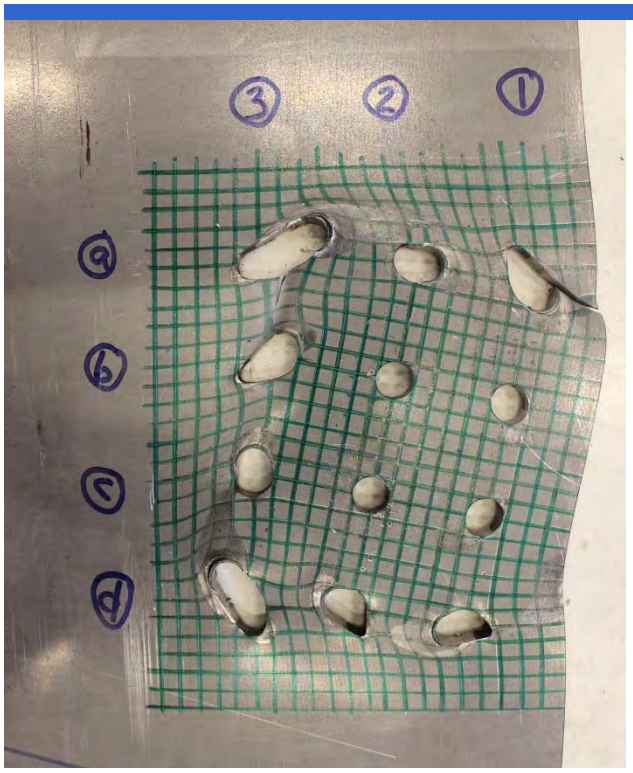
Test of gusset plate connections



Jonatan Stær Nissen

BEng Thesis

Department of Civil Engineering
2014

DTU Civil Engineering
January 2014

DTU Civil Engineering
Department of Civil Engineering

Preface

This project is a BEng project credited 20 ECTS points written in the period September 2nd 2013 to January 16th 2014. The project is the final paper of the Bachelor of Engineering in the Building study line.
Both the project and the BEng have been carried out at the Technical University of Denmark (DTU) in the Department of Civil Engineering (BYG)

The project has been carried out in cooperation with master student *Steen Winterskov-Andersen*, who is more concerned with theoretical analysis, *Abaqus* modelling and testing the steel material.
The supervisor of the project is Professor and Head of Section for Structural Engineering Jeppe Jönsson (BYG, DTU). Great appreciations goes to him for the dedicated guidance throughout the project

Lyngby, the 16th of January 2014

Jonatan Stær Nissen

Abstract

The process of designing structural members of a project is complicated and time consuming. In order to ease this process standards for how to calculate capacities of the members are developed. The basis of these standards is typically experimental verifications of theoretical knowledge.

The subject of the current project is bolted gusset plate connections between two perpendicular beams. Normally this type of connection is loaded with normal and shear force and is placed geometrically where the moment contribution is low. The European standard covers this type of connection well however introducing moment of a greater value makes the calculations insufficient. The subject has been studied in a Master Thesis by Noergaard (2013) where the current knowledge of gusset plate connections has been presented and new rotational capacity verifications were proposed.

In the current project design and testing of a configuration intended to fail by the rotational verifications is made.
The project consists of two main parts. The first part is the theoretical background and design of a feasible configuration for testing optimized to fail by the rotational verifications. The second part is an objective test report describing the performed tests. The result of the tests is a combination of bearing and rotational block failure. The yield and ultimate strength of the configurations have been determined however the material parameters have not. The comparison of results and theory will be done in a later project.

Resumé

Design af konstruktionselementer i et projekt er en kompliceret og tidskrævende process. For at lette processen er der udviklet standarder for beregning af kapaciteten af de enkelte elementer. Grundlaget for disse standarder er typisk eksperimentelle eftervisninger af teoretisk viden.

Emnet for det aktuelle projekt er boltede laskepladesamlinger mellem to bjælker vinkelret på hinanden. Normalt er denne type samling lastet med normal- og forskydningskraft og er placeret geometrisk således, momentpåvirkningen er lav. De europæiske standard dækker denne type samling godt, men introduktion af større moment gør beregningsgrundlaget utilstrækkeligt. Emnet er studeret i et Master project af Noergaard (2013), hvor den nuværende viden om laskepladesamlinger er præsenteret, og verificering af nye rotationskapaciteter er foreslået.

I dette projekt udvikles og testes en forsøgsopstilling beregnet til at bryde ved de førnævnte rotationsverificeringer.
Projektet består af to hoveddele. Den første del er den teoretiske baggrund og design af en gennemførlig opstilling til test optimeret til brud ved rotation. Anden del er en objektiv testrapport, der beskriver de udførte test. Resultatet af disse test er en kombination af brud ved hulrand og blokrotation. Flydestyrke og brudstyrken af forsøgene er blevet bestemt, men materialeparametrene er ikke. Sammenligning af resultater og teorien bliver udført i et senere projekt.