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Building height regulation: is it still relevant for the 21st century city?

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Abstract

In many Western countries the regulation of the city skyline and high-rises is already well established, while east European countries are still undergoing early capitalism processes, with tensions surrounding the dimension of values. What should dominate the city skyline: towers of old town churches or 21st century skyscrapers? During the past five years, the authors of the article have carried out several research projects tasked with identifying in the new built-up formation an optimal relation between the new and historic centres of Vilnius. In this paper the authors present the applied methods of modelling and assessment of height parameters. Each research project was unique and needed a tailor-made research methodology, depending on the analysed parameters. In principle the following questions had to be answered: 1) does the future object cohere with the characteristics of the existing urban structure; 2) how the height parameters of the future building relate to the neighbouring valuable historical parts of the town and how they affect the latter. It has been noted that such research projects help to form the character of individual urban parts and to preserve an optimal relation among them within the town's overall image.

Keywords: building height regulation; city skyline; high-rise buildings; urban design; Vilnius

Introduction

From time immemorial humankind has sought to express its might through majestic constructions: the biblical Tower of Babel, the pyramids of pharaohs, the Great Wall of China, etc. The might hierarchy in a town has always been visually represented through a dominant vertical dimension. In the early period of urban development, only the buildings of religious and secular authorities could have a dominant height in the urban tissue. However, the last two centuries saw business entities joining this group and increasing their visibility by leaving traces in the city skyline. This development gathered momentum in the 20th – 21st centuries, when technological progress made it possible to build high-rises. In many Western countries the regulation of the city skyline and high-rises is already well established, while east European countries are still undergoing early capitalism processes, with high tensions surrounding the dimension of values. What should dominate the city skyline: towers of old town churches or 21st century skyscrapers?

As urban development becomes an increasingly complex process, there is a growing need for research that not only provides a better understanding of the ongoing changes in the built environment and their scale, but also offers methodological guidelines for addressing and managing the challenges of transformation. In

the practice of architecture and urban planning/urban design the task of ensuring a harmonious relationship of objects of different eras in high-value cityscapes is becoming more and more relevant. However, there is still a lack of reliable (objective) and flexible (universal) scientific methods for assessing these interactions and consequences, with a preference for expert evaluation, which is often methodologically subjective.

This article focuses on the regulation of the construction of high-rise buildings. An overview of such practices in Western countries is carried out, which helps to systematize the urban principles of the formation of high-rise construction zones and the experience of high-rise construction regulation. The authors of the article also present their experience gained through preparing feasibility studies, the main object of which was the relationship of newly designed high-rise buildings with heritage areas and the surrounding urban environment. In this paper the authors present methods of modelling and assessment of height parameters, as applied in Vilnius. The research projects presented in this paper were carried out in two phases: 1) establishment of research methodology and initial assessment of the situation; 2) analysis of the object under research in 3D format and drawing up of conclusions. Although a common feature of all these projects was the issue of building height regulation, each case was unique and required a tailor-made research methodology (depending on the analysed parameters) to be applied. In principle the following questions have to be answered: 1) does the future object cohere with the characteristics of the existing urban structure; 2) how the height parameters of the future building relate to the neighbouring valuable historical parts of the town and how they affect the latter. The authors have noted that such research projects have a positive impact on the formation of the character of individual urban parts and the preservation of an optimal relation among various parts of the town within the context of its overall image.

Background

During the past five years, the authors of the presentation have carried out several research projects tasked with identifying in the formation of a new built-up an optimal relation between the new and historic centres of Vilnius. To initiate new constructions in central Vilnius one must provide to the municipal authorities' evidence of urban research which forms the basis for certain parameters (height, built-up intensity, morphological type of built-up, etc.). The article illustrates the methodology and results of the analytical work carried out for the central part of Vilnius.

Formation of high-rise building zones: experience and tools

When drawing up the study, knowledge of the concept of high-rise construction (CTBUH Criteria...; CTBUH Height...; Bennett, 1995) and understanding of the urban principles of formation of high-rise construction zones (Al-Kodmany, 2017; Daunora *et al.*, 2004; Eisele and Kloft, 2003; Guidance..., 2007; Vyšniūnas, 2003) as well as of high-rise construction regulation were deepened (Firley and Gimbal, 2011; City of Vienna, 2015; Mayor..., 2012; Burdett *et al.*, 2002; Saint-Pierre *et al.*, 2010; Kowalczyk *et al.*, 2013; DEGW, 2002; Stadt..., 2002). This also included analysis of European cities with situations similar to the ones examined in Vilnius.

