

The Potential Influence of Progressive Construction Materials and Structures on Market Value of Buildings

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Abstract. Use of so called progressive materials and structures has been more and more common in architecture and building construction in recent years. We can simply describe them as materials and structures characterized in one or more characteristics with significantly above-average level of quality compared to materials and structures usually used today. The buildings where such elements are incorporated are usually characterized with higher value – architectonical, technical, economical, and environmental, or there was time and/or financial savings during their realization. Since the word ‘progressive’ is used in connection with whole range of construction materials, it is necessary to distinguish among them those which don’t really have such features. This paper is focused on the motivation of use of progressive construction materials and structures in buildings and their potential influence on market value, technical characteristics, and architectural level of the buildings.

Introduction

The principal reason for using progressive construction materials and structures as well as technologies is mainly to reach higher reliability, durability, endurance, economy, and technical parameters of the buildings and their constructions (especially the rigidity, bearing capacity, thermal and acoustic insulation, harmlessness etc.). Its side-effect is extension of possibilities to reach better architectonical expression of the buildings (composition, dematerialization and form of the buildings, interior arrangement and release, structure, plasticity and purpose of the structures etc.) and wider possibilities in the area of reconstructions. For the owner of such building it is also important that use of progressive materials and structures is usually accompanied with either immediate economic effect (e.g. faster realization) or increase of the real estate market value of the finished building.

It is possible to find very wide assortment of items labelled as ‘progressive’ on the current construction materials and elements market. The reality is however that in many cases such materials or elements are not worth the label and they are rather a marketing tool. Really progressive construction materials or structures should prove such characteristics, which exceed in one or more parameters significantly the characteristics of the materials and structures, which are widely used today. Examples of these kinds of materials and elements are e.g. high-strength concrete, super-insulating and thermally accumulative masonry elements, aerogel, reinforcement elements from carbon and glass fibres [1], noncorrosive and chemically resistant metals, elements for large-area glass-walls, natural and biodegradable materials, or more and more the nano-materials e.g. self-cleaning paints or protecting layers etc. Progressive technologies of building realization, characterized with mainly speed, economy, and ecology of the construction are also more and more common. A significant representative is for example spatial completed prefabricated units on wide material base and technology of removable (able to be disassembled) building constructions for repeatable use [2].

Progressive Materials in Modern Architecture and Building Construction

Choice, design, and use of construction materials in modern building construction is becoming more and more sophisticated process including wide range of criteria [3]. Depending on the character of the building it is possible to choose among traditional construction materials, standard, and progressive ones. Use of progressive materials and structures in modern architecture is not limited on one small group of buildings but it is becoming a part of construction in wide scale. They are more and more common in developers' projects, which characteristics is to minimize the construction costs; it shows the fact that the progressive materials and structures are becoming cost comparable to the standard ones. This process is motivated mainly by development of technical, architectural, and environmental requirements on buildings and increasing requirements of the owners and users of present buildings on their characteristics; also the changing climatic conditions are the reason.

Technical and architectural or urban requirements on buildings and their structures are often contradictory. A typical example is systematically decreasing required value of heat transfer coefficient mainly of the peripheral structures of the buildings, which leads to increase of their thickness. A natural consequence is technical and optical increase of the weight and massiveness of the common buildings and further reduction of the area of usable space inside the building or increase of their volume and using more space to build on. In many cases this is architecturally or from urban point of view difficult to accept or completely unacceptable. It is possible to largely eliminate the problem when using progressive materials – according the need either by super-insulating construction (masonry) elements, or by combination of bearing structures made from high-strength materials and effective thermal insulation system. Especially with the second variety it is possible to reach relatively small thickness of the perimeter walls of the buildings.

Specific area of use of the progressive materials is reconstructions of existing construction fund. Their use is mainly in cases of increasing bearing capacity, improvement of thermal insulation or sound insulation characteristics, more reliable remediation of the constructions damaged by floods, explosion, fire etc. Requirements to perform the adaptations in way they were visible as little as possible or not at all on the original construction appearance are common not only for historically valuable buildings. Depending on the character of the construction of the building it is very difficult or even impossible to reach this target when using standard elements and materials [1]. Similar problems have to be solved in connection with maintenance of the buildings, in conditions of worsening climatic phenomena (e.g. excessive wind, snow, solar radiation, and temperature changes, air pollution, floods), etc.

In connection with use of progressive construction components in the modern building construction it is necessary to point out the requested high quality of performance. The quality of the final product of the construction – the building structures or the whole building – depends not only on the used materials but also on the used technological process. In case of use of progressive materials the process of realization must be very precise. If the required technology is not abided it is possible the requested characteristics of the structures or building might not be reached and use of progressive materials than can be rather a disadvantage – the expended funds than are not proportional to the reached effect.

