

## The effects of mirror reflection from flat and curved translucent structures

Valentina Karpenko

Kyiv National University of Construction and Architecture  
Povitroflotskyy prosp., 31, Kyiv, Ukraine, 03680, e-mail: vallav1988@gmail.com

**Summary.** The article gives examples of flat and curved translucent, mirror walling. There are presented variations of their formation by comparing with geometric transformations of form. Combinatorial technique is applied.

**Key words:** Mirror effects, geometric transformation, mapping, glass, facade, translucent walling.

### INTRODUCTION

Project design system involves form manipulating as an important element in the initial stage of formation of integral object. Architect, guided by specific conditions and restrictions, enters a new constructive form and gives it tectonics that generally determines development projected [2]. General classification of translucent enclosures includes a large number of items from windows to special facilities. In this study, attention is given to facade systems with different types of glazing curved walling [9].

### PURPOSE OF WORK

Determine the variance of comparison of simple geometric forms by transformation for finding opportunities and formatting their management tectonics. One of feature of light-reflecting structures is their feature,

leading to a multitude of options for creating objects with interesting mirror effects [6].

### THE RESEARCH RESULTS

Buildings of glass do not lose current market position. The first "Glass House" was built in 1949 by architect F. Janson in New-Keynen (USA). Houses function was to be aquarium because it does not protect the internal content of external factors. In a further effort to reduce the intensity of light and transparency began to use colored, frosted, mirror, polaroid glass (with one-sided visibility) [10].

There are global practices buildings with mirrored facades tectonics are fully fits into any environment through its reflecting properties. The primary function of such projects is the viewer's interest in exotic arrangement of the facade. For example "Mirror House" Peter Pichler is located near Bolzano, Italy [14]. Mirror glass, on the west facade of the building reflects the panorama of nature, making house barely noticeable (Fig.1, a). Laminated glass is covered and protected from UV radiation [8].

Another example of interesting and unusual architectural projects is one of the hotel rooms in Sweden [15]. The hotel consists of four rooms located on one of the trees where one of rooms is "Mirror Cube» ("The Mirror

cube") with dimensions 4×4×4 m (Fig.1, *b*). Visually little cube is visible as reflected in the mirrored walls surrounding. Windows made by solid monolith of mirror glass, and only in the night-time, they become noticeable from the light source located inside the cube.

a functional space for various cultural events. Through the use of the pavilion coating with reflecting properties, it does not appear facades but the mirrored space dynamics [3].

For the purpose and function of glass facade systems distinguish such key [9]:



*a*



*b*

**Fig. 1.** Global practices buildings with mirrored facades:  
*a* – "Mirse" by Peter Pichler; *b* – "The Mirrorcube", the hotel room

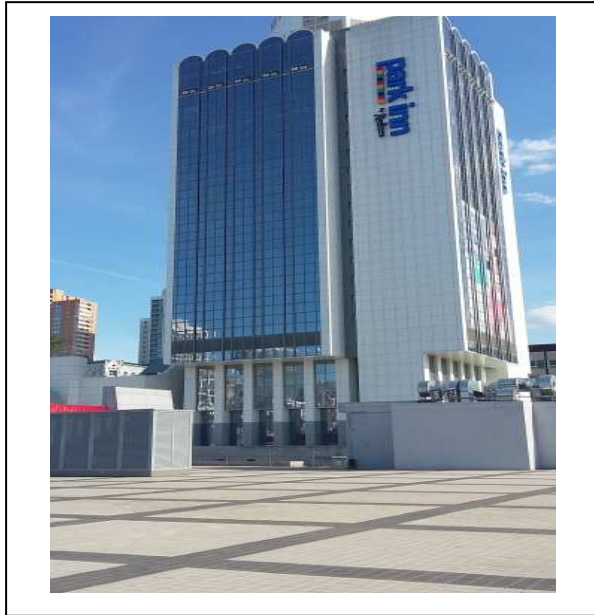
Small architectural forms with a mirror basis are also in high demand. Such example is Normans Foster mirrored roof. Pavilion area of 1000 sq. m consists of rectangular segments 22×46 m, which are supported by eight thin columns. The basic idea is to create

- General-purpose,
- Shockproof,
- Sun protection,
- Energy Saving,
- Freeze proof,
- Noise proof.

