Elements of architectural and artistic expressiveness of urban highways

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Abstract. In the conditions of global autobilization of the population, modern people get the first impression of getting acquainted with any city on its highways. The architectural and artistic expressiveness of the panorama of access roads to the megalopolis, of its ring roads and highways is a peculiar business card of the city, reflecting the level of its economic and cultural development, its status. The relevance of this analysis is that with modern broad technological possibilities of design and construction, a choice of means to achieve the architectural and artistic expressiveness of forming panorama of streets and highways is far from always effective. In the most of case the lack of application of the theoretical basis of the integration urban planning approach in the distribution of urban-forming elements along the route through urban arteries is obvious.

It is necessary to analyze the features of linear, unidirectional communication spaces of the city, which are the highways. It is also necessary to analyze the specificity of the conditions of a dynamic, relatively remote perception of the panorama of highways by person. In this case, it is necessary to take into account the whole complex of his psychophysiological possibilities of perceiving visual information. The aim of the article is to perform such an analysis and give recommendations on the choice of effective means of design the panorama of communication urban spaces.

On different highways, as well as on different sections of highways, the requirements for their respectability do not coincide, the conditions of perception are not homogeneous. The method of this study is the modeling of two situations most typical for a megapolis in urban highway conditions and their consideration from the point of view of the driver of the car and the passenger of public transport. Taking into account the peculiarities of the perception of the participants of the movement, taking into account the spatial parameters of each of the situational models, recommendations for the architectural solution of the main elements were developed. With regard to the structural construction of the facades of buildings that form these spaces, recommendations on the nature of their structural units, rhythmic organization and scale relationships are presented. These recommendations are the result of research and are the development of a common system of principles that reflect the objective laws of the formation of urban spaces.

In architectural and artistic terms, the highway is a complex linear composition that opens gradually, in motion, as it sequentially alternates its constituent elements—the front of buildings, recreations, squares and prospects of adjacent streets.

The volume spatial decision of the highways can be presented in two main types (Figure 1):
1) linear space with "blurred" boundaries, formed by the front of houses with a large margin from the roadway, and
2) space by the type of traditional street solutions, formed by the front of soundproof houses close to the roadway.

![Figure 1. Types of urban highways depending on the conditions of perception of the objects of their panoramas.](image)

The first type of highway is typical for the peripheral areas of the city, where the traffic intensity is significantly higher than in the center, due to the lower density of the transport network. They are characterized by large volumes of transit traffic and straight-line routes, transport interchanges in several levels. The distance between the opposite sides of such highways reaches 150-200 m and more. The front of houses is separated from the roadway by a strip of green plantations that perform noise protection functions.

Specific conditions of perception on highways of the first type - high speed, greater distance of architectural objects and hiddenness of the lower belt of the panorama. This imposes certain limitations on the choice of expressive means in creating the architecture of highways.

In such perception conditions, the process of image formation in human consciousness is associated with a reduction in the complex of identification properties and is based on such features of objects as: 1) character silhouette, 2) generalized structure, 3) form of symmetry. The person uses these signs in case of need to increase the speed of identification, when the decrease in the accuracy of perception due to the maximum generalizations does not affect the result.

Silhouette, or contour perception is considered the earliest and most developed type of visual perception. The nature of the contour acts as the only informer, when all other types of perception lose their meaning [9].

Studies of silhouette compositions [9] showed that for silhouettes of buildings located on highways and their intersections, it is advisable to use such signs as rhythmic constructions of clear outlines that are businesslike and activate perception. For buildings, occupying the ordinary position in the panorama of the highway, it is recommended that the silhouette consisting of straight line elements and fit within the conventional rectangle. For ordinary houses adjacent to the accent building, a dynamic silhouette with an increasing rhythm of outlines and the presence of a dominant element in the outline is recommended. For the accent buildings themselves, a compact solution and type of silhouette is recommended, which has an emotionally attractive outline close to the trapezium. For accent buildings occupying an angular position at the intersection of highways, the type of silhouette is recommended, described by a curve that increases exponentially (Figure 2).
The most common ways of obtaining expressive silhouette of the panorama of highways are still ways of blocking the multi-storey sections and using the completion of buildings with expressive outlines. It is also practiced to increase the spatial density of the front of houses of different heights on some parts of highways and rarefaction it in other parts. As a result, the continuous silhouette of the panorama is replaced by the rhythm of alternating silhouette groups of houses.

