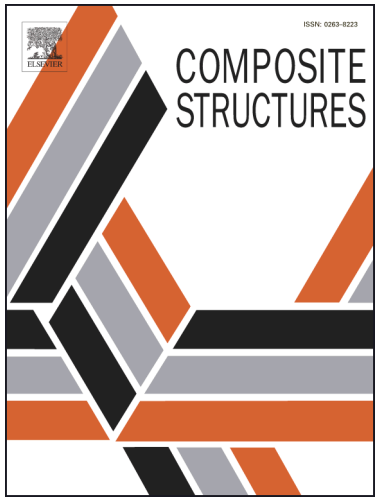

Comparison of steel-concrete composite column and steel column

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Keywords: steel-concrete composite column; steel reinforced concrete column; steel; FEM

Abstract

The aim of the work was numerical analyses of a steel-concrete composite column and a steel column. An internal column 3.60 m in length was considered. The column was on the second storey of a six-storey building designed for retail and services. The column was subjected to compression and uniaxial bending. The existing steel column was made from a welded H-profile. In the first stage of the work, the composite column was designed as an alternative to the existing steel column using the analytical method. A steel reinforced concrete column with a steel H-profile was selected. The second part of the work consisted in modelling the steel and composite columns. The geometries, loads and boundary conditions used in simulations of the columns were the same as in the analytical calculations. Numerical analysis was carried out using the ADINA System based on the finite element method. In the steel column, the stresses and displacements were considered. In the composite column, the stresses in the steel and concrete elements, the stresses distributions in the reinforcement bars and displacements of the whole column were evaluated.

1. Introduction

Steel-concrete composite columns are new composite members. They are widely used due to their high load-bearing capacity, full usage of materials, high stiffness and ductility and large energy absorption capacity as pointed out by the authors of [1,2]. The steel reinforced concrete (SRC) member (Fig. 1a), also known as the concrete encased composite member, is the result of filling the empty space in a steel H-profile with concrete [3].

Combining reinforced concrete (RC) and structural steel sections provides several advantages over traditional reinforced concrete and steel members. The concrete provides fire resistance to the steel section and restrains the steel member from buckling [4,5]. Applying steel-concrete composite columns has a beneficial impact on the course and values of concrete strains in relation to reinforced concrete columns. However, SRC columns require longitudinal and transverse reinforcement to prevent the concrete from spalling while being subjected to axial load, fire, or an earthquake [6]. A well-confined concrete core is vital for the column to develop a satisfactory plastic hinge rotation capacity. On the other hand, the reinforcement cage in SRC columns creates difficulty in concrete casting of the beam-column connections [7,8].