UNIVERSITY OF CAMBRIDGE
Department of Engineering

CONSTRUCTION ENGINEERING MASTERS DISSERTATION ABSTRACT

Do existing rules for designing gusset-connected struts assure conservative design? Does the construction industry learn effectively from structural safety failures?

The dissertation investigates the methods and philosophy used by industry to design steel struts connected by gusset plates. The methods in question are those used routinely in the UK and the USA. Concentric gussets and eccentric details are considered, although this study is not merely about connections, but the strut system as a whole.

The question is addressed through theoretical analysis of traditional rules, and of the research publications informing those rules. Evidence reported by international engineering advisors is also used to complement the theory. Finally, practical and empirical considerations are explored to determine if past performance of existing rules is a fair indicator of their quality.

From the analysis of current practice, a division emerges between connection design and member design, which receive separate treatment. By comparing with the theory of the whole system, it appears there is scope for this fragmented approach to overestimate both the capacity of the connection and the member. Evidence from other countries further raises suspicion of existing rules.

In the course of researching the gusset-connected struts, a second question emerged. The reaction of industry bodies suggested any fault or public debate about design guidance would be a sensitive issue. It begs the question of readiness or willingness to learn from structural safety failures.

Gusset plate rules and a potential fault are put into the context of system failure analysis. This provides a backdrop against which the reactions and views of different bodies can be discussed. The question is also addressed by comparing structural safety practice with other industries, especially aviation.

The other industries examined do appear to handle safety issues more effectively, although this can be a harsh comparison if the product ranges are very divergent. There also appears to be a difference in attitude towards debating safety issues with some room for improvement.

John Gradwell

December 2013