

# LIGHT STEEL STRUCTURES IN RESIDENTIAL HOUSE CONSTRUCTION

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## Abstract

The application of light construction steel-framed living houses is increasing in Hungary. This new building technology came to the foreground because of the rapid development in the building industry, surely it has a lot of advantages from the technological point of view, which meet all the requirements these days. But it is more important beside the points of view mentioned above that the construction of these buildings protects the natural environment, and suits the standpoints of sustainable development and guarantees a healthy environment for the users for the whole lifespan of the building. In the following paper I will justify the existence of light, steel-framed constructed building system in the residential housing with the points mentioned above. This article is connected to my Ph.D. thesis under preparation. (Supervisor: Dr. Mária Széll, University Professor.)

*Keywords:* light construction building system, steel-framed building, lifespan, environmental friendly standpoints.

## 1. Characteristics of the Building System

Light construction residential building is more and more frequently used in Hungary. Although the application quantity is still low, in the last decade it came to the foreground due to numerous advantages. Because of that, this system is not a traditional building type in the Hungarian circumstances, a lot of questions are raised by clients and often by engineers.

The building system characteristics would be summarised as follows:

- The light construction residential house's frame is assembled from cold formed steel profiles. In the gaps between the elements of the frame heat insulation material is placed and the frame is supplied with surface layers made of various materials, forming a layered structure.
- Generally, the elements of the frame structure are constructed of C and U profiles with a dry, assembly style building technology. Numerous steel fasteners, stiffeners and other complementary profiles are connected to the basic elements of the structure.
- The applied materials filling the gaps between the elements of the frame not only perform heat insulation, but also meet acoustical requirements and they are an efficient fire protection tool. With the application of efficient heat

insulation materials a good level of fire protection and an excellent heat and sound insulation can be achieved.

- The inside cover is mostly made by plasterboard. Composite layers by wood as basic material (e.g. OSB) are preferably used as outside wall board cover and floor slabs. With this, we can exploit the advantage of high strength, which provides stiffening function.

*Figs. 1 and 2* show steel framed living houses during the building process. The structural characteristics are visible in the pictures.



*Fig. 1.* Protektor profile house



*Fig. 2.* Lindab Familyline building

## 2. Environment and Health Protection Viewpoints

The ecological approach has pointed out that the current high-level energy consumption, characteristic of people's activity nowadays, the level of exploitation and the pollution of the natural environment lead to a global catastrophe. To decrease this danger, it is absolutely necessary to economize basic materials and energy, as well as extended protection of nature is required. The macro-level changes mentioned above should appear in all micro-level processes in the construction generally and in the building of concrete houses. This can be put in reality by following the directives of environment friendly, energy-conscious design and building.

In the ecological architecture the most important issue is the enforcement of the viewpoints of environment protection and public health protection. During the building, the environment protection is reachable by reducing significantly the energy consumption by

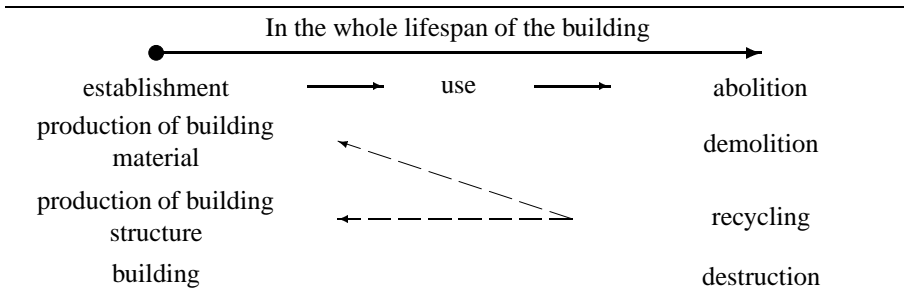
- application of building materials with low embodied energy;
- employment of recyclable building materials;
- usage of a building technology with low energy need, etc.

The health protection viewpoints have to be taken into consideration during the total lifespan. Naturally, the health protection refers not only to the inhabitants but also to people living in the wider environment and globally to the whole humanity. The principles of health protection suggest the application of possibly natural materials and technologies, which are absolutely harmless to people.

### 3. Lifespan Analysis

The flowchart below reviews the whole lifecycle of a building. The viewpoints of natural and health protection have to be enforced in each phase of the lifespan.

Table 1. Phases of the building’s whole lifespan and their interactions



#### 3.1. Phase of Establishment

At the inspection of building material’s production we have to focus on the steel profiles, which form the frame structure. This is the differential speciality of the analysed building system. The embodied energy needed to the steel production is high, but as a result of the good mechanical properties, it is used in a much smaller quantity than traditional bricks to reach the same bearing capacity.

The production of the various heat insulation materials, which are built in in a high quantity, depends on type. But the invested energy for production could be multiply regained by significant energy savings of heating in the whole lifespan.

The production of the building structure and the building is realized with an assembly technology, which has a lot of positive aspects. The result of the dry construction technology is a fast building, because there is no need to wait for the structure to dry. The building is independent of the weather, so the house is instantly inhabitable. Due to the precise, assembly style technology there is less waste.

The damage of the natural environment has a smaller extent on the site and it is much easier to remedy. In respect of induction energy the light construction building system has also a lot of advantages, because the small weight and bulk of the building materials, transportation and storage demands decrease.

#### 3.2. Phase of Using

The inspected buildings with properly designed building structures and heat insulation save energy, at the same time they provide almost the same level of comfort – with appropriate layered form – as the highly efficient silicate based ones. For

instance, in the case of careful design, the building materials do not harm health. For example, a good property of the plasterboard is that it can regulate on optimal way the indoor space's relative moisture.

The steel framed buildings adapt well to the fast changing requirements, they are easy and quick to transform, on the one hand because of the assembly style technology, on the other hand as a result of the fact that the separation walls are independent of the frame structure.

With careful usage and maintenance the assembled, steel-framed building's lifespan may reach that of the traditional ones. It is also acceptable and satisfactory if we consider the constant change of demands caused by the quick rhythm of life, which leads to a fast moral depreciation.

### 3.3. Phase of Abolition

The result of the light construction building system is the possibility of a rapid demolition. The abolition circumstances cause less charge to natural environment than the liquidation of silicate based ones, and a large amount of building materials from the demolition are recyclable. The elements of the steel-frame can be fully reused primarily (i.e rebuild), or secondarily (recycling steel). Plasterboard is also recyclable, but the other, undamaged removed elements of the building can also built in again.

## 4. Conclusion, Appreciation

The light construction building system's characteristics mentioned above justify the environmental friendly properties. A steel-framed building inspected for the whole lifespan causes low level charge for the natural environment and insure a healthy lifespace for the users. Consequently it equally fulfils the natural protection's and the healthy protection's requirements and besides this, the building and the maintenance of it are also economical.

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