

Evaluation of Anchor Bolt Clearance Discrepancies

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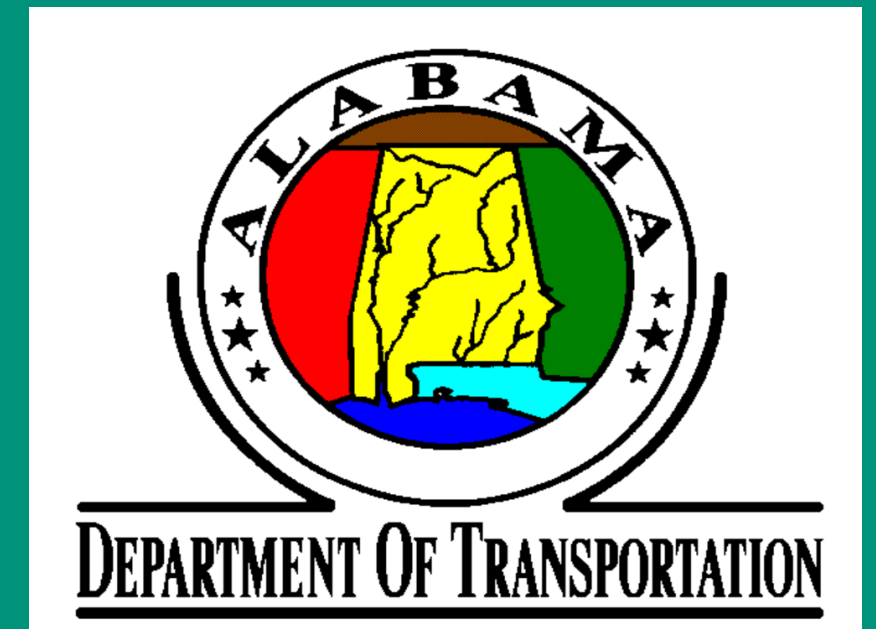


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ABSTRACT



The purpose of the research is to investigate the effect of anchor bolt clearance discrepancies on the stress distribution within the anchor bolt group due to extreme and fatigue wind loading events.

- Anchor bolt clearance is defined as the length between the bottom of the base plate to the top of the concrete foundation surface.
- Clearance discrepancies caused by topographical limitations and leveling procedures performed at the construction site.

RESEARCH PROBLEM

- Double nut anchoring system is a type of connections that depends on resting the sign structure on a leveling nuts, leaving clear distance between the bottom of the lower nut and the foundation.
- The loads are transferred to the foundation through the anchor bolts, resulting in shear and bending stress over the exposed length of the anchor bolts.
- Preliminary results showed that, in the case of unlevelled clearance distance, the anchor bolts are experiencing a significant irregularity in the stress distribution compared to the stress distribution commonly calculated in design.
- The innovation in this research project is to analyze the effects of construction methods such as leveling and clearance distances on the stress distribution to the anchor bolts.

SPECIFIC OBJECTIVES

The research will involve theoretical and experimental programs.

Specific Objective #1: Study the significance of clearance discrepancies on the stress distribution within the anchor bolt group due to extreme and fatigue wind loading events.

Specific Objective #2: Evaluate the effect of anchor bolt clearance discrepancies on the stress distribution in the shaft support above the base plate weld.

