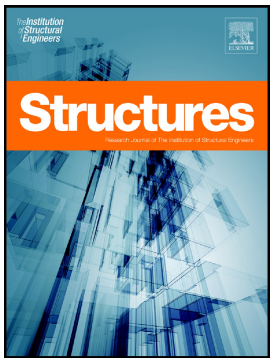

Design for lateral stability of slender timber beams considering slip in the lateral bracing system

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PII: S2352-0124(18)30109-7
DOI: doi:10.1016/j.istruc.2018.09.007
Reference: ISTRUC 330

To appear in: *Structures*

Received date: 10 November 2017
Revised date: 25 July 2018
Accepted date: 20 September 2018

Please cite this article as: Anders Klasson, Roberto Crocetti, Ivar Björnsson, Eva Frühwald Hansson , Design for lateral stability of slender timber beams considering slip in the lateral bracing system. Istruc (2018), doi:10.1016/j.istruc.2018.09.007

Design for lateral stability of slender timber beams considering slip in the lateral bracing system

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Abstract

The present study investigates the significance of potential slip in the bracings of simply supported slender timber members. Three bracing configurations are considered. The first case is that of a timber beam braced at one point at mid-span, the second one braced at two points and the third one braced at three points. Possible slip in the bracing members can for example be due to joint deformation, initial crookedness of purlins and slack (or relaxation) of cables in the stabilizing bay (catenary action). In this study, it is shown that slip in the bracing system can result in a reduced load-bearing capacity (due to larger beam stresses) of the beams. Also, the greater the slip, the greater lateral deflections and consequent bracing forces of the braced member. A simplified approach, using a larger initial geometrical imperfection, to account for potential slip in bracings is also evaluated. This approach is found to work reasonably well in terms of stresses and bracing forces, but underestimates the lateral displacements.

Keywords: Timber beams, Instability, Buckling, Bracing, Slip, Non-linear modeling

1. Introduction

Post failure investigations have determined that insufficient bracing is a major cause of roof failures; see e.g. [2] and [7] concerning hundreds of roof structures which collapsed due to loads of snow. In most cases, at the time of collapse, the measured weight of snow did not exceed the loads specified by the design