Analysis of the stability of the outer partition of a steel frame house using FEM

Mariusz Kosiń [1,*] and *Maciej* Major[1]

[1]Czestochowa University of Technology, Faculty of Civil Engineering, Akademicka Street 3, 42-200 Częstochowa, Poland

Abstract. The subject of the analysis is a separate fragment of the external partition located in the ground floor of a residential building made in the technology of light steel skeleton without stiffening plating. The motivation to carry out this analysis is, among others Investors' growing interest in alternative solutions to traditional single-family housing. The selection of the considered fragment was made on the basis of maximum displacements obtained as a result of numerical analysis carried out in Robot Structural. Then, for the selected structural element of the wall, three calculation models in the Ansys program for the assessment of bending - torsional analysis were made. The calculation models adopted for the calculations differed in the way in which the bracing used were assembled. One of them included the author's own development of an insert stiffening the transverse profile at the bracing assembly site. The results of the calculations showed the legitimacy of strengthening the structure when the stiffening plating is removed.

1 Introduction

The technology of light steel skeleton based on thin-walled elements in industrial and single-family construction as well as the superstructure of existing buildings is used. Thin-walled elements are characterized by the fact that one of the dimensions determining the cross-section (thickness) is incomparably small in relation to the others [1, 2]. In the design of structures made of thin-walled elements, the application of the basic hypotheses applicable to solid steel elements does not apply.

Investors are increasingly looking for optimal technological solutions. One of such solutions is construction in the lightweight frame construction technology. Thanks to the lightweight construction, quick realization, easy rebuilding, the use of recycling materials and meeting the requirements of building physics houses in light steel construction can easily compete with those built in other, e.g. traditional technologies [3]. The use of modern technologies based on thin-wall structures substantially reduces the time to complete the investment (construction of a building). For testing the structure in this technology FEM analysis is commonly used by researches [4]. The numerical modelling of thin-walled construction were conducted in [5-8].

* Corresponding author: mariusz.kosin@pcz.pl

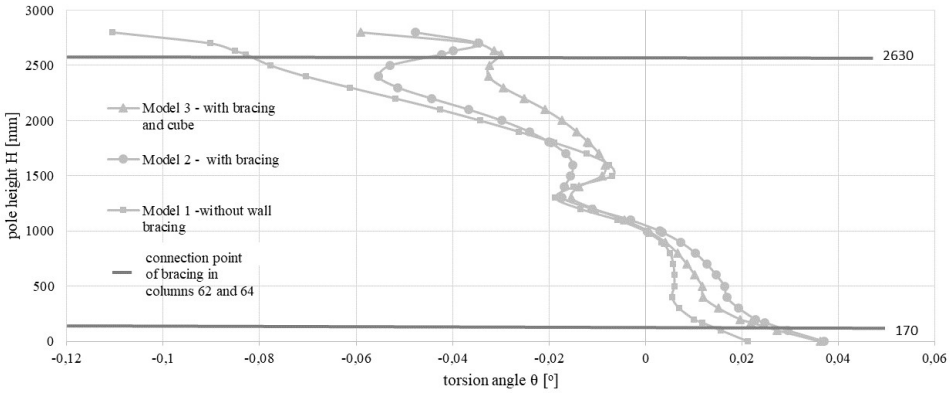

Fig. 4. The course of torsion angle variability for the column no. 62 in the bracing attachment plane.

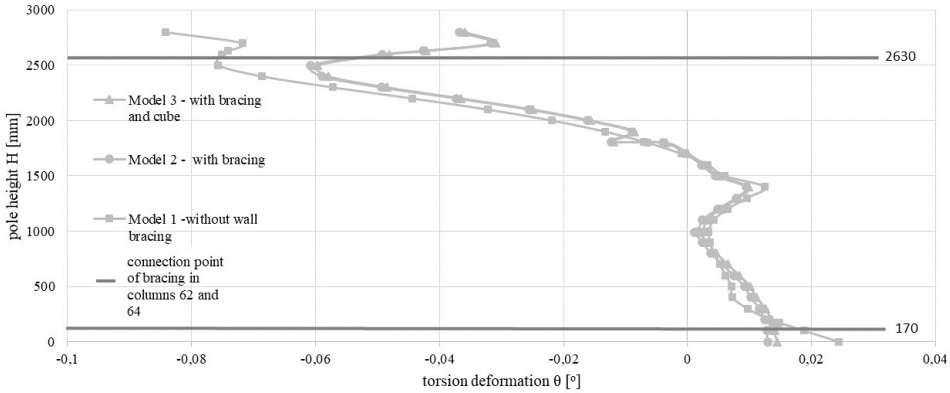

Fig. 5. The course of torsion angle variability for the column no. 63 in the bracing attachment plane.

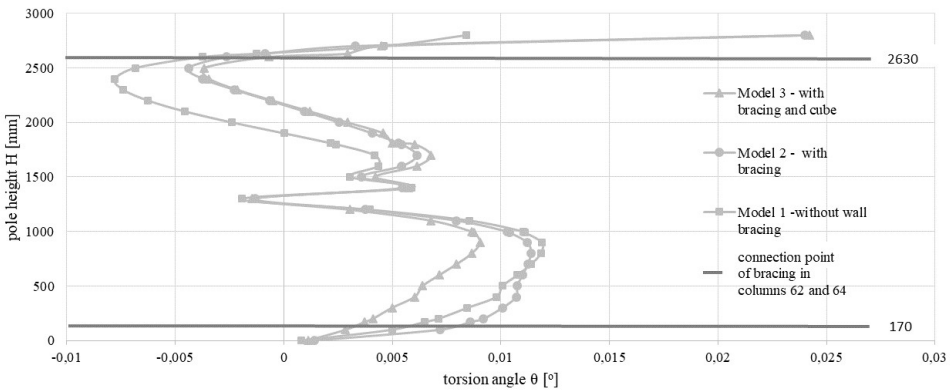

Fig. 6. The course of torsion angle variability for the column no. 64 in the bracing attachment plane.

Table 2 summarizes the average value of the torsion angle for individual models and analyzed columns. An increase in torsional stiffness due to the use of the mounting insert is noticeable in all models and analyzed columns. For example, the difference between the torsion angle for Model 3 is about 22% smaller than for Model 2.