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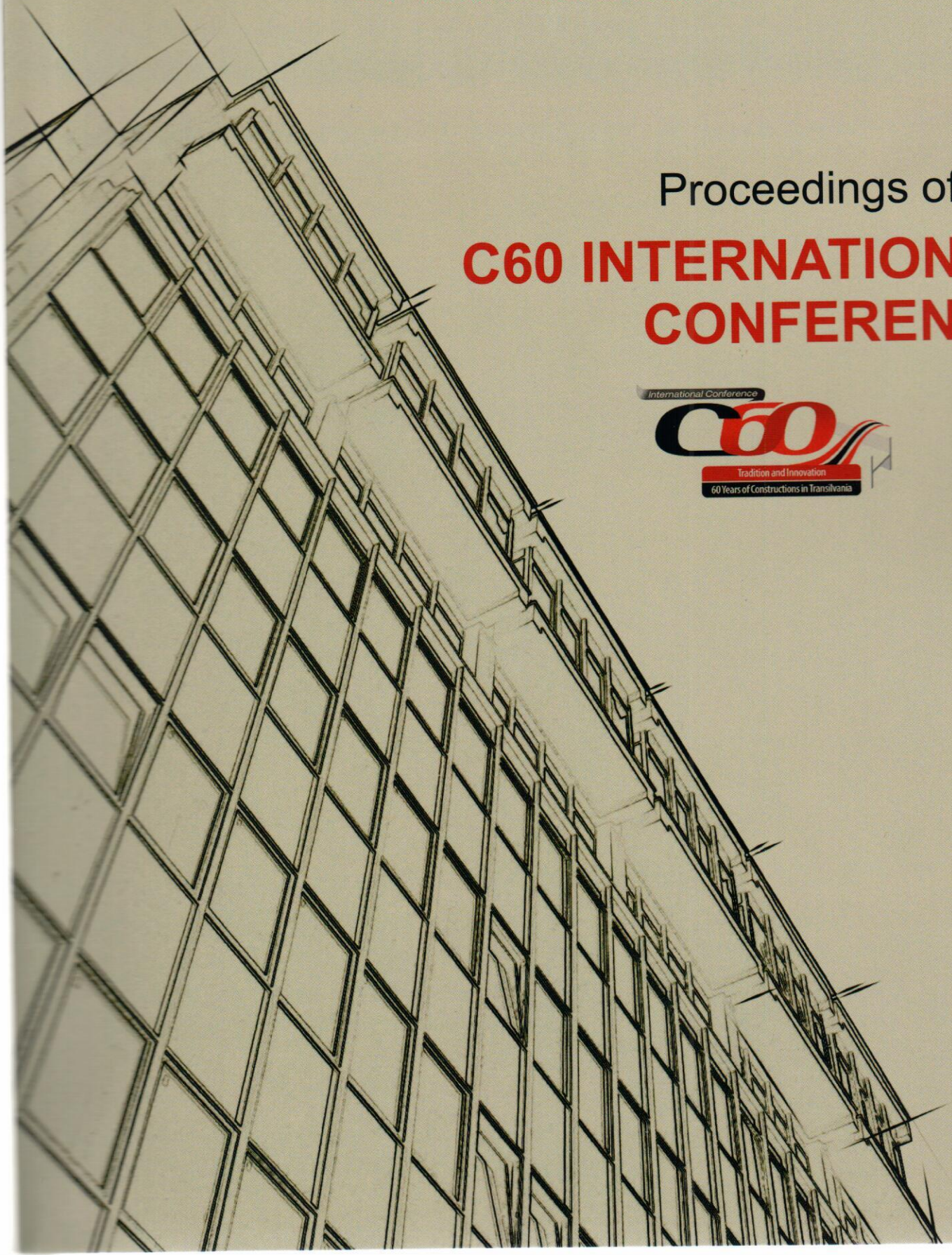

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# Case Study Regarding the influence of Linking Metal Columns in a Steel Building's Foundation Having a Durable Frame Structure

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**Summary:** *The case study presented in this paper was performed on a steel frame structure belonging to a ground floor steel building. The main objective of this paper is the analysis of the tension and strain state accumulated in the frames elements, depending on how the columns are connected in the foundations. A two versions structural analysis was made, one with articulate clamping of the columns in the foundation and the second one with rigid clamping..*

**Keywords:** *structure, metal frame, strain, displacement.*

## 1. Introduction

The steel structure presented in this paper belongs to a ground floor building with a production hall and office destination. The building is located on a land outside Codlea town, on a flat emplacement, with a land stratification that is suitable for construction works.

The case study was requested by the customer, being sceptical on the concept, dimensioning and composition of the structural elements for the building that was in progress during investigation.

The structural analysis was focused on:

-Evaluating the influence of manufacturing errors

-Evaluating the influence of the composition concept on the strength conditions, stiffness and stability.

The resistance structure was completed on the investigations time, with the following composition:

-Isolated foundations of simple concrete block type and concrete lining

-Continuous linking foundations in A-E/1 axes;

-Steel structure made of transversely main frames with an 20 m opening, longitudinal linked between A/E axes, rows 3-4 thru a solid section metal beam (HE220 A) placed at the end of the pylons;

-Metal structure made of columns and beams supporting the concrete slab located at +2.80, between A-E/1-3 axes;

-Roof metal purlins made of UNP180 profiles and horizontal bracings between A-E axes, rows 2-3 and 6-7;

-Vertical bracings located on A and E axes between 5-6 rows.

The paper presents how connecting the main columns to the foundation can influence the state of stress and strain.

## 2. Stresses and deformations analysis

The actual stiffness of the nodes may have a large influence on the structural response especially for those un-braced with movable joints. The way of how structural analysis and design is made generally uses fully rigid or fully articulated joints.

The studies and research consisted of an advanced structural analysis of the existing building using advanced computer programs for checking the level of achieved requirements in terms of

-Terms of resistance;

-Terms of rigidity;

-Terms of stability.

Structure modelling was performed using the finite and dimensioning element program of reinforced concrete and steel structures, Advance Design. The program uses a separate calculation module, Advance Design Steel Connections, for verifying the joints, interactively, according to SR EN 1993-1-8.

## 3. Conclusions

From the analysis of the two cases we can see that for the articulated frame in the foundation we see a significant increase of almost 50 % of lateral displacement to the limit state of service. This is also influenced directly by the bracing system which in this case was kept, being the one put in place by the manufacturer.

In terms of maximum values for the bending moment, the values differ by up to 5 % in both cases. Negative moment

from the middle of the main beam increases with 20 % for the articulated frames in foundation.

Real behaviour of nodes has direct effects on the forces and internal moment distribution and on the total [illegible] of a structure. Base plate connection in simple construction are generally modelled as pins, and designed [illegible] either concentric force (compression or tension) or a combination of axial and shear force.

The nodes rigidity can have a big influence upon the structure response. European standard norm SR EN [illegible] admits that most nodes are semi-rigid and therefore recommends integration of the real behaviour in the calculation [illegible] introducing semi-rigid nodes and / or partially resistant.

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