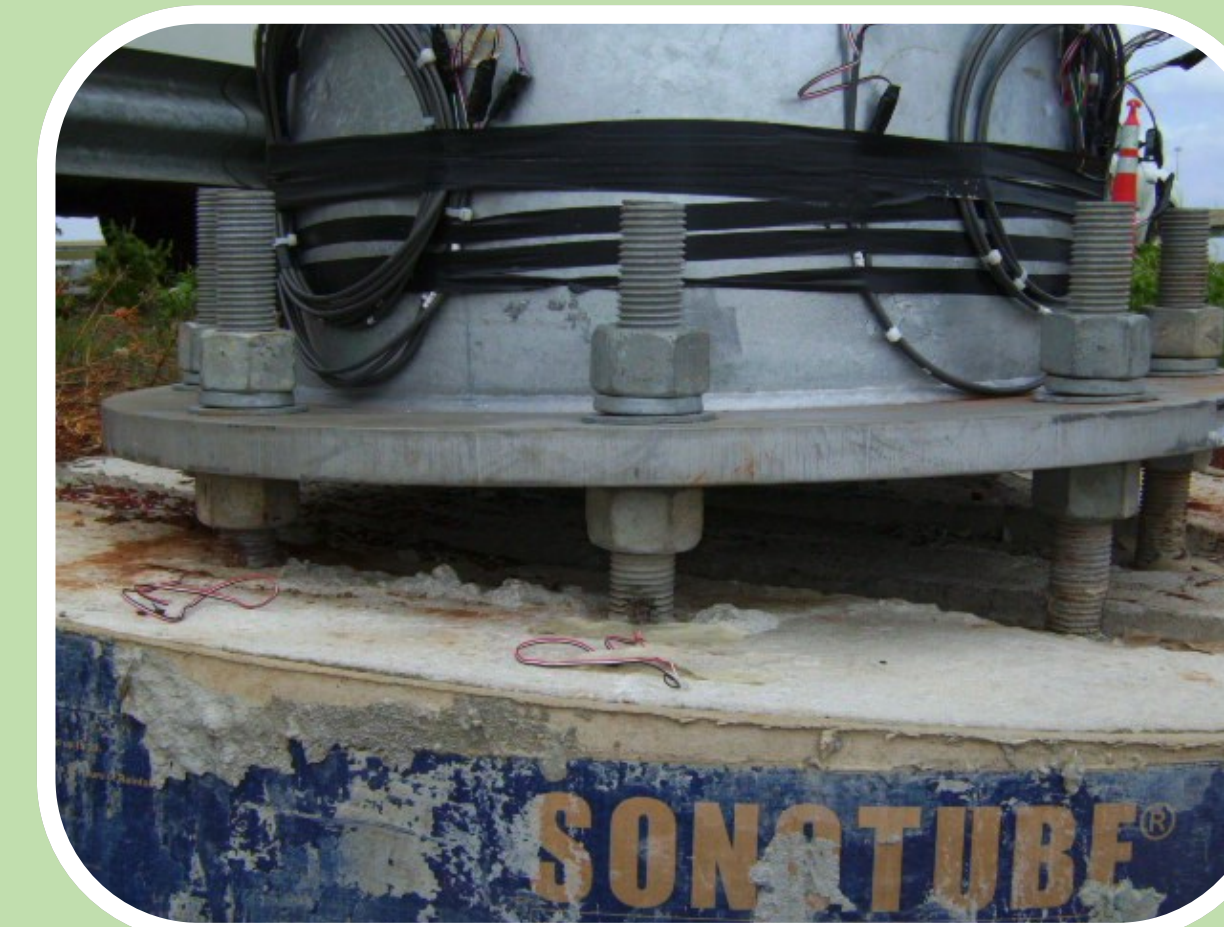
Specific Objective #3: Develop structural design methodologies and design aids to account for anchor bolt clearance discrepancies for the calculation of stresses in the anchor bolts and above the base plate weld.

PRELIMINARY RESULTS

- Preliminary results were derived from experimental data obtained from a cantilever sign support structure with ALDOT/UAB Project #930-680, "Design of Overhead Sign Structures for Fatigue Loads".
- Anchor bolts were instrumented with uni-axial strain gauges attached on the outer surface of each of the 8 anchor bolts that made up the double nut moment joint connection.

