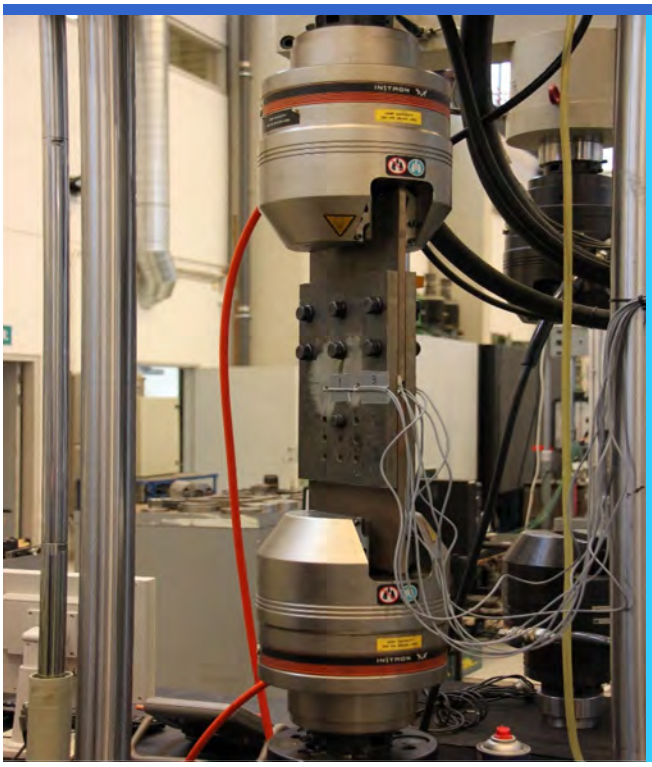
Experimental Investigation of Gusset Plate Connections in Tension



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Preface

This is a BEng project credited 20 ECTS points written in the period 2014.02.03 – 2014.06.13. The project is the final paper of the BEng in the Building study line. Both the project and the BEng have been completed at the Technical University of Denmark.

The project have been completed in cooperation with Bsc. Student Jakob Schmidt Olsen, who has the responsibility for a more thorough theoretical analysis of the test results as well as some investigation using the Finite Element program ABAQUS. The supervisor of the project is Professor and Head of Section for Structural Engineering Jeppe Jönsson. A lot of appreciation goes to him for guidance during the project.

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Abstract

When designing constructions there are standards for how to calculate capacities and bearing strengths. This is done in order to simplify the process and save resources. However, these standards are often very conservative. In order to optimize these standards, tests and research are required.

In this project bolted gusset plate connection in tension are investigated. The project explores the effects from preloading of bolts and different modes of failure one might experience for such a connection. In order to do this six test configurations are designed based on the standards. The configurations are then each tested with three different degrees of preloading of bolts. Each combination of test configuration and degree of preloading is then repeated three times bringing the total of tests to 54. The three modes of failure explored is lack of bearing resistance, lack of capacity in the cross section and block shear failure.

Additionally, a series of material tests have been made in order to gain sufficient knowledge of material properties of the test subjects in the gusset plate connection tests.

For each gusset plate connection, the yield load and the ultimate load of the configuration are determined. These measurements are then compared to the capacities found when designing the plates using the knowledge acquired from the material tests.

The data showed a tendency of preloading of bolts caused an increase in the capacity for the test configurations. When inspecting the individual tests it was indicated that the increased capacity was due to friction between two plates in the test configuration. In addition to this, additional tests were proposed in order to optimize the test results and to investigate the subject further.