

Use of aluminium and glass facades in the public space of the city of Krakow

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Abstract: As an element of structural and material solutions, aluminium and glass façades are the mainstay of urban architecture; they are especially used in public utility buildings. The article provides a review of architectural styles and trends of the 20th century, when exterior elevations began to take the form of aluminium and glass façades. It illustrates the main architectural trends of urban architecture in the 20th century and their evolution throughout the years. Furthermore, it specifies and refers to the architecture of the 20th and 21st centuries in Krakow and presents selected public utility buildings which have become an integral part of architecture in this city.

Keywords: aluminium and glass façades, urban architecture, public utility buildings

1. Introduction

Façades, especially aluminium and glass ones, as exterior walls of buildings and civil structures, are an element of modern urban architecture. The form, shape and material of which front elevations are made shape public space and, above all else, keep the layout and internal harmony of the town or city in check. Each and every elevation is a showcase of a building and, simultaneously, a distinguishing feature and symbol of a specific town or city.

Elevations are not only part of the image of a building, its aesthetics, form and architectural solid but also testify to the quality of solutions and functionality. All of the above elements include the shape and inclination angle of the façade plane, type of the system used and type of glass, which affects the indoor illumination, acoustics or thermal comfort of the user. The listed components are only several factors affecting the quality of use, but also finances and savings of the building [1].

The history of architecture and its trends is basis for the art of creating the modern image of urban space. The combination of architectural aesthetics, form, solid and the functionality mentioned above can be observed especially in the case of public utility buildings, such as office buildings, cinemas, theatres, shopping malls, airports, etc. [2]. This mainly stems from the status of such structures; therefore, the investor seeks a unique and original look of the elevation. The development of said solutions raise the architect's awareness and sets new trends in construction and architecture.

The imagination of the architect, as to the shape of the building body and the appearance of external walls is limited by the spatial development plan [3] [4]. It specifies the exact form and shape of the building facade so that they fit into the principles of shaping the municipal spatial policy and the building alignment. However, it often happens that newly designed objects, their facade, colour material used, raises a lot of controversy among the residents

and users. That is why social spatial planning process consultations are organized to create an urban area friendly for both the user and the environment [5].

Modern-day aluminium and glass façades are not only the solid and its form. State-of-the-art options, solutions and technologies for the preparation of designs and their implementation allow the creation of exterior fences of buildings and civil structures as partitions increasing energy efficiency and eco-friendliness. Newly designed and constructed facilities based on the principles of sustainable development [6], care for both the external environment and user comfort [7]. Solutions for using natural plants and natural solar energy are sought to create zero energy buildings [8], [9]. Designing new objects based on green facades [1], [10] and photovoltaics [11] reduces overheating of cities through natural shading and transpiration cooling [12], [13].

The article presents the current notions in contemporary architecture that shape shaping the public urban space, based on aluminium-glass facades. Individual solutions of architectural solid, characteristic of the corresponding period of the twentieth century, were presented. Additionally, on the example of the city of Krakow architectural solutions and objects being the showcase of the city of Krakow, are demonstrated confirming the thesis that the modern city and its public facilities are the solutions based on aluminium-glass facades, both in the form of all-glass buildings, or in combination with other facade materials such as ceramic tiles or architectural concrete.

2. History of contemporary urban architecture

Urban architecture has been developed since antiquity, when the civilization of the Roman Empire was built. Ancient buildings went down in history as a legacy of world culture and mankind. Throughout the ages to come, architecture evolved and changed thanks to technological development. The Middle Ages introduced the systematisation and precursory design of the town/city [14]. One characteristic element was the stronghold surrounded with a wall as a means the defence of residents who lived on such premises. The pursuit of functionality caused European settlements to be designed around the cathedral, together with the accompanying hall and market [14]. The era that followed, the Renaissance, created the basic principles of urban planning, of which the main one was the perpendicular layout of the streets. To this day, many towns and cities in Europe have maintained their spatial plans dated back to the Renaissance. However, it was only in the 20th century that the new architectural trends of the modern town or city were conceived. During this period, new styles and disciplines of the art of urban planning were created. The individuality of form caught people's attention; designers would come up with new and original architectural shapes and details and used materials which gave civil structures a new dimension of aesthetics and originality [15].

This work presents and specifies selected trends in urban architecture, which art and discipline involves spatial planning in the 20th and 21st centuries, when glass was used as an exterior element of buildings and civil structures.

