

# Undersøgelse af blok- udrivning i boltede samlinger

- Teori rapport

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Bachelor projekt

Department of Civil Engineering  
Technical University of Denmark

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# Preface

This project is a Bsc projekt credited 20 ECTS points written in the period 01-09-2014 to 30-01-2015

The project is a final Bachelor project of the Civil Engineering on the Building study line.

The project has been carried out at the Technical University of Denmark (DTU) in the department of Civil Engineering (BYG).

The supervisor of the project is Jeppe Jönsson (BYG, DTU). Great appreciations is dedicated to him for guidance throughout the project.

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# Abstract

When calculating the design of structural constructions, certain calculation are used. This is done to make some standardized calculation methods. By having these standards it is a lot easier getting an overview, so all aspects and safety factors are taking into account when calculating the constructions.

The standards current used, are very conservative in their calculations of the strengths in the constructions. By optimizing these calculations, it would be possible to make use of a lot more of the material properties and strengths. Changing the standards require further studies, and some of those studies are the topic of this project.

Throughout this project bolt connections with a central applied force is taken into account. No moment is taking into account in the hypotheses made in this rapport. The current calculation methods on central loaded connection are explained, as well as new hypotheses to get closer to the actually strength achieved through the tests of the connection. Calculations from Eurocode are used to calculate the strength of bearing resistance, capacity of cross section, blockfailure and shear resistance for the bolts. The new hypotheses are made for bearing resistance and blockfailure, and explained at what conditions they are made.

Furthermore the results from [5] is taking into account, to examine how the distance between the bolts perpendicular to the force effects the strengths of the connection. In [5], tests are made of connections with both 4-bolts and 6-bolts, and the results of these tests are also taken into account to look at how the amount of bolts influence the bolt connection.

The final results confirms that the calculations made with the new hypotheses gets closer to the exact strength of the results from the tests than the Eurocode calculations. It is noticed that the strength of the bolted connection increases with an increase in distance and increased amount of bolts.

However, before a final conclusion of the precise effect of the increased distance, and for how far the new hypotheses are valid, further studies have to be made. The amount of bolts to increase the strength of the connection is also a subject for further studies to make a general conclusion on the new hypotheses.

# Resumé

Ved beregninger af bærende konstruktioner bruges en række beregningsstandarder. Dette gøres for at standardisere beregningsmetoderne. Ved at have en standard for beregningerne, er det lettere at få et overblik over alle aspekter og derved sikre at alle forhold bliver taget i betragtning. De nuværende standarder er dog meget konservative ved beregning af konstruktionernes styrke. Ved at optimere disse vil der være mulighed for bedre udnyttelse af materialernes egenskaber og styrker. Ændringer af standarderne kræver dog videre studier og dette projekt arbejder med nogle af disse undersøgelser.

Der er i denne rapport lagt vægt på at undersøge centralt trækpåvirkede boltesamlinger. Der er altså ikke medtaget eventuelle momenter i de hypoteser der bliver opstillet. Der er gennemgået hvordan de nuværende standarder udregner bæreevnen for en centralt påvirket boltesamling, samt opstillet nye hypoteser for at komme tættere på de egentlige styrke der opnås ved at teste samlinger. Beregningsmetoder fra Eurocode der benyttes til beregning af hulrandsbæreevnen, hulsvækket tværsnit, blokforskydning og boltens overlappings bæreevne er gennemgået. Der bliver opstillet nye hypoteser for hulrandsbæreevnen, samt blokforskydning, og der er forklaret på hvilken baggrund disse bliver opstillet.

Der er derudover set på resultater fra [5] for at undersøge hvordan afstanden mellem boltene vinkelret på kraften har af indflydelse på bæreevnen. Der er i [5] også undersøgt for både 4-bolts samlinger og 6-bolts samlinger, og der bliver derfor også set på indflydelsen af antallet af bolte.

De opnåede resultater bekræfter at beregningerne lavet med de nye hypoteser opnår en større del af den testede styrke end Eurocode. Det ses også at styrken af boltesamlingen stiger ved større afstande mellem boltene og ved forøgede antal bolte. For at lave endelige konklusioner på hvor meget den øgede afstand har af indvirkning, og om den er gældende for større afstande, skal der dog stadig foretages flere undersøgelser. Antallet af bolte for at

forøge styrken, er også noget der skal undersøges og testes yderligere for at kunne lave en generel konklusion af de nye hypoteser.