The second determining factor of fast memorization is the character of the symmetry of the building's silhouette. Psychophysicists have experimentally proved that the process of memorizing objects with symmetrical forms is accelerated and simplified. Symmetry greatly increases the accuracy of identification, regardless of other signs [3, 6].

As for the structural construction of the facades of buildings that form the panorama of high-speed highways, then structures of a homogeneous character are advisable for them, as the pattern of the facades in the perception from a distance and at high speed, not read. An exception may be buildings-the accents, the facades of which is it makes sense to form as more complex structures with large-scale solution of the basic shapes, contrasting to the main background of the facade.

The second type of highway with the front of buildings near the roadway, usually located closer to the central areas of the city. The speed of high-speed passenger transport on these roads is slightly lower than at the periphery of cities. However, the intensity of perception is also high due to a decrease in the opening of the angle of the field of view. There is an effect of flashing, which is natural, when the object of observation is located close to the observer moving at high speed. Under such conditions, the perception of the silhouette as a whole is difficult. The viewer's interest is not concentrated on the general character of the silhouette, but on the individual, most distinctive elements of the line of houses read against the sky. In accordance with this, the arsenal of effective means of obtaining an expressive silhouette is also changing. To the use of different height sections are added such techniques as changing the height of some parts of the parapet or alternating lattice and solid parapet. Also used are the console output plots of transverse walls, of the stairwells and Elevator shafts, silhouette elements of the roof, large advertising constructions, as well as the complication of large forms of facade in its upper tier. When viewed from below it creates a sophisticated silhouette line, changing depending on the angle of perception.

A significant approximation of the panorama of the highway to the viewer raises the importance of the structure of the facades (Figure 3).
Perception of the approximate front of the facades of houses by a rapidly moving person has a number of singularities. On the one hand, the frequent rhythm of vertical elements causes the passenger to have an irritating flicker effect. In this regard, for the facades of houses on urban highways, the horizontal character of the arrangement of the structural elements of the facades is most appropriate. On the other hand, the lack of vertical elements that play the role of certain reference points reduces the sense of movement and enhances the monotony of perception. The purpose of creating favorable conditions for the perception and memorization of high-speed transport by a passenger raises the question of optimal rhythmic intervals of vertical elements, as well as the step of accent structural elements of facades. The author of the article made calculations based on the optimal indices of the periodicity of phenomena taken from experimental studies on the psychology of perception [8]. Calculations showed that the optimal period of a step of rhythmically recurring accents should be 7-60 m, depending on the size of the structural units. It is important that their number does not exceed 9 (the Miller number). The rational interval between such rhythmic rows should allow a person to rest and prepare for obtaining new visual information. By calculation, this should be at least 65-140 meters. The choice of the length of the interval from the proposed range depends on the degree of activity of the accent series. The more active the elements in their outline and contrast on the general background, the stronger their impact on the psyche of the recipient. Accordingly, the interval of their alternation should be increased.

For the architecture of soundproof houses, it is characteristic of the adjoining to the street facades of such planning elements of the house as common corridors and galleries, staircase-elevator nodes. This allows to obtain compositions of facades with dynamic horizontal elements, supplemented by a rigid rhythm of the fences of vertical communications. Street facades of noise-protective houses of sectional planning are characterized by the absence of summer premises and the presence of clean, deaf wall surfaces. This allows to use the techniques of graphic (color and texture) dismembering the walls, creating compositions in accordance with the general author's project and taking into account specific conditions of perception. Often for noise-protective houses, planning techniques are used that give a complex contour of the outer walls. In these cases, the folds of the wall contours create additional protection against direct noise flow, extinguish it with their own forms. Such methods often allow to create a monumental, large-scale, one might say, "serf" character of the spatial boundaries of highways that cut off intraquarter spaces of residential areas from the uncomfortable conditions of communication spaces.