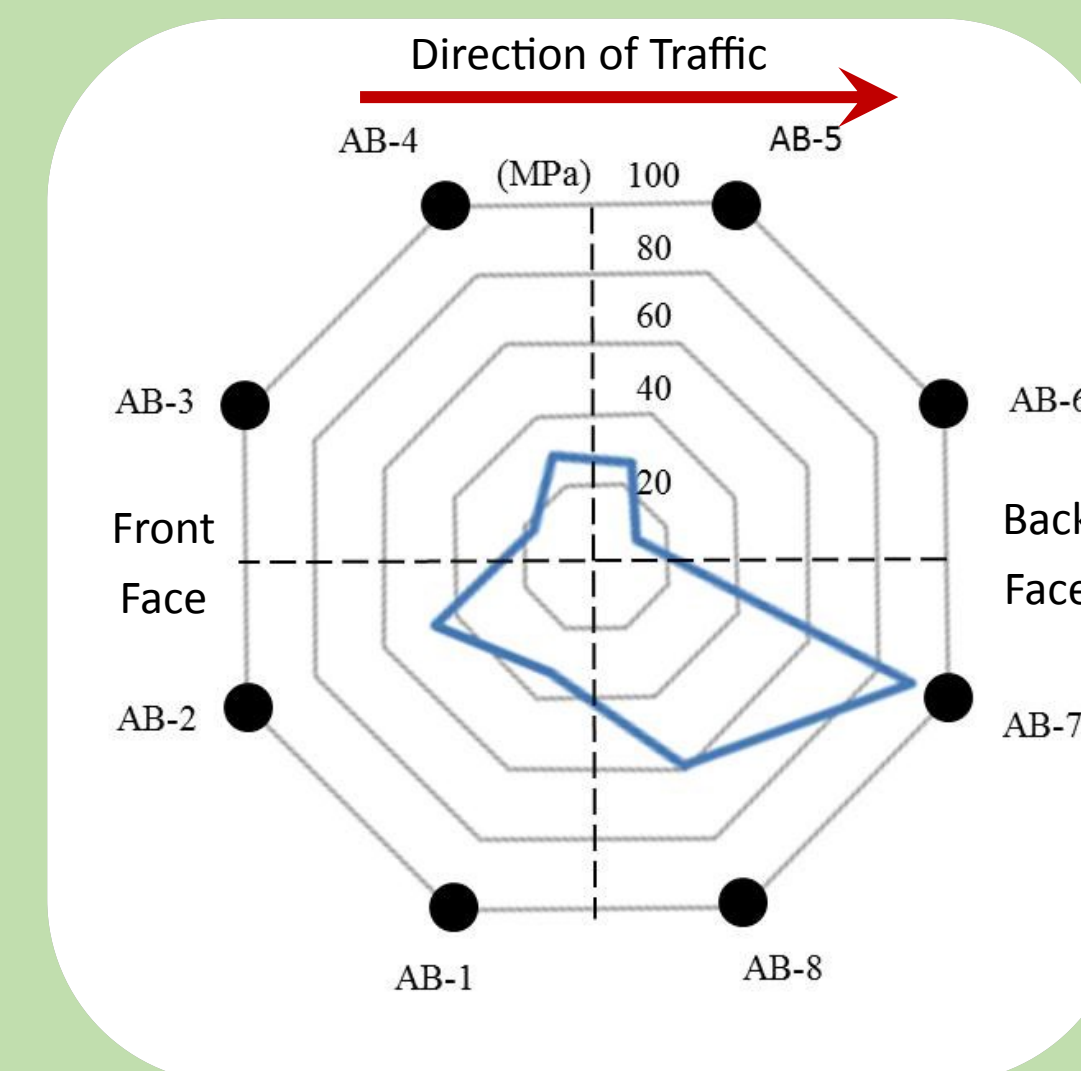


Attaching the Uni-axial Strain Gauge



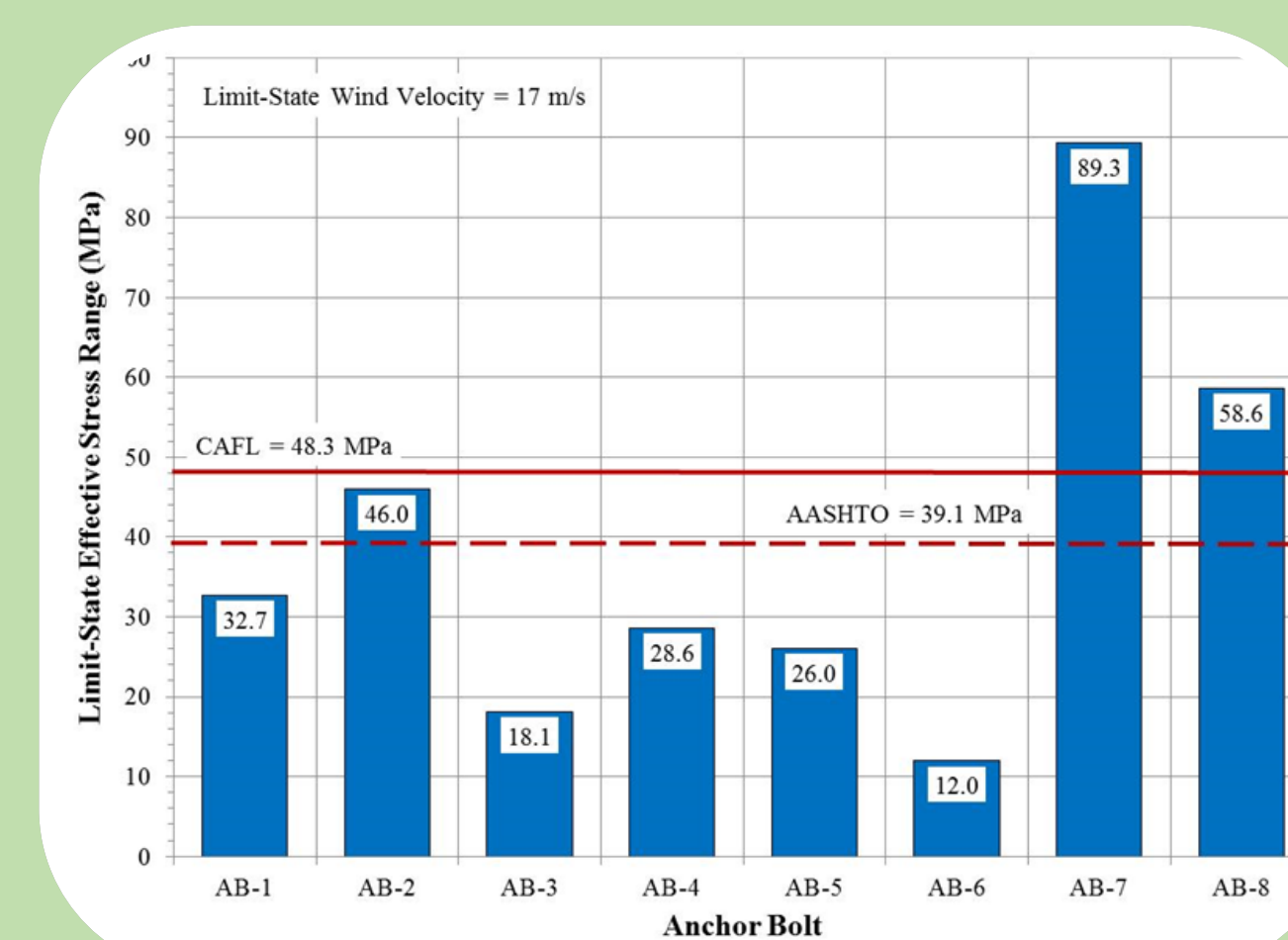
A Close-up View of the Strain Gauge after the Completion of the Structure

- Results indicated significant irregularity in the stress distribution in the anchor bolt group believed to be caused by the clearance discrepancy.
- Highest stresses found with anchor bolts AB-7 and AB-8 (see figure below) having the largest clearances of approximately 3 in as compared to 0.5 to 1.0 in of other bolts.



