

# Increasing Housing Demand: Analysis of Steel Frame as a Sustainable Solution

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**Abstract—** The objective of this paper is to present the steel frame as a possible solution to the growing demand for housing. The steel frame is a dry construction system that seeks to replace traditional methods, presenting certain advantages over them, which will be developed in the paper along with its disadvantages. This analysis shows that this method is an optimal possibility for the problem dealt with, since it meets the requirements requested by the Sustainable Development Goal number 11, included in the United Nations report, of being sustainable and having low environmental impact.

**Resumen—** El objetivo de este paper es presentar al Steel Frame como una posible solución a la creciente demanda de viviendas. El Steel Frame es un sistema de construcción en seco que busca reemplazar a los métodos tradicionales presentando ciertas ventajas sobre ellas, las cuales serán desarrolladas en el paper junto a las desventajas. Este análisis muestra que este método es una posibilidad óptima para el problema tratado, ya que cumple los requisitos solicitados por el Objetivo de Desarrollo Sustentable número 11, incluido en el reporte de las Naciones Unidas, de ser sustentable y de bajo impacto ambiental.

## I. INTRODUCTION

The growth of the world's population is accompanied by the increase in demand for housing. As it has been stated in the United Nations' Sustainable Development Goals (SDGs) report, "[a]dequate housing is a human right, and the absence of it negatively affects urban equity and inclusion, health and safety, and livelihood opportunities" [1, p.44]. However, this housing demand cannot be met by making use of traditional unsustainable infrastructure construction methods. The need to address the growing demand for housing while promoting sustainable construction practices is related to the Sustainable Development Goal number 11, which emphasizes the urgency to "make cities inclusive, safe, resilient and sustainable" [1, p.44]

The use of alternative construction methods is continually increasing due to the various advantages they offer over conventional methods. The need to provide housing to the world's population and to reduce the environmental impact of construction processes has led to the use of alternative construction methods such as steel frame. The use of steel frame has been implemented to address the rapid and effective construction of houses while reducing the damage to the environment.

The aim of this paper is to analyze the use of steel frame as a sustainable construction solution. In order to do this, this

paper has been organized as follows. First, the problem of the growing demand for housing will be presented. Secondly, the use of steel frame as a solution for the growing demand for housing will be discussed. Third, the advantages of steel frame will be analyzed. Finally, the disadvantages of the method will be mentioned.

## II. GROWING DEMAND FOR HOUSING

In all countries there is a need for affordable housing for their population. However, there are countries with greater needs, which are called developing countries. The urbanization of these countries is increasing due to the constant migration of the population from rural to urban areas. This increase in the urbanization of certain areas means that there is, in turn, an increase in the demand for housing. [2]. The aforementioned is reflected in the statistics provided by the United Nations (UN), which state that "[t]he world is becoming increasingly urbanized. Since 2007, more than half the world's population has been living in cities, and that share is projected to rise to 60 per cent by 2030" [1, p.44].

Apart from this urbanization process, it is important to note that there are other factors that encourage the growth of housing demand, such as the increase in population, the decrease in supply and the increase in prices set by suppliers. However, the purpose of this paper does not cover the study of the causes of this problem but the solution that can be provided by means of new alternative construction methods that are developed in a sustainable manner.

Engineering aims to offer alternative methods to solve this growing demand for housing without neglecting the environmental impact that conventional methods have. From this concern, sustainable construction methods arise, which are those that do not use a large amount of natural resources for their execution, reducing their environmental impact. In this way steel frame appears as a possible as a possible sustainable solution to the growing demand for housing.

## III. STEEL FRAME AS A SOLUTION FOR THE GROWING DEMAND FOR HOUSING

To understand steel frame as a possible solution to the great demand for housing, first of all, steel frame must be known as a construction method. The characteristics and construction process of this method should then be analyzed.

### A. Characteristics of Steel Frame

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Steel frame is a method that has become more widely known throughout the world in recent years. Steel frame has a resistant structure that is made of steel profiles of low thickness and light weight, which is combined with a series of elements that work together. Some of these elements are insulation, which is used to increase thermal and acoustic efficiency, enclosures, which are usually wooden plates, and joining elements that are usually self-drilling screws. This set of structural elements makes steel frame a construction method that entails a simple and fast construction process. Another main characteristic is its dry assembly, which means that mixtures with water are not used. As well as this, steel frame has environmental advantages that will be mentioned later [3].

