EFFECT OF DESIGN PARAMETERS ON COLUMN SHORTENING IN TALL CONCRETE BUILDINGS

By

Eslam Abd El-Nabi Ahmed Hemayed

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Structural Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

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Title of Thesis:

Effect of Design Parameters on Column Shortening in Tall Concrete Buildings

Key Words:
Column shortening; creep; shrinkage; differential shortening; steel stress

Summary:

In tall concrete buildings, the vertical elements: columns, shear walls, and cores undergo elastic shortening and time dependant axial shortening caused by creep and shrinkage. In this study, a computer program was developed and verified to calculate column axial shortening based on the ACI 209R-92 model. The developed program was used to investigate the effects of different design parameters on column shortening. The results showed that increasing the column design reinforcement ratio increases both before-floor-casting and after-floor-casting column shortening. In particular, compared to 1% ratio, increasing the column reinforcement ratio to 2%, 3%, and 4% increases the before-floor-casting column shortening by 5% to 11%, 9% to 22%, and 13% to 32%, respectively. Besides, compared to 1% ratio, increasing the column reinforcement ratio to 2%, 3%, and 4% increases the after-floor-casting column shortening by 7% to 9%, 14% to 17%, and 20% to 27%, respectively. However, the effect of column aspect ratio has a minor effect on column shortening. Nevertheless, increasing the rate of construction results in a significant increase in the after-floor-casting shortening but greatly reduces the before-floor-casting shortening of columns. In addition, the results showed that increasing the design concrete strength increases the column shortening.

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