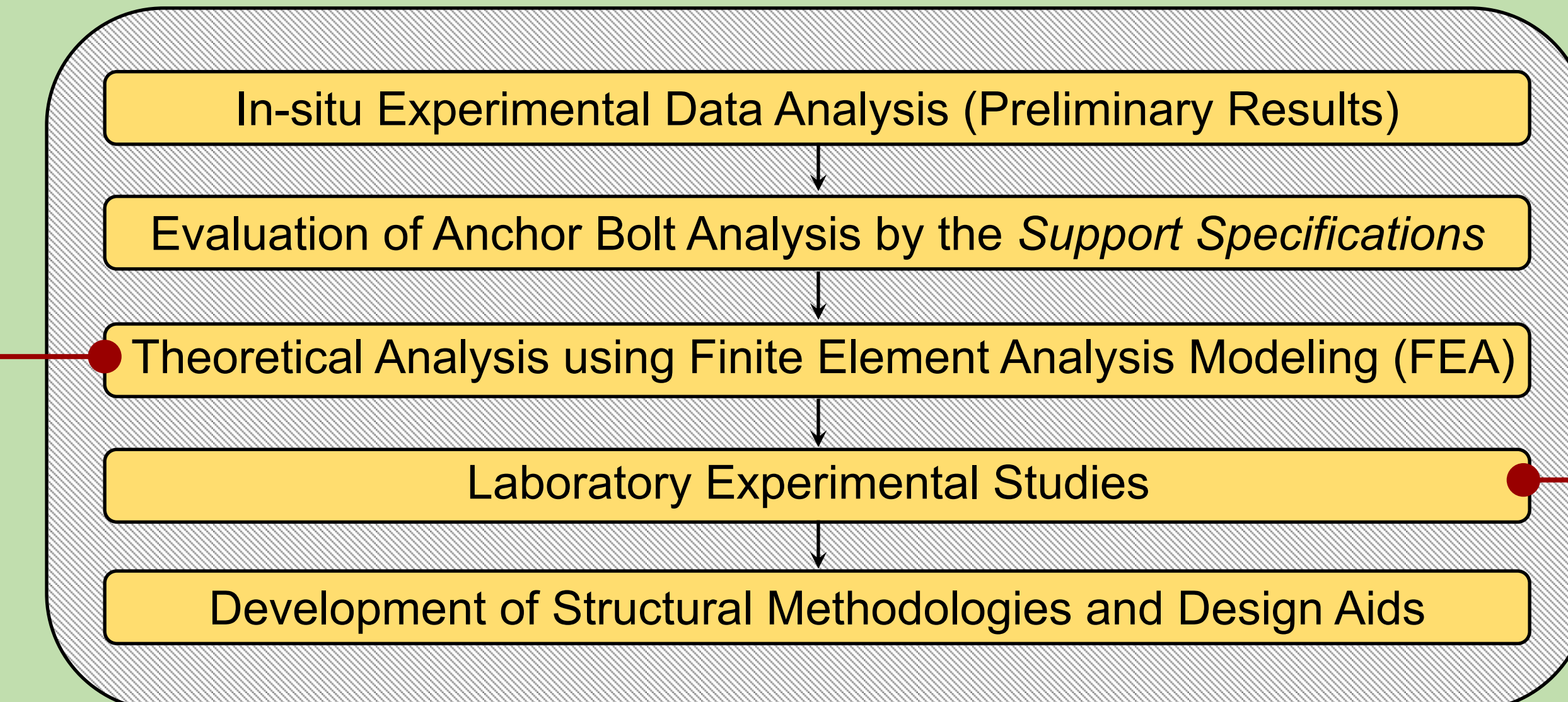
Orientation of the Anchor Bolt Group and Distribution of Limit-State Effective Stress Ranges

Stress ranges for anchor bolts AB-7 and AB-8 exceeded the AASHTO constant amplitude fatigue limit (see figure below) for the connection type, as well as from structural analysis design calculations.

