DRISI
CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION
TRANSFORMING IDEAS INTO SOLUTIONS

Research Notes

Geotechnical/ Structures

MAY 2023

Project Title:
Development of Headed Bar Reinforcement

Task Number: 4026

Start Date: May 1, 2023

Completion Date: June 30, 2025

Task Manager:
Foued Zayati
Senior Bridge Engineer
Foued.zayati@dot.ca.gov

Development of Headed Bar Reinforcement

Conduct pullout tests on #14 and #18 headed bars, in order the establish design specification for tension development length of headed bars.

WHAT IS THE NEED?

Current American Concrete Institute (ACI) and proposed American Association of State Highway and Transportation Officials (AASHTO) specifications limit the development length requirements for headed bar reinforcement to #11 and smaller bars due to lack of experimental data on larger bars. Bridge columns where headed bars are most likely to be used, often use #14 bars, and sometimes even #18 bars. In order to be able to use a headed bar larger than #11, it is necessary to carry out experimental studies to generate sufficient experimental data to establish design requirements for large diameter headed bars.

WHAT ARE WE DOING?

The California Department of Transportation (Caltrans) will conduct an experimental research program using full scale reinforced concrete anchorage tests. 36 test specimens will be constructed. Each specimen will be used for three separate tests using various bar embedment lengths. A total of 108 tests will be conducted. The generated data from these 108 tests will be sufficient to evaluate the embedment requirements for #14 and #18 headed bars embedded in reinforced concrete with strengths ranging from 4.0 ksi to 12.0 ksi.

WHAT IS OUR GOAL?

The goal of this research is to establish design specification for the development of #14 and #18 headed bars. This study will either extend the range of applicability of current ACI/proposed AASHTO specifications or develop specifications that are specific to #14 and #18 headed bars, using the anchorage tests data.

Caltrans

DRISI provides solutions and knowledge that improves California's transportation system

WHAT IS THE BENEFIT?

Headed bars are an attractive alternative to standard 90-degree hooks which are quite large for large diameter bars and result in excessive congestion in the beam-column joint and present serious constructability issues. Bar heads are quite compact and can be used to alleviate the issues that come with using standard hooks. For a #14 bar the bar head can be as small as 3 inches by 3 inches in dimension and about 1.75 inches thick. A hook on the other hand, extends a minimum of about 37 inches from the bar. If such a large and unwieldy hook can be replaced with such a compact head, it would greatly improve constructability. However, without design standards, engineers must contend with using hooks or make overly conservative assumptions when using #14 or #18 headed bars. This research seeks to develop design specifications that will simplify bridge design and detail leading to efficient bridge designs. Efficient designs reduce bridge construction costs which frees up resources for use on other projects or other state transportation priorities.

WHAT IS THE PROGRESS TO DATE?

This project is anticipated to begin May 1st, 2023. The first task will be to conduct a literature survey and collect existing test data on the topic. The second task will be to build the first set of test specimens and conduct the pullout tests.

IMAGES

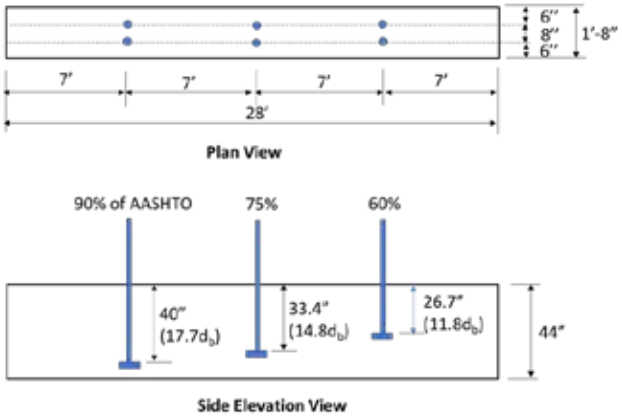

Figure 1: Beam Specimen with #18 headed bars with different embedment lengths

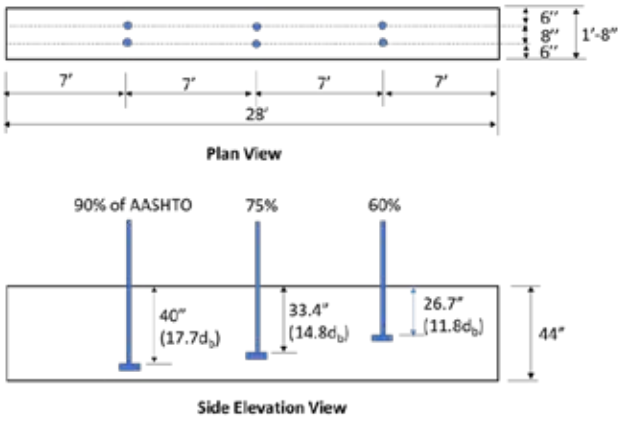

Figure 2 – Test Setup – Side Elevation View