A review of experience has shown that the planning and regulation of high-rise construction is a complex process. A precondition for its coordination is the existence of clearly defined principles of the spread of high-rise construction objects in the city that would form the basis of a purposeful formation of high-rise construction zones and/or assessment of the need for construction of individual high-rise buildings and the impact of solutions. There are various tools for regulating high-rise construction in European urban practice, most of which aim to address (directly or indirectly) some of the following long-standing challenges in planning and construction of high-rise buildings:

- image, viability and sustainability of high-rise buildings and their concentration zones;
- the impact of high-rise buildings on cityscapes and objects of cultural value;
- the relationship of high-rise buildings with the surrounding urban fabric (building and open spaces).

Due to their size and scale of impact, high-rise buildings become urban complexes that directly affect the image and functioning of the city. The time when high-rise buildings could be designed as isolated “statistics” or accents diversifying formal and monotonous building schemes has passed. This irreversible transformation should be understood by all actors involved in the planning and construction processes of high-rise buildings and responsible for their sustainability. When high-rise buildings or their groups are perceived as urban formations, both the compliance with the general principles of urban planning (expression in panoramic city views, impact on cityscape composition, relationship with transport system, etc.) and the arguments defining the degree of local integration (relationship with the surrounding territory and the public spaces of the city, impact on their character, etc.) become relevant for the assessment of their impact. This forms the basis of the modern complex assessment methodology of high-rise buildings and their groups.

Methodology

The methodology of building height assessment proposed by the authors of the study is based on a system of principles and criteria, which is formulated on the basis of an overview of global experience in high-rise construction regulation and a study of building possibilities and restrictions applicable to a specific area. Also, to establish specific principles for the formation of a new object and to formulate evaluation criteria (Figure 1), the authors propose to evaluate the urban structure according to the following main aspects:

- configuration of the plan – integration of the existing and new structures in relation to the urban fabric formed or to be formed in the area;
- functional organization – the relationship between the existing and new structures in relation to traffic, pedestrian and cycling flows created or being formed in the area;
- volumetric composition – the relationship between the existing and new structures in relation to the volumetric-spatial parameters of the built-up formed or being formed in the area;

- structure of spaces – the relationship between the existing and new structures in relation to the structure of public urban and other open spaces established or being formed in the area;
- visual impact – the impact of the existing and new structures on the visual character of a site (perspective and panoramic overviews).