### B. Description of the Process

The development of a structural work with steel frame has multiple stages. These go from the design of the work to be executed until its completion. The process begins with the development of the project to be carried out, according to the needs of the clients. Secondly, the development of the project and the calculation and budget of the work is carried out. Then, the foundations are built according to the calculations made in the project stage regarding the type of soil and the loads to be supported by the structure. At that moment, the dry construction that characterizes steel frame begins, assembling the profiles and screwing the oriented strand board (OSB) to them. This last stage is what differentiates this method from the traditional ones due to its rapid execution and little contamination due to the low emission of dust and pollutants [4].

The characteristics mentioned above have made steel frame an alternative method that can be a good option to solve the increasing problem of housing demand. Along with the advantages and disadvantages, the justification as to why this method of construction is a convenient option to counteract this necessity of dwellings will be developed.

## IV. ADVANTAGES

The development of steel frame as a possible solution to the problem of housing demand is due to the advantages that it offers as opposed to traditional construction methods. Among the advantages that it presents, there are two that stand out from the rest, namely, the speed of construction and the environmental impact.

### A. Construction Speed

The simplicity of steel frame makes this method faster than traditional methods. This advantage is due to the execution of prefabricated structural elements. Unlike traditional methods that take a long time to build, these elements are assembled at the construction site and at the construction development. An example of this is the enclosures because, with steel frame, only the wooden plates must be screwed to the previously placed profiles. This process is less time-consuming than that of the traditional construction method, in which the mortar should be prepared to bond the bricks and it is necessary to wait after laying the bricks before moving on with the construction of the structure that supports this masonry. In the same way, the time of other stages of the

construction process is reduced. This characteristic makes steel frame an efficient method [5].

### B. Environmental Impact

In addition to the construction speed, this method is sustainable due to its low environmental impact. The sustainability of the steel frame is due to many reasons that could be summarized in sustainable design, construction, use and end of life [6].

As far as the design is concerned, a good design is key in sustainable construction. The decisions made at this stage are fundamental because of the effects they will have in the future. With a good design, high efficiency of the materials used, energy efficiency and recyclability in the future can be achieved [6].

In terms of the second environmental advantage, the construction of steel frame offers advantages over the construction of traditional methods because the construction elements are prefabricated in factories that are intended for that purpose, reducing waste and pollution in work areas. In addition, the little waste that there is can be reused to minimize expenses [6].

As for the last advantage, that is, use and end of life, it can be stated that the sustainable use of steel frame is also due to the durability of this material. This property is improved due to the simple form of maintenance that this construction method has. In the same way steel frame is both easy to maintain and easy to dismantle. For this reason, it has a sustainable end of life since, when it is decided to dismantle the work, the related pollution is not as high as that of traditional methods [6].

## V. DISADVANTAGES

The advantages and positive aspects of the steel frame compared to traditional construction methods were mentioned above. However, there is no perfect material or method, and that also includes steel frame, which has its own disadvantages which will be discussed below.

### A. Maintenance Cost

In the study to develop a project, the initial investment and maintenance costs must be analyzed. These maintenance costs are important to extend the useful life of the construction.

Considering the maintenance costs, steel frame presents a problem that traditional concrete constructions do not have, which is corrosion. The concrete covers the steel bars preventing their corrosion, unlike steel frame constructions where the steel is in direct contact with corrosive agents. It is for this reason that investments must be made on anticorrosive paints to cover the steel frames in steel frame constructions. For logical reasons, the larger the construction, the higher the maintenance cost because there are more structures to cover from corrosion [4].

### B. Conduction of Heat

Although steel frames are incombustible, their resistance varies according to the temperature at which they are found. At large heat exposures, creep, which is plastic deformation under a constant load over a period of time, becomes more pronounced causing structures to deform excessively [4].

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The cost of construction rises due to the need to prevent accidents due to fire attacks that the construction may suffer.

## VI. CONCLUSION

The choice of steel frame, despite its disadvantages, is optimal in terms of providing a solution to the growing demand for housing. As indicated in SDG number 11, the growth of cities and access to housing for a greater number of people must be based on a better use of resources and the reduction of pollution.

Steel frame provides, through proper design, both energy efficiency and possible future reuse if desired. Apart from these advantages, it has a sustainable end-of-life since, when it is decided to change its use or structure, the possible contamination it produces, compared to traditional methods, is extremely reduced.

Having analyzed steel frame, it can be concluded that it offers great advantages to traditional construction methods. Despite its high initial cost, this sustainable method can be put forward as a solution to the growing demand for housing.

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