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LIGHT STEEL FRAME (LSF) SYSTEMS: A SUITABLE STRUCTURE FOR BUILDING IN IRAN'S EARTHQUAKE-STRICKEN AREAS (A REVIEW)

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INTRODUCTION

According to the statistical data of the Iranian Seismological Center in the first three months of 1398, a total of around 2880 earthquakes were recorded and determined in Iran and borderline regions. The largest earthquakes with the Richter magnitude scales of 4-5.1 occurred in Kermanshah province, Iran, and its suburbs. In addition, a severe earthquake occurs in Iran every 7 years on average which leads to dramatically high financial loss and casualties. According to earthquake-induced losses and damages, the building industry has intended to lighten and provide industrial construction of structures to facilitate better support against seismic forces. In this respect, light-weight steel structures have been applied by engineers as one of the excellent industrialization and lightening approaches. This modern building system has greatly welcomed in developed countries and has used as an alternative to traditional systems. This system can be employed for rebuilding in earthquake-stricken areas and construction in prone-to-earthquake regions. This study was conducted aiming at reviewing features of light-weight steel structure to be used in prone-to-earthquake and earthquake-stricken areas.

METHODOLOGY

In this review study, we refer to Persian and English databases including SID, Google Scholar and Science Direct to access relevant articles. Studies conducted by 2019 with LSF, earthquakes, steel frame frames keywords, there were 20 related studies that full text was reviewed.

RESULTS

Lower time required to build, easy transportation, rapid implementation, cost-effectiveness, safety at work, easier and less costly performance, resistance (against heat and cold), fire safety, energy saving (earthquake resistance), eco-friendly and recyclable, all materials being traditional materials, employment of graduated engineers, implementation of a resilient economy through the use of domestic products (steel), construction culture reflected in the type of building and the similarity of this Iranian-style building are the advantages of LSF structures.

Vosuqifar and colleagues (2010) found that the use of the LSF system, due to its ability to reduce relative displacement, reduces the weight of the structure by about 40% compared to that of the conventional metal systems, reduces the consumption of concrete by about 60% compared to that of the conventional concrete structures, and 30% compared to conventional metal systems. It has a good seismic performance in comparison with the common metal systems. Although a case study by Tavakoli et al. (2017) indicated that in addition to positive response to sustainable architecture, the use of LSF technology increases the affordability of buying a home, as well as the strength and the durability of these structures compared to conventional constructions in different environmental and seismic conditions.

Mahdavinejad et al. (2011) concluded that the comparison of the conventional construction costs with the LSF costs shows that by reducing the construction costs, the LSF technology plays the pivotal role in controlling housing shortage crisis and the increase of the house ownership possibility, and finally, the housing sustainability.

In 2012, Zeynalian et al. performed a feasibility study to compare the conventional construction system with LSF, concluding that LSF structures are more stable and reliable for constructing buildings in earthquake-stricken regions. Gerami et al. (2015) showed that using LSF structures in severely prone-to-earthquake regions yields the enhancement of seismic behavior. In another study, Zeynalian and Zare (2017) suggested that increasing the thickness of columns and decreasing the spacing of bolts can improve the performance of cold-rolled steel frames against earthquakes. Danesh et al. (2013) implied in their study that using the light-weight steel frame system can reduce construction wastes to 4.8 m^3 per $100m^2$ constructed area compared to traditional systems (i.e. a decrease by 22%). Furthermore, this system provides the possibility of 100% recycle of pieces, materials, and construction components, which is a great advantage to diminish the negative environmental impacts of the building industry.

CONCLUSION

Considering the advantages mentioned in this study, construction and implementation of LSF structures in Iran's earthquake-prone areas is economical and functional. Therefore, managers and planners of reconstruction are recommended to implement this structure in their plans.

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