The first architectural style in XX century was modernism. Its motto was functionality, in other words "form follows function" [16]. During the modernist period, highly functional buildings were designed and erected, characterised by cubic forms and light-coloured elevations. The building façade was stripped off ornaments, as they were deemed impractical and non-functional from the perspective of users. The building solid was characterised by simple and geometric shapes, usually in the form of cuboid with a flat roof and large ribbon windows. Buildings designed in the modernist style were perceived by critics as "boxes". The simplicity

of shaping modernist structures was complemented by the careful selection of materials and implementation of new technologies used in the construction of front elevations, which made such civil structures extraordinary and unique at the beginning of the 20th century. One of the many examples illustrating the characteristics of modernism is the Museum of the 20th century in Berlin, nowadays Neue Nationalgalerie (Fig. 1). This building was designed by the German modernist architect Ludwig Mies van der Rohe, who refined his vision of monumental architecture incorporating minimalism in its form; he contended that the building elevation should rely only on “skin and bones”, which is basis for the current design of aluminium and glass façades [14].



Fig. 1. Museum of the 20th century in Berlin [17]

Yet another contribution to urban planning was postmodernism. It began in the second half of the 1960s [17]. This architectural style caused much controversy among people who valued delicacy and minimalism. It combined all styles and trends in architecture, from ancient arches, to modern technological solutions of the 20th century. Postmodernism was a backlash against the simplicity of modernism. It broke with all conventions, it defied against the order and concept of modernism, where the solid of the building is to follow its function. Postmodernism is the lack of order and, above all else, freedom of creation and originality of form. The leading architect of postmodernism Robert Venturi paraphrased the words of Ludwig Mies van der Rohe “less is more” as “less is a bore” [17]. Postmodernism came to Poland much later, at the turn of the 1970s and 1980s [18]. One of the examples of postmodernism in Poland is the Polish Television Headquarters, designed by Czesław Bielecki (2001-2007) (Fig. 2). It is considered one of Poland’s greatest eyesores. The structure illustrates the essence of postmodernism, combining a variety of forms and meanings. Architects and onlookers refer to it as the “Tower of Babel” as its form incorporates steel arched tubes and volutes, using both stone plinths and glass façades of the rotunda [18].



Fig. 2. Polish Television Headquarters, designed by Czesław Bielecki [19]

De-constructivism is yet another trend to continue the tradition of postmodernism. It originated in the 1980s [20]. Its basic feature is the fragmentation of a civil structure, creation of curvilinear shapes and surfaces of the elevation and distortion of the cuboid frame. The creators of de-constructivism defied the ideas of modernism, insofar as the elevation is the skin and bones and the form should be pure and follow function. This inspired experiments with the solid and its geometricity. Civil structures were designed with unique and original shapes and planes. However, ornaments were rejected as redundant (Fig. 3).



Fig. 3. UFA- Palast Dresden [21]

The analysis of modern urban architecture would not be complete without Hi-Tech architecture. This is another trend to continue the tradition of postmodernism and its concepts. Technological achievements and solutions also determined the shape and image of a contemporary building [22]. When creating the solid and form of a civil structure, architects decided to conjure their vision of present day by designing elevations as installations or electronic systems. The installation till now concealed under the plane of glass or other materials becomes visible to the observer. Ornaments left out of the architecture of the 20th century, deemed redundant both in modernism and in postmodernism, made a comeback in Hi-Tech architecture. In place of former rosettes, cornices or columns, technologies were built in, such as light shelves, façade screens, acoustic blinds, whereas the entirety is enriched with such technologies as elevations producing living organisms or ones incorporating photovoltaic panels. One of the buildings symbolising Hi-Tech is Hearst Tower, designed by Norman Foster (Fig. 4) [23].



Fig. 4. Hearst Tower [23]

The urban architecture of the 21st century combines art, science and new technologies. Architects and visionaries challenge stereotypes and traditional construction. This inspires the design of original towns and cities with a unique approach to urban planning dominated by globalisation. The town or city of the 21st century is a landscape of high-rise buildings, catching one's eye with their lightness or even pretentiousness. These are symbols depicting the town or city of the 21st century, where ancient and colonial styles mix with modern skyscrapers as well as high-rise and apartment buildings.

3. Aluminium and glass façades of public utility buildings in Krakow

Aluminium and glass façades are an indispensable image element of each and every town or city, both in larger agglomerations and in smaller locations. The advantages of using aluminium-glass facades in public facilities located in urban space is to give objects a light form and high aesthetics, along with shaping remarkable architectural details. In addition, the use of large glazing in aluminium facades, opens the space and office space to the surrounding outside world, enabling the user to contact natural light. The negative effect of using large glazing is excessive overheating of office rooms, which reduces the comfort of their use. Therefore, especially in such buildings, glass with special properties- photo-chromatic, thermotropic, etc. or solar protection system, which prevents excessive exposure and shining effect is applied. Solar protection systems consist of panels, shutters, shaders or blinds, often made of atypical materials or as technological devices.

The architecture of Krakow includes not only sites of cultural heritage on the UNESCO list, but also a cluster of the modern architecture of the 20th century, originated by modernism and subsequent trends, such as postmodernism, de-constructivism, brutalism, etc. [14]. Modern-day Krakow of the 21st century retains its individuality and extraordinary aesthetic appeal. Architects try to combine the uniqueness of cultural heritage sites in Krakow with contemporary civil structures, where glass and state-of-the-art technologies are predominant.