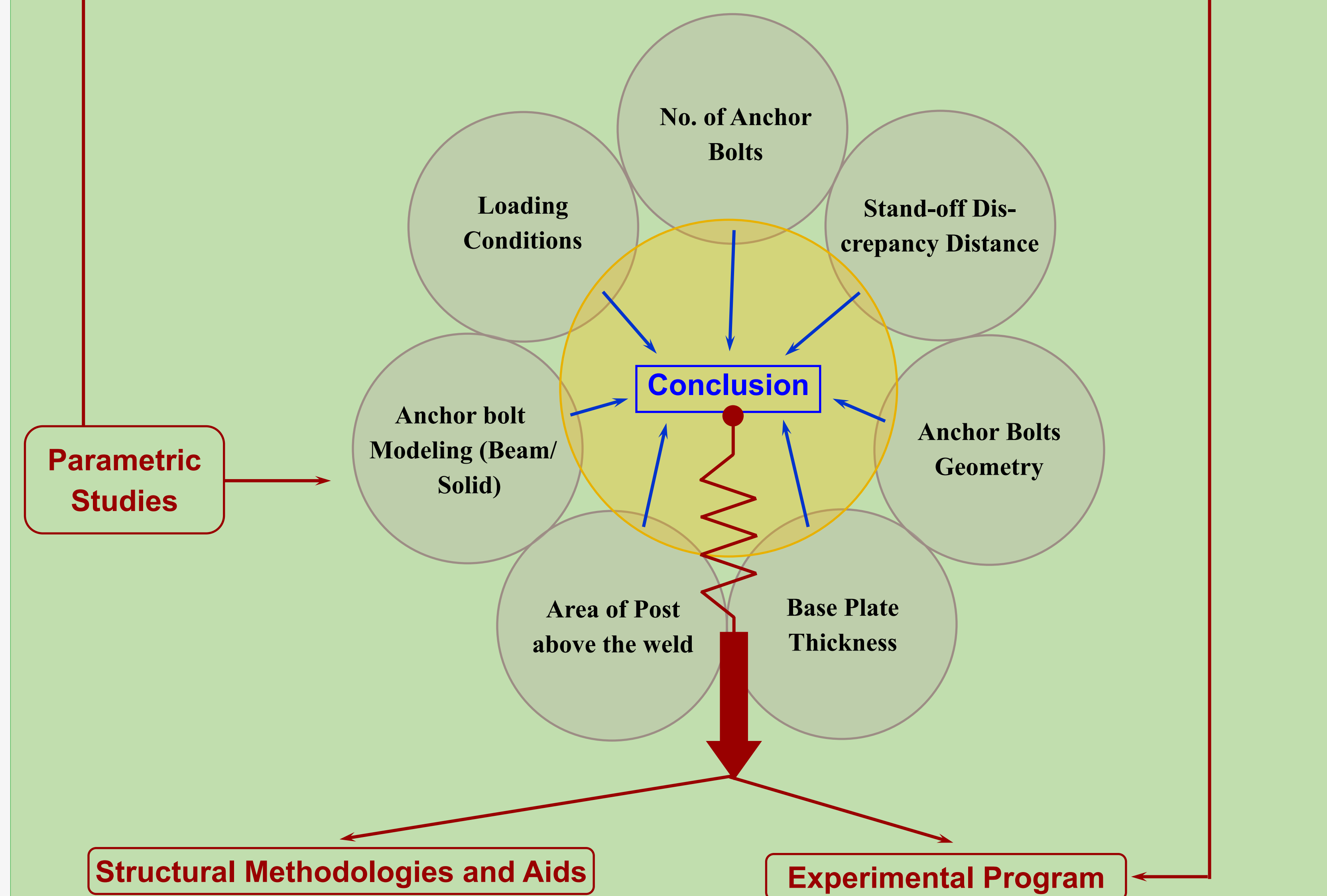


Anchor Bolt Comparison of Limit State Effective Stress Ranges

WORK PLAN



Conclusion that Satisfies the main Purpose of the Research