For the purposeful formation of a memorable image of a city highway of the second type, it is essential to create architectural solutions for the facades of houses, taking into account their compositional significance in the panorama of the highway.

Not all buildings in dynamic conditions of perception contribute equally to the creation of a memorable image. This circumstance is associated with the intensity of perception and memory capacity of a moving person. In scientific theories on the psychophysiology of the assimilation of visual information [2, 7, 8, 12], human memory is divided into 3 categories. First, it is an iconic memory that corresponds to perception no more than 0.1 seconds and does not give complete memorization. Secondly, operative or short-term memory, corresponding to perception of not more than 10 seconds and retaining the common,
most striking features of the form. And, finally, long-term memory, not limited by the time of perception and allowing to receive any amount of information about the object.

In accordance with this it makes sense to divide all objects of communication spaces into 3 categories:

1) dominants that are in the field of view of a person for a relatively long time and creating a sufficiently capacious image, fixed by long-term human memory,

2) local accents, the perception of which is not more than 3-10 seconds and create generalized schematic images that are fixed by the operative memory, and

3) the ordinary houses located between accents and dominants or forming a background for them. Their perception is not significant for the formation of a memorable image of highways. The time interval occupied by the movement of a person along the front of such houses allows one to relax and prepare for the perception of more significant objects.

Taking into account that the panorama of highways is formed by houses of different functional and compositional significance, it is necessary to clarify the formal qualities of their appearance, which would allow visually to differentiate these buildings into dominant, local-accented and ordinary buildings (Figure 4).

| Objects of highways | The ordinary houses | Local accents | Dominants |
|---------------------|---------------------|--------------|-----------|
| Scale of components | Relatively small, but larger than inside the microdistrict | Relatively middle | Large, hypertrophic or indeterminate |
| Number of components | More than 7-9 | Less than 7-9 | Less than 5-7 |
| Character of homogeneity | Any - homogeneous or heterogeneous - depending on the required informative saturation of the object | Inhomogeneous structure | Inhomogeneous structure. Homogeneous - only to create a hypertrophic scale |
| Character of rhythm | Any - metric, rhythmic, arrhythmic, - depending on the required dynamism and information of the object | Metric, rhythmic, multiple rhythmic, - depending on the required, - dynamism and information of the object | Multiple rhythmic, arrhythmic, - depending on the required dynamism and information of the object |
| Height of the object | Any | Contrasting with the height of ordinary houses (higher or lower) | Contrast prevailing |
| Degree of dynamism | Dynamic - near an accent or dominant. Static - near the ordinary houses | As a rule, they are static. Dynamic - next to the dominant | As a rule, they are static. |
| Contrast of relations | Relations of identity or nuance | Contrast of main components | Any degree of contrast, depending on the overall concept |
| Shape of components | Any | As a rule - rectangular. Accent components - symmetrical, characteristic shape | Forms with a characteristic contour |

**Figure 4.** Recommended types of the structure of the of houses, depending on their compositional significance in the panorama of the city highway
One of such qualities, first of all, after the silhouette characteristics, should be the architectural scale of the building. The larger the architectural scale of structural elements of a building, the correspondingly, the smaller the number of these elements. This constitutes a rational basis in the supply of visual information related to the limited perception of it in time. The architecture of such buildings is generally easier to perceive and better remembered. In this regard, the architectural scale of local accents should be greater than the scale of ordinary buildings, but at the same time much less than the scale of the dominant located in this same view frame.

The use of such techniques as the introduction of undivided walls into the composition of the facade, the installation of large stained-glass windows, the use of reflective partitions between the windows, the inclusion of the upper floors in the completion of the facade, and the grouping of the typological facade elements undoubtedly strengthen the scale contrast of the accent building and its environment.

A special place in a series of scale relationships is the so-called "undefined" scale of homogeneous composite structures of facades of buildings. It is characterized by the absence of significant structural elements that the human eye is able to fix. The existing small numerous facade elements are perceived when moving and away from the object as the texture of its surfaces. Such structure is good as a background and ordinary elements of the panorama.