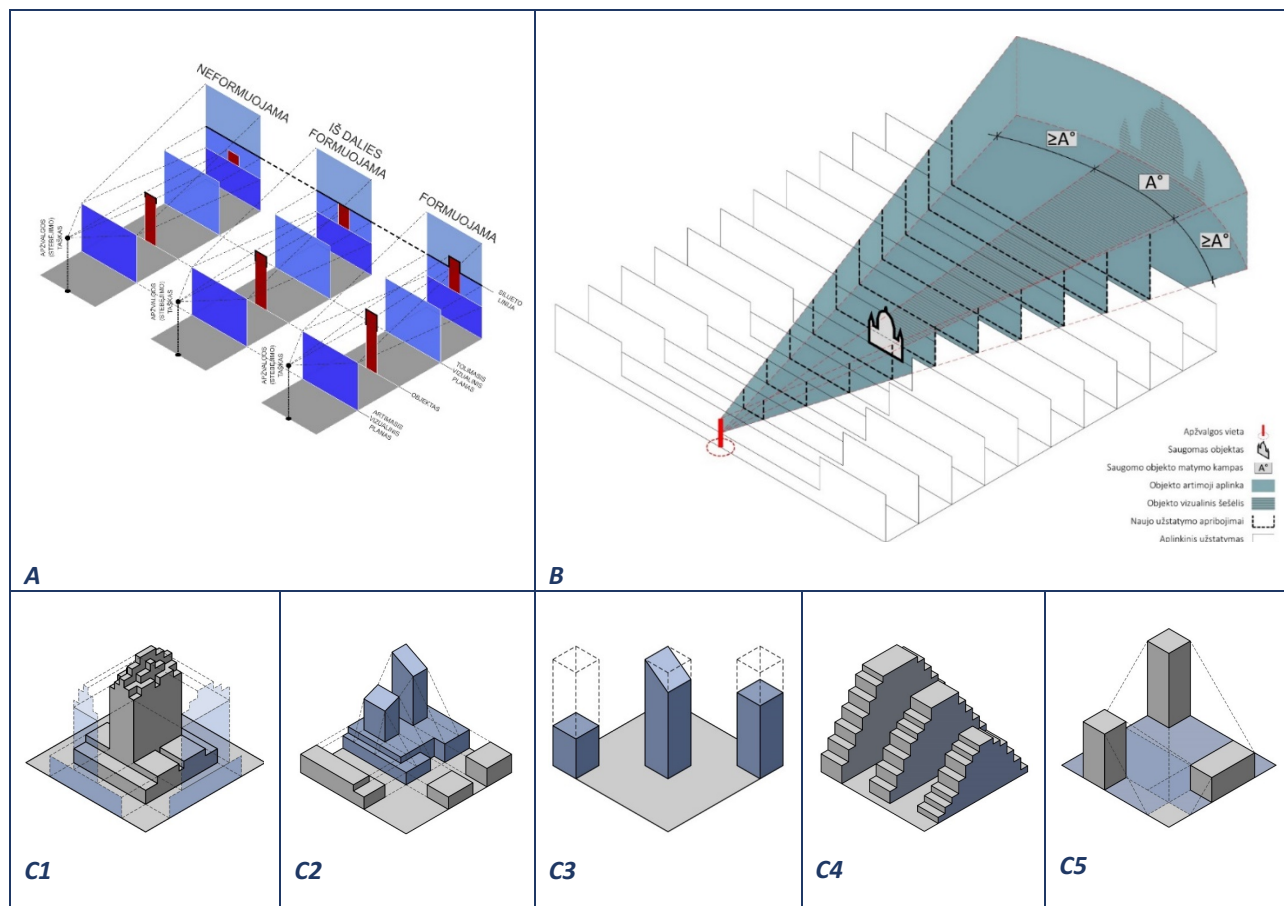


Figure 1. Examples of graphical models of criteria according to which the parameters of new construction are evaluated: A – evaluation of silhouette line shapes; B – evaluation of the impact on the dominance of a cultural heritage object in panoramas; C1-C5 – evaluation of volumetric composition.

Not all aspects may be equally important when looking at a particular area. In the feasibility studies presented in the article, the most significant aspect was the visual impact. Although all the three newly designed objects are outside Vilnius Old Town, they are very close to it – less than 1500 m (800, 1300 and 1400 m) away. The object closest to the Old Town is "at risk" to become a competitor of the city's semantic symbol (the Hill of Grand Duke Gediminas and the castle tower, reminiscent of the origins of Vilnius). The second object in question seeks to become an iconic symbol of Vilnius, but its design proposals exceed the permissible height regulations of the city's general plan. The third object is part of the new structure (Urban Hills) and complies with the building regulations but competes with the city's semantic symbol (the Hill of Grand Duke Gediminas and the castle tower).

In the examined cases, the main tool for built-up impact assessment becomes the analysis of the change of valuable panoramic views and the artistic expression of local perspectives. Possible built-up parameters are

selected by examining abstract (schematic) variants of the building's volume, differing in their physical dimensions (width, length and height) and position, taking into account their visual impact, and classifying them into possible, to-be considered and impossible. As the evaluation of submitted final building design solutions is the prevailing practice of urban environment formation, the proposed method would allow to determine maximum built-up indicators of the territory and to specify the volumetric configuration of the building (buildings) before the start of the design phase. This would help avoid the accidental and often unpredictable effects of new built-up. The application of this method in modelling the possibilities of redevelopment of larger parts of the city would create preconditions for a more harmonious relationship between the reconstructed or new construction and the historically formed urban landscapes of the central parts of the cities.

Results and Discussions

In the research discussed, the functional program and built-up parameters of newly designed buildings have already been set. The aim of the studies was to evaluate the relationship of the parameters of the objects with the surrounding urban fabric and, if necessary, to adjust them or suggest alternatives. The evaluation results were obtained by analysing the panoramas obtained by inserting a 3D model of the new object into the 3D model of the city, created using a selection of relevant observation points. The evaluation of the new built-up was performed according to the developed criteria. After summarizing the results, suggestions were made to adjust height, volume parameters and/or position of the new objects in their land plots. The authors of the study suggested alternative parameters of the new buildings being formed.

The results of the research enrich the fields of architecture and urban science with new knowledge about the tendencies of change in the central parts of cities and the possibilities of analysis and coordination of this process. The study reveals that even despite the existence of strict restrictions related to the heritage protection status there are preconditions and even the need to diversify the visual expression of urban areas, applying clear artistic and compositional principles. This is relevant in the context of today's urban development challenges, where instead of urban expansion priority is given to more efficient use of internal territorial reserves.

Conclusions

The research presented in this article introduces one more urban design tool – feasibility study – the purpose of which is not to design a new object, but to assess the impact of that object on the urban context and to reveal the possibilities of its volumetric parameters. The use of appropriate scientific methods and analytical tools can ensure coherence of the development of the central part of the city, minimize the negative impact on the characteristics and values of the protected urban and natural structures.

Depending on the magnitude of the impact of high-rise construction, its impact on the urban structure can be twofold. Therefore, when formulating evaluation criteria detailing individual aspects of urban structure, the focus can be placed on the evaluation of either local or global impact. However, both are considered to be equally significant.

The research presented in this article also allows to draw specific conclusions about what specific parameters should be considered when designing new high-rise buildings in sensitive urban areas. The application of the proposed method would allow determining the maximum built-up indicators for the territory and to specify the volumetric configuration of the buildings before the design phase starts. This would prevent accidental and often unpredictable effects of new construction from taking place.

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