Economic and Market Evaluation of Use of Progressive Materials and Structures in Buildings

The factors influencing the economic effect of use of progressive construction materials and structures in buildings can be divided into two groups. In the first group there are parameters connected with the realization of the building and don't have to necessary influence the market value of the finished building:

- time necessary for the realization of the building with use of progressive / standard materials and components and its influence on the construction costs – can be the same, higher or lower;

- costs on purchasing and incorporating the progressive materials and structures compared to the standard materials and structures – can be the same or even higher;
- possibility of structures or building to be repeatedly disassembled and realized again on another places of the construction and its economic context.

The second group contains factors that influence the value of the completed building on the real estate market. These can but don't have to have connection to the parameters in the first group. They include especially:

- higher architectonical and aesthetic level of the building;
- higher technical level, durability, and reliability of the building and its structures;
- higher environmental friendliness of the building (during the stage of construction, use, maintenance, and demolition of the building);
- better ability to use the interior space of the building.

When evaluating the influence of use of progressive construction components on the market value of the buildings it is necessary to perceive the difference between parameters easily to specify and parameters that are subjective [4]. Especially the parameter of architectonical and aesthetic quality of the building belongs among so called special influences on determining the market value of the building (influences of intangible character); it is very difficult to calculate it and has wider context too. This factor makes the difference between the common price (market value) and time value of the real estate. In general an architect influences the architectonical and aesthetic quality of the building and he can increase its market value compared to the time price of the real estate with the quality of his work (so called goodwill) or decrease it (so called badwill) [5]. Using progressive components can help to reach higher aesthetic, architectonical, and urban level of the building and that means also its market value. The difference can be up to 10 % in favour of the building with high aesthetic quality; determination of the market value is however quite dependent on experience and subjective evaluation of the real estate appraiser, who has to be able to assess the value of the building [6]. Some means for this can be for example elements with high bearing capacity (high-strength concrete and metals, large-area glass-walls etc.) as when used it is possible to design and perform very subtle constructions with high shape variability.

A parameter of durability and reliability of the structures is possible to be quantified through costs on maintenance of the building in which they are incorporated. It is possible to assume that the structures made from suitable progressive materials will request less extend of maintenance than constructions made from common materials. Market value of such building can be increased for saved costs on future maintenance and repairs. Quantification of the higher market value of the building with progressive constructions is quite individual; compared to standard building it usually varies for a few per cent.

Ecological friendliness of the building is very wide parameter overstretching into other areas. It includes mainly the energy performance of the building and also possible ecological fee connected with environmental characteristics of the materials used during construction and environmental connections to the maintenance and demolition of such building (e.g. fee for production of emissions, fee for deposit of demolition waste in landfills, etc.). In these cases too it is possible to include these potential savings on the future costs into the increase of market value of such real estate.

Relatively the most objective is the economical quantification of the use of interior space in the building. It is possible to reach realization of more subtle structures (compared to common construction) when using suitable progressive construction materials, which leads in case of vertical load bearing elements to creating larger floor space area. In real estate business this area is included in the sale or rent and accordingly increases the market value of the building. This increase can make only a few per cent, however especially in the large developer projects from financial point of view it makes very interesting numbers. In the case of reconstruction of existing buildings without reducing the floor area, the use of progressive elements can help to keep the value of real estate.

Summary

Contemporary technological progress and changing requirements on constructions motivate development of besides other things also the progressive construction materials and structures. One of the effects of their use in a significant extend is also potential increase of the market value of the buildings. That can be reached through several factors of which some are difficult to quantify and their evaluation largely depends on extend of use of these elements and experience of the real estate appraiser. Increase of the market value of such a real estate compared to similar standard buildings potentially reaches a few per cent up to circa 10 % and depending on the size of the building it can generate also quite significant amount of funds. In the future there will be more and more significant distinguishing of the value of traditional buildings and modern progressive buildings due to that fact on the real state market.

On the other hand using progressive construction materials and structures does not necessary lead to increase of the market value of the given buildings compared to the buildings realized from common construction components. The reason for that can be on one hand a different purpose of use of such elements during construction (e.g. to shorten the time for realization, decrease the area of the construction site etc.) and on the other hand there is higher dependency on the quality of the performance. In case of insufficient level of technology of the realization and following low quality of the construction itself the market value of the real estate equals to the market price of a standard property and in extreme cases it can be even lower. It therefore depends a lot on the competence of the real estate appraiser of the real estate value and complexity of the documentation on which base the evaluation is elaborated. Stress must be put especially on the identification of the above mentioned facts and their correct including into determination of the market value of the building.

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