The authors present selected public facilities in the city of Krakow where aluminium-glass facades are used. The selected objects have become the symbols and the landmarks of Krakow and have been completed over the past 15 years, creating the contemporary city space. The first public facility where architects displayed the modernity and originality of form by designing curvilinear planes of aluminium and glass façades is the Congress Centre (Fig. 5). Its characteristic large glazings lend a unique image to the solid of the building. The front elevation of the Congress Centre is not only the aluminium and glass façade but also a ventilated façade made of colourful ceramic tiles. The entirety reflects the vision of the author who designed the form and solid of the building as a melting ice cube, unambiguously distancing himself from the principles of modernism, which provide for the construction of simple cuboid public utility buildings.



Fig. 5. Krakow Congress Centre [photo: Alsal Sp. z o.o. S.K.]

Yet another example of a public utility building with aluminium and glass façades is the International Airport in Krakow-Balice (Fig. 6). Its design reflects the modernity and functionality of glass in combination with the aluminium structure of the external frame. The construction of the International Airport testifies to the possibilities offered by architecture and thus related structural solutions which allow the creation of planes with any inclination angle. Additionally, to maintain sufficient solar irradiation and comfort of use, low-emission glass was used as protection against the excessive heating of the structure.



Fig. 6. Krakow-Balice International Airport [photo: Alsals Sp. z o.o. S.K.]

Public utility buildings are mainly office buildings, where their glass front elevations underline the prestige and net worth of the company. The use of glass façades as an exterior enclosure of the office building improves the comfort of work for each user by providing daylight and sufficient solar irradiation of the usable area. Furthermore, properly designed aluminium and glass façades result in decreased energy consumption by civil structures; they ensure proper acoustics and, as a fully recyclable material, have influence on the environment and ecology of the city. All of these features earn glass office buildings additional points in the international certification systems such as LEED and BREEAM [24], which specify the basic principles of sustainable construction. One example of an office building where the elevation is in the form of an aluminium and glass façade is the BIG building in Krakow (Fig. 7).



Fig. 7. BIG office building in Krakow [photo: Alsals Sp. z o.o. S.K.]

Example of an office building with an aluminium-glass facade is a building located at 33 Kalwaryjska street in Krakow (Fig. 8). The outer wall was implemented in the semi-structured system, which presents the building as an all-glass block, without visible, external aluminium profiles. Above the communication part of the office building an aluminium-glass skylight, made in the facade system was designed.



Fig. 8. Office building at 33 Kalwaryjska street in Krakow [photo: Alsal Sp. z o.o. S.K.]

Another example of an office building is the Comarch building in Krakow (Fig. 9), where aluminium and glass façades are combined with the light technology. Light shelves were assembled in this structure, creating an amazing and colourful illumination which attracts the attention of each passer-by.



Fig. 9. Comarch office building in Krakow [photo: Alsal Sp. z o.o. S.K.]

Aluminium and glass façades used at public utility buildings are not only all-glass structures. The aluminium and glass façade is a solution which nicely matches concrete or other material solutions. One example of such a combination is the Polish Aviation Museum in Krakow (Fig. 10). The form, solid and combination of materials so distinctive from one

another, namely glass, aluminium and concrete, is amazing not only due to its visual aspect but also aesthetic values and unconventional character. The design of the building which houses the Polish Aviation Museum is based on the architect's vision as an aircraft propeller, where the paddles are a massive concrete structure and the glass façades fill in and enclose the building space.



Fig. 10. Polish Aviation Museum in Krakow [photo: Alsal Sp. z o.o. S.K.]

4. Conclusion

Aluminium and glass façades are a type of elevation which are inseparable from public utility buildings and constitute the mainstay of urban architecture. The history of 20th century architecture many a time referred to solutions based on glass combined with the aluminium frame. From modernism and its minimalism to Hi-Tech civil structures. Glass, as well as its compilations in the form of façades, is the future of 21st century towns and cities. The construction of skyscrapers and high-rise buildings will be a symbol of all larger metropolises or agglomerations. Using the example of the city of Krakow, technological and structural possibilities were illustrated, showing where aluminium-glass facades were and can be used, proving the initial thesis that for a modern city, a solid made in the form of aluminium-glass facades is an indispensable element of architecture. Such design solutions in particular form the basis for public facilities. Thanks to such solutions, architects can design all-glass buildings, which can additionally be combined with other material solutions, such as ventilated façades, made of composite panels, ceramic tiles or fibre-cement boards. The lightness of aluminium and glass façades allows them to be easily matched with heavyweight concrete buildings, lending the concrete jungle a new lease of life.

The article contains pictures taken by Alsal Sp. z o.o. S.K. I would like to kindly thank Alsal for sharing the collection of private pictures.

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