APPLICATION OF LIGHT STEEL FRAMING IN SEISMIC REHABILITATION

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ABSTRACT
Light Steel Framing (LSF) construction systems allow the structures to become more flexible, adapting to the changes observed, for example, during seismic actions. Considering its characteristics and properties, LSF can be applied with great advantages, for remodelling and rehabilitation of buildings, particularly in historical centres and / or accessibility conditioned areas. The presented work corresponds to the preliminary stage of an ongoing MSc thesis, being also envisaged some guidelines for the development of future work.

Keywords: Light steel framing, remodeling of buildings, structural and seismic rehabilitation.

INTRODUCTION
Earthquakes emerge as one of the most destructive manifestations of nature, being unpredictable in terms of magnitude, frequency, duration and location. The forces resulting from them, produced by strong and irregular movements are characterized, in most instances, by large intensities presenting frequently high impact in different structural systems. The Light Steel Framing (LSF) construction systems allow the structures to become more flexible, adapting to the changes observed during seismic actions. The intrinsic characteristics of LSF systems allow classifying them in the so called sustainable construction or green buildings. The Portuguese construction sector is currently facing a crisis in its production. Considering this situation, national companies have bet more on the building rehabilitation market. Due to its significant advantages, the use of LSF building systems in rehabilitation may be one of the solutions required to achieve improvement in the Portuguese construction sector.

LIGHT STEEL FRAMING (LSF)
Light Steel Framing is the international designation given to building systems in which the main elements are metal profiles cold formed, usually of galvanized steel [Futureng, 2014]. Light indicates that the elements are lightweight and can be easily employed in rehabilitation works. Steel indicates the raw material used in the structure, i.e. steel. Framing corresponds to a structural skeleton composed for many individual elements linked and working together. In the context in which it appears, the more appropriate term is structure.

ADVANTAGES OF USING LSF IN REHABILITATION
The advantages of using LSF in rehabilitation are clear [Carvalho, 2012]: i) Reduced construction time; ii) lower load on fragile structures with the use of light sections; iii) lighter materials resulting in higher workers efficiency; iv) easiness in transportation and lifting of the materials; v) easiness in the access to historical sites; vi) reduction of the space for construction and less occupation of public way; vii) more rigorous leveling; ix) more efficient
connections (screws instead of nails); x) reversibility; xi) excellent compatibility between old and new; xii) avoids formwork and shoring, xiii) requires no cure time; xiv) in case of fire, the steel does not contribute to fire propagation; xvi) does not rot, warp or crack; xvii) better seismic behavior; xix) competitive prices due to the speed and easiness of assembly.

**LSF IN STRUCTURAL AND SEISMIC REHABILITATION**

The ideal structures to withstand the forces resulting from seismic actions should behave in a consistent and predictable way. LSF are able to conform to this pattern due to the properties of steel, to the construction methods used as well as to the rigorous process used during its manufacture. All over Portuguese territory, are already identified several interventions in existing buildings using constructive solutions fully or partially based on LSF, which demonstrates its ability to adapt. As application example is highlighted a residential building (Figure 1), located in Lisbon [Moreira, 2012]. The seismic rehabilitation interventions consisted in: i) reinforcement and consolidation of 3rd floor pavement; ii) full replacement of the attic floor pavement (Figure 2) and strengthening of connections (Figure 3).

![Fig. 1 - Building façade](image1)
![Fig. 2 - Attic floor pavement replacement](image2)
![Fig. 3 - Connections strengthening](image3)

**FINAL REMARKS**

It is considered that LSF constructive solutions are very directed to the housing sector. The architectural flexibility and the undeniable speed of execution are fundamental requirements for those who want to see the result of their investment returned in the shortest amount of time. It is also natural that the LSF is also pointed as a good option for the rehabilitation segment, particularly in terms of structural and seismic rehabilitation. Its constructive lightness allows excellent adaptation to existing structures without the need for complex structural reinforcements. Nationally, it may be an opportunity in the sector, considering the wide built heritage and the need for development in rehabilitation.

**REFERENCES**