However, homogeneous structures can also be used in the architecture of dominant buildings, provided that the shape and silhouette of such a building have an exceptional, concise expressiveness. Then the absence of significant structural elements makes it possible to read this form without interference, as a memorable geometric form of a hypertrophied scale. This ensures its visual separation from the familiar forms of environment. Modern practice provides us with many such examples of architectural solutions dominant objects ranging from the skyscrapers of Moscow-city and ending with architectural landmarks Dubai or London in the style of Norman Foster.

The need to form an optimal volume of visual information coming from a local accent imposes certain limitations on the character of the rhythmic organization of its facades.

The simplest forms of rhythmic organization, which does not cause a special tension of the nervous system, are metrical and harmonically rhythmic (with regularly increasing or dying rhythm) structures. The efficiency of memorizing and recognizing an object is also significantly affected by the characteristics of its individual elements. Straight lines, rectangles and squares are perceived easier than curved lines, round and polygonal shapes. First of all, the eye fixes the elements of the greatest contrast, as well as details with an unexpected and unusual contour [3, 6, ]. Proceeding from this, it can be concluded that the architecture of the facades of the local accent is expedient to be formed from rhythmic elements, predominantly of a rectilinear form, and as "recognition marks" to use elements or their groups with an unusual original contour contrasting from the general background of the facade.

The principles of structural organization of the facades of dominant buildings are somewhat different than those of local accents. Since the perception of dominant buildings is not limited by time, the nature of remembering such objects is largely determined by the volume of unusual visual information that can make the greatest impression. The more complex the structure, the more informative it is, the more likely it will hold the attention of a person longer and leave a memorable image in his memory.

One of the distinguishing features of ordinary buildings, a local accent and a dominant building that fall into one view frame, can be a different degree of their dynamism. Theorists in the field of architectural composition repeatedly stressed that the leading element in the composition is always static, and the appointment of dynamic forms consists in organizing the movement of the view towards the static forms [43/28]. It is noticed that the increasing and decreasing rhythms of the divisions can subconsciously speed up or slow down the movement of the glance. Uniform vertical divisions are able to have a relaxing effect, horizontal divisions activate the movement. Asymmetry and contrast of forms direct the view and attention towards the prevailing magnitude. Static systems, as a rule, are associated with a uniform distribution of vertical and horizontal divisions, the symmetry of the main masses, the proximity of their proportions.

For a long time the principle of statics has traditionally been considered a condition for the solution architecture dominant. However, in modern practice there are many convincing examples of a dynamic solution of dominants. Analysis of such solutions shows that the dynamism of dominants differs from the
dynamism of ordinary buildings. In the panorama of ordinary buildings, dynamism, as a rule, is not limited to the facade of a single building. The composition theme “flows” from volume to volume. In the architecture of the dominant dynamism does not go beyond its boundaries. Voltage is concentrated within its structure, accompanied by compositional completeness and fixed on any significant element of the structure.

The architecture of the ordinary elements of the highway panorama should be somewhat contrasted with the architecture of the buildings-accents and dominants. The nature of ordinary, background buildings most closely correspond to homogeneous structures with their inherent neutrality. However, quite often, due to general compositional reasons, the significant surfaces of the facades of ordinary panorama elements require the introduction of additional divisions. In such cases, in order to maintain the effect of homogeneity of the composition, it is advisable to soften the contrast of structural elements of the facade, bring them closer to uniform characteristics and set their number much higher than the Miller number (7-9), which will reduce the activity of each individual element. The degree of dynamism of the facades of ordinary houses can vary depending on their position in the panorama of the highway. The ordinary houses nearest to building-accents and dominants are expedient to solve, as a rule, dynamically. Buildings located in the middle sections of neutral zones, functionally and compositionally identical, are likely to be static in nature.

The ability to program the perception of a person with the means of architecture and concentrate his attention on the key points of panoramic compositions of highways makes it possible to purposefully form a memorable image of the city. This should be one of the directions of conceptual urban planning, which defines local tasks for the developers and architects.

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