THE EFFECTS OF MIRROR REFLECTION FROM FLAT  
AND CURVED TRANSLUCENT STRUCTURES

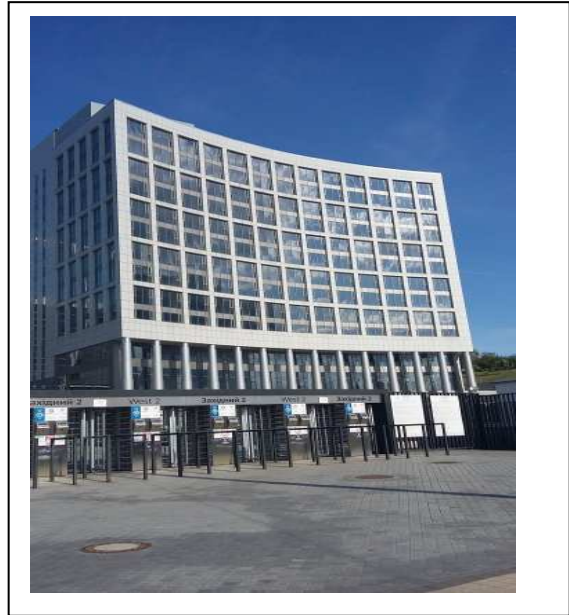
**Table 1.** Types of surface objects

Straight



Convex

Concave



Fold system



Curvilinear








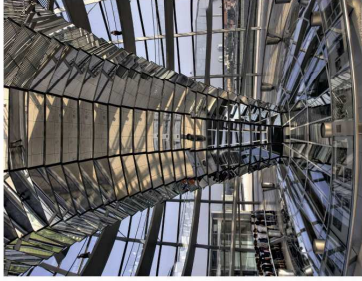





**Table 2.** Variants of transformation form

<p>The types of converting</p> <p>The types of shape</p>	<p>Symmetry</p> 	<p>Turning</p> 	<p>Transfer</p> 	<p>The mirror-turning</p> 
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>
<p>1. Paralelepiped</p>				
<p>2. Cylinder</p>				

THE EFFECTS OF MIRROR REFLECTION FROM FLAT  
AND CURVED TRANSLUCENT STRUCTURES

**Table 2 (Continuation).** Variants of transformation form

1	3. Sphere	2		3		4		5		4. Pyramid					5. Cone				
---	-----------	---	---	---	---	---	---	---	---	------------	---	---	---	---	---------	---	---	---	---

The shape: flat and curved. Variants of this division are presented in the example of Kyiv in the Table 1.

These five types of surfaces are translucent structures with reflective properties that create mirror effects.

The first type is outline mirror on the facade of where no material deviations affect the environment. A large area of glazing is divided into segments to provide rigidity design, distortion display factor is small.

The second type is a concave curve that becomes concave mirror effect, where the rays falling, by the light reflected law, form the focus. In practice, there are negative consequences of scorched grass from sunlight focused at some point.

The third type is convex front system opposite scatters sunlight by reflecting the sun's rays in a convex mirror, and the façade segments the environment.

The fourth type is folded structures included the same overall mirror canvases, different rotation is only reflected directions of space, due to folded façade [4].

The fifth type is parametric architecture, design formed by splitting planes of the same type elements. This form is curvilinear light reflection, which leads to interesting effects [13].

In Table 2 there are conducted a comparison of simple shapes that create objects with geometric transformations. This classification allows more broadly understand the variability in the forms through a combination of architecture and geometric properties developing morphogenesis [16].

Geometric transformation applied to the overall glass facades add showiness and uniformity and form new-combined effects [17].

Presented in the analysis facilities are functioning as character exhibits due to their originality in the perception of spatial and visual qualities. [1] By competing in the championship of the world market eccentric architectural forms and objects set a trend dominance of simple geometric shapes based on complex tectonics [12].

Structures made in such extraordinary style shaping objects are usually not as prac-

tical for general image of the city or metropolis as unique fantasy of architect. Buildings in the form of spheres or inverted cone are the manifestation relevance as an institution venues, entertainment centers, libraries, etc. Glass structures add effects designed display environment, providing insolation and is easily perceived visually than such structures in reinforced concrete design.

