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Energy Procedia 19 (2012) 269 – 275

Energy Procedia

Optimization in the Selection of Structural Systems for the Design of Reinforced Concrete High-rise Buildings in Resisting Seismic Forces

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Abstract

In this paper the application of a solution the issue of optimization in the selection of structural systems for design of reinforced concrete (RC) high-rise residential buildings is studied through the study and design of three models of RC high-rise structure buildings consisting of (10-15-20) storeys, where the genetic algorithm (GA) was based on to find designing models to facilitate access to the optimum solutions, as the technical Analysis-Design Cycle was applied to determine the optimum cross-sectional dimensions of all reinforced concrete elements of high-rise structure building, thus determining the best structural system, which ensures the economic dimensions that achieve the saving in concrete and steel amounts thus achieve lower cost.

Keywords: Structural Systems; RC high-rise buildings; Concrete and Steel;Earthquakes;

1. Introduction

The economic cost for engineering projects is the most important factor in the design of structures after the achievement of those structures for the safety factors and design requirements in accordance with international codes. Reinforced concrete (RC) high-rise buildings designed to resist vertical loads in general, and checked on the seismic loads, in particular, adopted structural systems in the design to resist the forces of earthquakes consist of [1] :

- Shear Walls System.
- Moment - Resisting Frame System.
- Dual System is the system that contains together frames and shear walls.

In couple system, shear walls were presented as central reinforced concrete core of the stairs and lifts, which were favourite to resist the shear forces in general in the regular structures and private due to its symmetry and placed in the centre of the structure, and if the shear walls were insufficient to resist the shear forces caused by earthquakes, the additional shear walls are added to give structural system appropriate stiffness to resist the horizontal forces in both directions [2,3].

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 doi:10.1016/j.egypro.2012.05.206

There are many types of structural systems, resistance to the forces of earthquakes, and structural systems which previous referred to it considered more systems used in the design of public and private structures, but in the design of RC high-rise buildings, can we adopt certain structural system without the other and generalization use in the design of RC high-rise buildings whatever the number of storeys, type of foundation soil and regardless of whether this system achieve the economic cost of the building required designing it, and what if one of these systems achieve economic cost of the multi-storey building without the other, whether those buildings are similar to or different from each other in the number of storeys, type of foundation soil. To answer these questions and study the problem at hand the following models of RC high-rise buildings was imposed, as shown in Fig 1:

- Structural models for RC high-rise building consisting of 10-storey, structural systems in it are:
- Frames system (F).
- Shear Walls system (SW).
- Couple system (C).

-Structural models for RC high-rise building consisting of 15-storey, structural systems in it are also F & SW & C systems.

-Structural models for RC high-rise building consisting of 20-storey, structural systems in it are also F & SW & C systems.

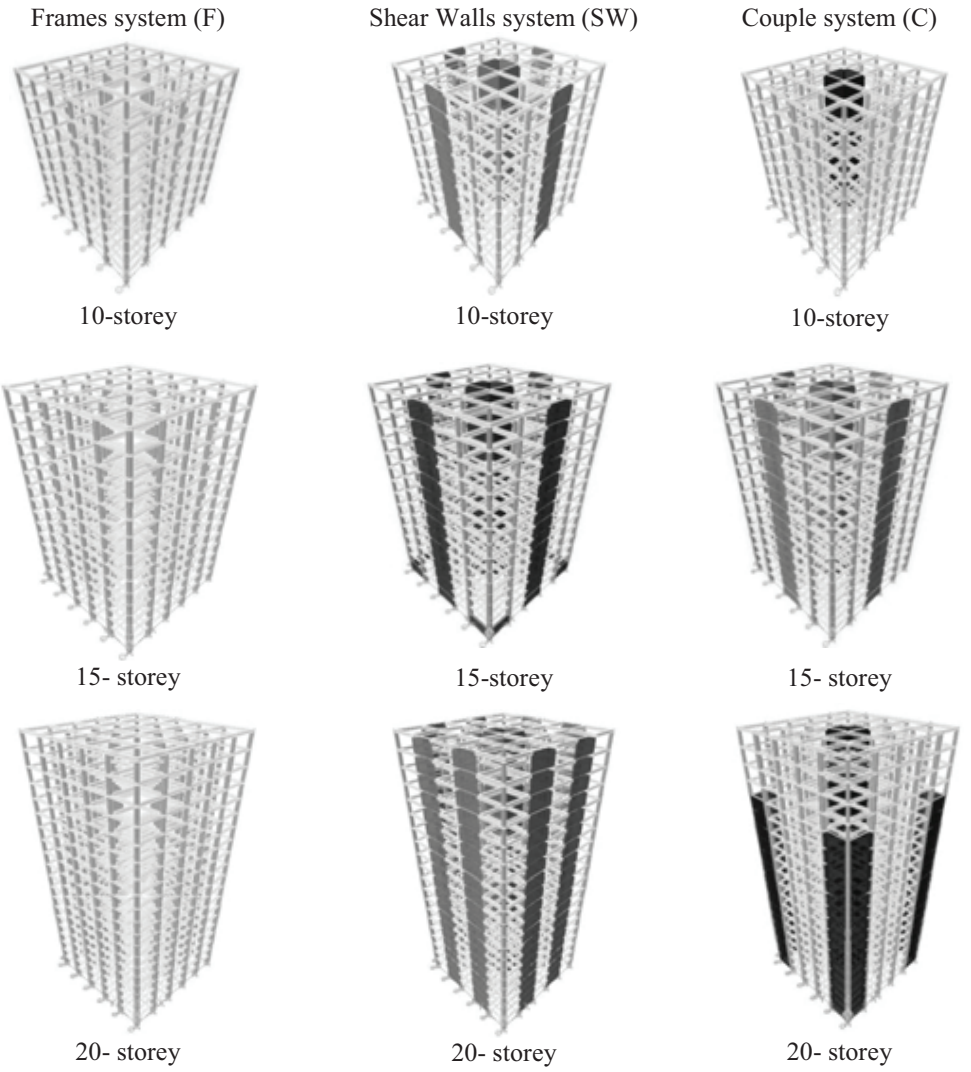

Fig 1: some of supposed structural models for three structural systems (F-SW-C)