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Axial Compression Capacity of Cold Formed Steel C-Channel Single Stud Section

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Abstract

Non-linear finite element analyses were carried out to evaluate the axial compression capacity of a C-channel cold formed steel section using software ANSYS. Different structural characteristics including: material nonlinearity, geometric imperfection, residual stresses and perforations are taken into account. Then, the numerical models were compared with some standard-recommended analytical methods including: Traditional effective width method, direct strength method. Also the results verified against the experimental outputs. The results show that there is a good agreement between the numerical simulations and the test results which indicate that the finite element analysis can be used effectively to predict the ultimate compression capacity of the CFS single studs; whereas the direct strength method has a considerable error of around 26%. In addition, compared to the experimental results, the simultaneous use of effective width method and CUFSM, concludes a rational result.

Keywords: Cold formed steel CFS, Light steel frame LSF, Compression capacity, Single Stud

1. INTRODUCTION

Nowadays, one of the most popular parts of structural research is numerical studies and use of relevant available FEM software such as ANSYS [1]. That is because the numerical models can be employed for analyzing the behavior of structures properly; and leads to considerable saving of money and time. However, it is so important that enough attention is paid to ensure the numerical models are accurate by verifying with either other available experimental data or numerical output. Also in any FEM model, it is so important to consider the sensitivity of the model to different parameters that might affect the model such as the size of the elements.

In this research study, the effects of different possible structural characteristics on a single stud such as imperfection, residual stress and perforation were studied. For this purpose, maximum numerical capacity of a 1200 mm stud is discussed considering the effects of different structural parameters. Also, it is compared with some other available theoretical method for calculating the single stud's capacity, as well as the experimental results.

2. SECTION PROPERTIES

Figure 1 illustrates the detailed dimension of the stud's section which has been used in the current study.