## CONCLUSIONS

1. Modern trends mirror glass architecture of space to earn more than the creation of architectural objects. [cubic city] Depending on the power of the variation is transparent glass mirror effect it is the main organization of space and reflected the environment.

2. The accent is filling the internal space into a dark time, accompanied by point sources of light, or media facades that transform plane as the category of information space.

3. In the organization of the city are set clear limits of saturation of objects and buildings. Trends of glass structures apply to the construction of many facilities, including the restoration and reconstruction of historical parts of the city, destroying the system, making contradictory elements in the image.

## REFERENCES

1. **Bar G.F., 2004.** Aspects of Geometry and Art. Journal for Geometry and Graphics. Vol.8, № 2, 231-241.
2. **Bartel K., 1958.** Perspektywa malarska. Warszawa: Panstwowe wydawnictwo naukowe, 585. (in Poland).
3. **Boguszewska K., 2014.** City for people on the example of Vieux Port revitalisation in Marseille. Motrol: Arch. Urb. Stud. Krajobr. OL PAN, Vol. 14 (2), 5-12. (in Poland).
4. **Differet glass and glassware in construction., 2013.** [E-resource]. URL: <http://www.bibliotekar.ru/spravochnik-33/54.htm> (date accessed: 10.07.2015). (in Russian).

5. **Kolotova O.O., 2012.** Mirror as a formative factor in modelling composition work of art. Bulletin of Cherkassy University, Vol.200, 10-16. (in Ukraine).
6. **Lavryk G.I., 2002.** Fundamentals of systems analysis. Kyiv. 140. (in Ukraine).
7. **Mitani G., 2012.** Column-shaped Origami Design Based on Mirror Reflections. Journal for Geometry and Graphics. Vol.16, № 2, 185-194.
8. **Morita K., 2011.** Some Theorems on Kissing Circles and Spheres. Journal for Geometry and Graphics. Vol.15, № 2, 159-168.
9. **Pidgornyj O.L., Shchepetova I.M., Sergeychuk O.V., 2005.** Translucent fence of houses, Kyiv, 282. (in Ukraine).
10. **Shapoval S.V., Chromenuyk O.R., 2013.** The selection of materials to the front glazing of the building. The communal property of the city, Vol.5, 23-27 (in Russian).
11. **Stepanov A.V., 2007.** Volumetrically spatial composition. Moscow, Architecture-C, 256. (in Russian).
12. **Sykta I., 2014.** The international exhibitions and their impact of the city landscape an attempt of retrospection and contemporary valorization of their influence on countryside. Motrol: Arch. Urb. Stud. Krajobr, OL PAN, Vol. 14 (4), 5-34. (in Poland).
13. **The glazing of façade, 2014.** [E-resource]. URL: <http://www.snok-c.com.ua/index.php?pageid=8> (date accessed: 10.07.2015). (in Russian).
14. **The mirror house in Italy, an architect Peter Pichler., 2014.** [E-resource]. URL: <http://luxdomik.com/2014/12/12/zerkalnyj-dom-v-italii-arxitektor-piter-pixler/> (date accessed 09.07.2015). (in Russian).
15. **The Mirrorcube., 2015.** [E-resource]. URL: <http://treehotel.se/mirrorcube/> (date accessed: 09.07.2015).
16. **Vityuk K.U., 2011.** The city of the glass cubes and cylinders. Architecton, Vol.3, 10-19. (in Russian).
17. **Yevseyenko L.M., 2007.** The effects of tinted mirrors to correction interior color range. Bulletin of the HUADA, Vol.8, 32-36. (in Ukraine).

#### ЗЕРКАЛЬНЫЕ ЭФФЕКТЫ СВЕТОПРОЗРАЧНЫХ ПЛОСКИХ И КРИВОЛЕНЕЙНЫХ ОГРАЖДАЮЩИХ КОНСТРУКЦИЙ

**Аннотация.** Приведены примеры плоских и криволинейных светопрозрачных и зеркальных ограждающих конструкций. Варианты их образования при сопоставлении с геометрическим преобразованием формы. Применено комбинаторную методику.

**Ключевые слова:** Зеркальные эффекты, геометрические преобразования, сопоставление, стекло, фасад, светопрозрачные ограждающие конструкции.