The use of glass structures in the design of unique structures

I A Mayatskaya*, S B Yazyeva, M A Kolotienko, B M Yazyev
Don State Technical University, 162, Sotcialisticheskaya, Rostov-on-Don, 344022, Russia

E-mail: irina.mayatskaya@mail.ru

Abstract. The paper considers the use of glass structures in the design of facades of buildings with unique shapes and the use of these elements in the interior of the structure. Attention is given to various types of glass and frameworks for glass structures. The advantages of using these architectural elements are shown.

Introduction
Glass structures have become one of the most common elements in the architecture of modern cities (Figure 1). Using these architectural forms gives easiness structures, without forgetting about their strength [1].

Figure 1. Examples of types of glass structures in buildings in the city streets.

This direction allows creating unique building structures. This is to emphasize the individual style of architects and building designers.

It should be noted that the following advantages of glass designs: the possibility of using various forms, durability, use of daylight interior of the structure, creating a comfortable environment inside it, maintaining a certain temperature and protected from street noise.

The main types of structures in buildings using glass
The creation of strong and reliable designs of unique structures is the most important task of designing buildings. This process is closely connected with the use of modern materials and technologies, which are rapidly developing at the present time. In the world of architects often build buildings, where use of glass design [2-4]. In recent years, unique objects have been built, in which they were used in the design (Figure 2).

![Figure 2](image)

**Figure 2.** The modern solution for the use of glass construction facade design of the buildings.

It should be noted that the designers tried to combine different materials and forms in the construction of unique buildings (Figure 3).

The structures of aluminum and stainless steel over time do not lose their strength characteristics and aesthetic properties.

Widely used glass structures in the internal space of structures (Figure 4).
Figure 3. Unique facilities, in which are combined structures from glass and aluminum panels.

Figure 4. The interior of a modern building.

Not only the facade, but also the roof, walls, floors can be glazed. Glass structures can be used in fences, ladders, canopies and, of course, shop windows and winter gardens [5]. In Fig. 4 shows the glazing of the ceiling and fences inside the room. Everyone knows that on the observation platform of the Ostankino Tower (Moscow, Russia) there are glass floors. This makes the panorama of the city unforgettable. But the site does not work in the winter time due to the influence of low temperature on the floor plane and with the exception of the additional load in this period.

Features glass constructions in view of their purpose
Glass designs require careful calculation of strength, durability, reliability and of course, special attention to detail and glass type. In Figure 5 shows examples of connecting parts of glass structures.
Figure 5. Examples of joining parts of glass structures.

With panoramic glazing of the facade, aluminum structures with the use of large glass (jumbo glass) are most often used.

Thanks to the use of glass in the architecture of modern buildings, interesting projects are being created. They can be used bent, tinted glass, triplex, with various coatings, reinforced, tempered, heat-resistant even self-cleaning. The type of glass is selected from the design purpose and from the architectural solution of the entire structure or complex of structures. In Figure 6 shows an example of the design of a space inside a room with curvilinear surfaces.

Figure 6. Example of the interior space with curvilinear forms.

In this solution, applied flat glass panel by fixing a curved line. But this space could be decorated with bent glass panels. This allows us to make modern technologies for manufacturing glass structures. Such solutions are increasingly used by architects in modern designs.

Conclusion

Increasingly, glass is used in architectural solutions of structures both outside and inside premises. It is necessary to take into account when designing that glass structures meet technical requirements and comfortable conditions for work and leisure. It is necessary to carry out heat and soundproof measures, take into account the shockproof properties of the material, as well as wind and snow loads.

Glass structures can change the appearance of modern cities. This creates an individual urban style and a comfortable environment for people to live.

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