



Comparative Study on Analysis and Cost Economics of Steel and Composite Structure

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Opinion

Turkey is well-known a country prone to high level of seismicity; on the other hand, steel-composite structures appear competitive today in this country in comparison with other types of structures, namely, steel or concrete structures. Composite construction is the dominant form of construction for the multi-storey building sector and other infrastructure. The underlying reason is very simple that in composite construction, concrete takes of compression and steel takes care of tension. The scope of this paper covers analysis, materials take-off, cost analysis and economic comparisons of a multi-storey building with composite and steel frames. The aim of this work is to show that designing load bearing systems as composite is more economical than designing as complete steel. Cost is one of the biggest factors in determining load bearing system material of a building. Additionally, architecture of the building and form of load bearing system are the factors in material selection. Steel load bearing systems are used scarcely in any multi storey buildings in Turkey. Turkey is located in seismic zone and steel structures behavior more sensible to earthquake effects. Moreover, the use of steel in the system brings a significant decrease in cost of load carrying and to use plastic analysis methods representing actual capacity of the material instead of elastic analysis methods. Design of the nine stories building which is under consideration is done according to the regulation of the Turkish Earthquake Code and by using static and dynamic analysis methods. For the analyses of the steel and concrete composite system, plastic analysis methods have been used and whereas steel system analyses have been checked in compliance with EC3 and composite system analyses have been checked in compliance with EC4.

Composite beams are more economic than steel beams trying to carry a reinforced concrete slab. While tension force comes from bending is carried by steel section in the composite beam,

compression load is carried only by reinforced concrete plate. Accordingly, steel section is either completely or mostly freed from carrying the compression load of bending. This superiority of composite beams against steel beams can be realized by comparing with reinforced concrete beams. The composite beam, which is always lighter than a reinforced concrete beam, may consume less steel than a reinforced concrete beam at the same height if there is a restriction in terms of height of construction. Composite columns provide significant structural and economic benefits for various applications in construction industry. Superior ductility and energy absorption capacity makes them attractive especially in seismic regions. In addition, larger bending rigidity is another reason of their use. Some results of preliminary study are discussed below:

1. As load carrying system consisting of beams, columns, and diagonals of building is examined as a whole, 14220.18kN steel quantity for analysis of steel and 8461.40kN steel quantity for analysis of composite were used. Composite construction was lighter in terms of steel material compared to steel construction.
2. Practicable area increased because sections were quite reduced in composite construction. This is more suitable for the principle of saving on space which is the building purpose of the high-rise construction.
3. Cost of steel profile was \$1.511.989,088 in the steel system and \$899.675,28 in the composite system. Composite system was observed to be more economical at the rate of %40 in terms of steel material compared to steel system.
4. Composite system was found to be more economical at the rate of 37% in terms of cost compared to steel system in the results.

At the end of the comparisons, it is revealed that composite load carrying systems analysis is more economical than the steel load carrying systems analysis considering the materials to be used in the load carrying system and the workmanship to be spent for this job.

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Conflict of Interest

No conflict of interest.