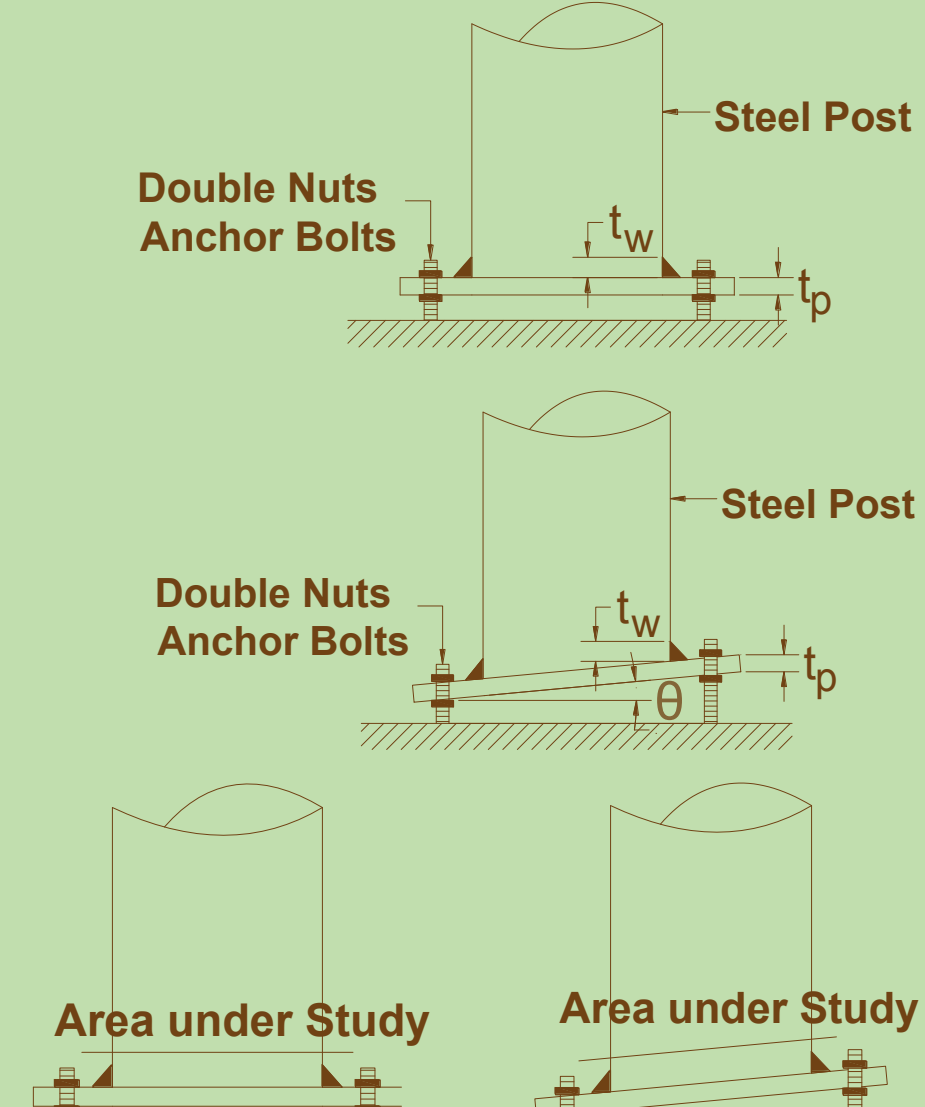
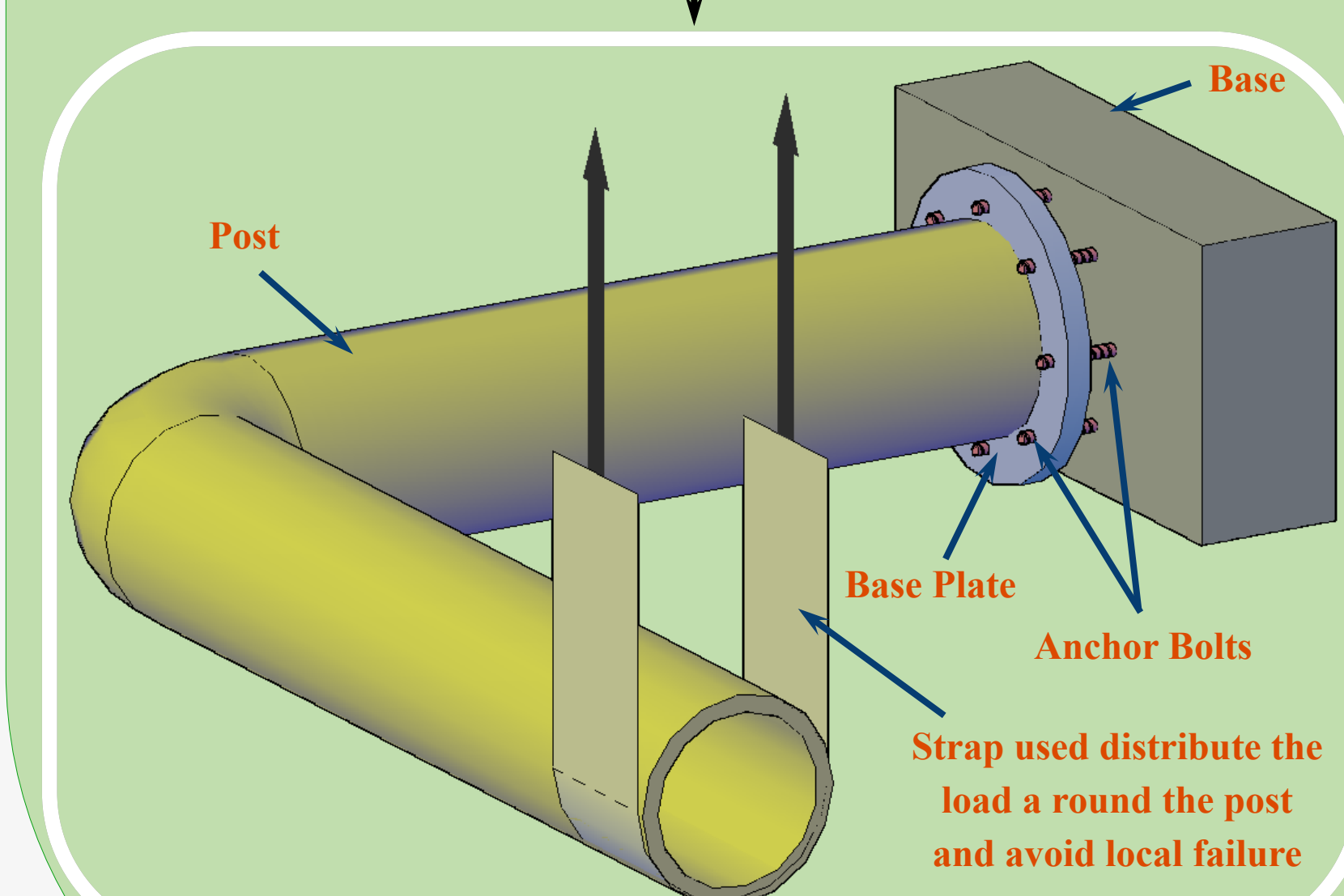


Structural Methodologies and Aids

Experimental Program

Test Set-up

Parametric Studies



Control Specimen / Compare to FEA to Validate

Discrepancy Level [Different θ 's] / Determined from FEA

Area above Weld / Study for All Experimental Specimens