVED