

Colour Plan of Residential Area of Almaty City on the Basis of Architectural Design Code

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Abstract The intensification of construction, typical for most Kazakhstani cities today, entails the densification of buildings in the central part, including areas with historical architecture. This allows us to talk about the need to form a new view of architectural objects to preserve the unified architectural appearance of cities based on architectural design codes. In this case, the creation of a non-standard solution is based on the use of a variety of compositional principles and techniques, including the use of a rich color palette. In almost all cases, the use of color needs to be substantiated, which leads to disparate color ratios in the organization of cities' environments, and Almaty is no exception. This research aims to develop a method for coloristic organization of the residential area of the city of Almaty using architectural design code. The article discusses the analysis of color characteristics of various historical periods of development of the city of Almaty, identifying key elements of architectural design code and their applicability to the modern practice of urban environment design. The research methodology is based on the literature analysis and research on the topic of colorism and its application in architectural design code. Observations and data collection were also carried out on the existing structure of the city of Almaty and its problems regarding the coloristic organization of space. The result of the study is the development of recommendations for creating a harmonious color picture of the city of Almaty based on the identified methods and principles. The work includes the following key aspects: a review of

architectural codes and regulations, an assessment of visual perception of different color schemes, and their impact on social interaction and the psycho-emotional state of residents. Through techniques such as questionnaires and visual surveys, data on residents' preferences for color schemes were collected, allowing the development of recommendations for creating a color plan that takes into account the characteristic features and cultural aspects of the region. The study's results can be used to further develop urban planning and architectural design codes in Almaty and other regions of Kazakhstan.

Keywords Urban Environment, Color, Facade, Style

1. Introduction

The study of style features and color characteristics can be highlighted using architectural design code methods, which consist of five steps.

The first stage is preparatory. This stage involves identifying the periods of the city's development and determining the factors influencing the formation of the city's color picture. When identifying the coloristic features of the architecture of different periods, the following methods are used: analysis and generalization of textual and graphic materials, field survey, and photo fixation. The result is a set of tables and charts that characterize the natural and climatic characteristics of the

city, the materials used throughout the development of architecture, the components of color culture, and the table "Color characteristics of stylistic directions" (Table 1).

The second stage is the research stage. Collect visual and graphic information on the studied environment. This stage includes three consecutive steps.

Step one. Identify the architectural elements of the city's characteristics for the color picture, conduct a field survey, and perform photo-fixation.

Step two. Graphic construction of street layouts,

namely, drawing the facades of architectural objects and displaying their main elements and details.

Step three. It is drawing up a table, "Color Characteristics of the Street," which identifies the main elements of the facade that reflect the character of the color scheme of the objects. These include the color of the facade plane, roof, glazing, entrance group, and decorative details: window framing, columns, cornice, and gutters. Element color ratios are determined according to the percentage of the total element area within the facade (Figure 1).

Table 1. Coloristic peculiarities of the architecture of Almaty XX- early XXI cc

№	Periods	Style	Objects	Color palette
1	late 1920s early 1930s	Classicism	   	
2	late 1920s early 1935s	Constructivism	   	
3	1950s	Neoclassicism	  	
4	1960s	Soviet modernism	  	
5	Since 2000s	Modern architecture	  	

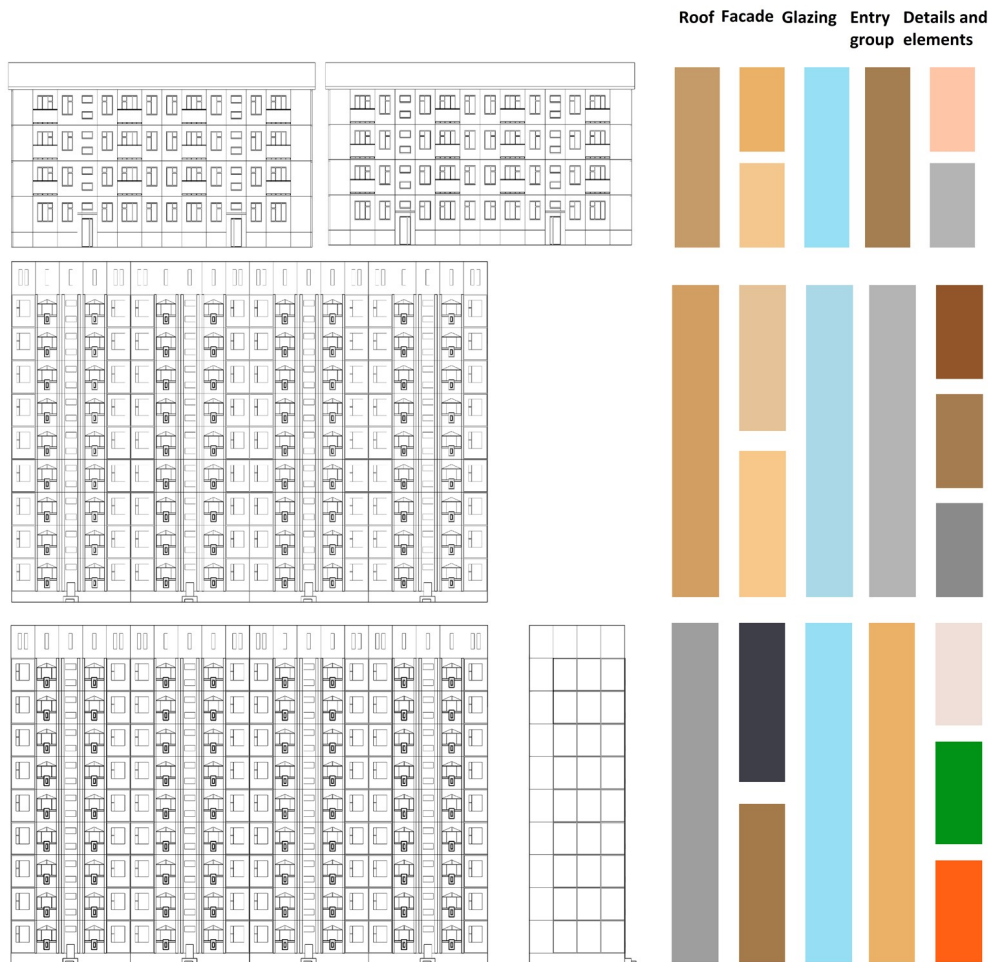


Figure 1. Color characteristics of Seifullinav street in Almaty city

When a historic site is "layered" on a modern site, the elements are analyzed level-by-level.

The third stage is graph-analytical. Construction of diagrams and schemes illustrates color characteristics of historical and modern parts of the city streets. The diagrams are based on the percentage ratio of color filling of architectural objects. Sectors are a graphical representation of architectural objects of the city street layout. They are an indicator of the area of color filling of the facade of the architectural object, part of which is displayed in the form of color characteristics of the main elements of the object selected at the previous stage (Fig. 2).

Color combinations are manifested by comparing the colors of the diagram sectors, revealing their contrast in various qualities. Not a single color is meant, but color combinations from which the surrounding coloristic reality is eventually formed. The result of this stage is a diagram of the dominant colors of the street, where colors are located along the horizontal axis, and the percentage of colors is located along the vertical axis.

Step four. The fourth stage is the comparative stage. Within this stage's framework is a drawing of summary graphs, where the characteristic colors of the streets of Almaty are revealed. On the horizontal axis are the streets

under consideration, and vertically - the percentage. The scheme allows us to compare streets with each other, namely - to identify what color dominates this or that street (fig. 2).

Step five. The fifth stage is the final conclusions based on the analyses. At this stage, a visual scheme is modeled, showing the coloristic features of architecture at all stages of the city's development and giving an idea of the color picture today. The use of the main provisions of the methodology makes it possible to consider the city in terms of historical stages (Table 1).

In order to better visualize the color picture of the city's historical center today, it is necessary to consider the features of architecture from the beginning of the XX century to the beginning of the XXI century. The selected period is proposed to be divided into five periods according to the principle of dominant stylistic trends:

1st period - the beginning of the XX c. - the last third of the XX century.

2nd period - the turn of the 20th century.

3rd period - 50s of the XX century.

4th period - 1960s of the XX century.

5th period - 90s of the XX century - beginning of the XXI century.

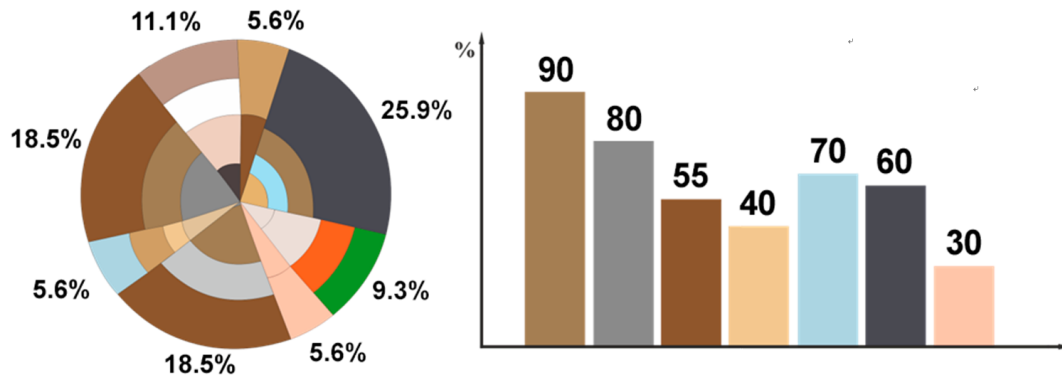


Figure 2. Layout of dominant colors on the facades of Seyfullin Street

Almaty is formed by buildings created in different styles: classicism, eclecticism, Russian style, art nouveau, constructivism, and neoclassicism. Its coloristic features characterize each of them [1].

At the turn of the 18th and 19th centuries, the part of the city that is now the central part of the city was mainly formed. At this time, theaters and houses in classicist style were built. The buildings brought new color tones to the city: yellow, yellow-orange, and white. In the middle of the XIX century, buildings in the "late classicism" style were erected. An example is the House of the Book, Abay State Academic Theatre of Theater and Music [2].

In the middle of the period, Art Nouveau-style buildings were constructed. They were primarily built of brick and wood; some were painted in gray, gray-purple, and blue shades. Buildings such as the Museum of Folk Musical Instruments, a rare example of wooden Art Nouveau, were constructed in this style [3].

At the end of the period, the style changed: the decorative "eclectic" facades and picturesque forms of Art Nouveau gave way to the simplicity of the new style of the Soviet era - Constructivism. During this period, the facades of many reconstructed buildings are overlaid with forms of constructivism. A striking example of constructivism is the Glavpochtamt, NKVD KazSSR, and the Academy of Arts named after Zhurgenov. Unlike the "Moscow" constructivism, which has a gray palette, "Almaty" - is based on yellow, light yellow, and light orange [3].

The next period (the 30s of the XX century - the first half of the 1950s) was characterized by buildings in the neoclassical style, or "Stalin's Empire". A part of Tole bi Street and the Academy of Sciences were built in this style. The coloring of buildings of this period used primarily gray, yellow, and yellow-orange shades [4].

The 1960s-1980s were the time of the monopolistic state construction complex. There was a massive industrial development of massifs; such residential complexes as "Three Bogatyrs" were built, "Aul." The architecture of these houses is characterized by monotony, impersonality, and imperfect execution [5]. Within the modern stage, we can distinguish three trends in the development of the city's architecture as a whole.

The first is the development of suburban areas and the construction of new districts, such as Botandyk district, the design of which uses a variety of shades and colors of objects located in it.

The second is the replacement of low-rise buildings by high-rise objects. The city's rapid growth generates problems such as disharmony in the interaction of architectural objects within the urban space at the level of color characteristics [6].

The third is the use of finishing materials in black, blue, beige, and brown colors, as well as glazing in blue, and brown shades, when developing the color scheme of facades of modern buildings, for example, in BC Nurly Tau, BC "Esentaitower," and others. These trends manifest in the context of Almaty's historical and modern streets.

However, when studying modern development in the historical environment, one can see a completely different picture: today, in Almaty, the historical center is actively developed with modern objects. In most cases, the rash introduction of modern architectural objects into the historical environment destroys its spatial context.

When identifying the trend of color application in the architecture of Almaty, it was noted that until the XX century, the color picture was influenced by the methods of color use typical for a particular style. Characteristic colors in the period of classicism were ochre-yellow and warm gray. The logic of using color is preserved in the period of Art Nouveau [7]. For colorism, art nouveau is characterized by the use of natural combinations. At the turn of XIX and during the XX century, Almaty saw changes in the use of color: several styles prevailed, each with its color characteristics.

When considering the objects of architecture of Almaty, it was noted that there is a general principle of color use, depending on the purpose of buildings. The coloring of residential buildings was dominated mainly by yellow, ochre-yellow, and pinkish colors, while the public, mainly administrative buildings, were painted in dark gray and light gray colors. Suffice it to recall the development on Seyfullina Street. Thus, throughout this stretch of the street, the color scheme of the facades of residential buildings in ochre-yellow and pink prevails. Houses on Kabanbai Street

are in a gray color scheme. The building of the Opera House is in beige tones, and elements such as lanterns, balconies, cornices, and window framing are painted in white. A striking example of this trend is Tole Bi Street's architecture, whose coloring combines nuances of ochre and soft yellow shades with white.

The color picture of cities is constantly changing. However, this change should be based on historical experience and current trends in the use of color. This is especially important in historically established cities, where, in most cases, the color picture is formed by numerous stands, signs, advertisements, and posters, which create an aggressive environment [8]. This leads to the fact that the integral image of the street is broken. Thus, we can discuss the need to create a model of a harmonious color picture of the historical environment, which will be based on the rules of color use.

We studied the different stages of Almaty City. For Almaty, we can talk about the diversity of color solutions dictated by the prevailing stylistic trends.

The current situation of coloristic chaos can be corrected by studying the historical and modern features of Almaty's color environment, introducing an architectural design code, and creating a methodology for identifying the style and coloristic features of architectural and artistic ensembles in the residential area.

2. Methods

The creation of a visually comfortable urban environment of residential development is as relevant in modern design as ever before. Of course, there have been changes in the requirements and modern ideas about the aesthetics of the city. The colorful organization of the facades of buildings is also relevant for such a megacity as Almaty, as many buildings are typical construction in the city and need repair. It is proposed that their architectural

appearance be diversified to overcome the uniformity in developing residential neighborhoods of old large-panel houses [9].

Also, the coloristic organization of facades located in the residential area of Almaty is relevant because the houses built in the 1960s-1970s are among the most reliable; the physical condition of these buildings allows them to operate until now. In Almaty, tests of building structures were conducted based on the testing laboratory of the Kazakh Research Institute of Construction and Architecture [10]. As a result of these studies, it was revealed that the most reliable and earthquake-resistant houses that are currently available in Almaty are large-panel houses. First of all, this is due to the peculiarities of the design of these buildings. Secondly, all these structures were factory-produced and of reliable quality.

Along Seifullin Avenue, there are many residential buildings that need repair and reconstruction (Fig. 3). Many of these houses were built at different times, so they have different architectural appearances.

Seyfullin Avenue runs from north to south, through Tukrsib, Zhetysu, Almalinsk, and Bostandyk districts, from Almaty-1 railway station to Al-Farabi Avenue. The avenue faces several significant objects: the railway station Almaty-1, the Almaty State Medical Institute building, the former cinema "Kazakhstan" and others. Therefore, Seifullin Avenue is one of the significant avenues running practically through the entire city.

When organizing the colour plan of facades in residential areas, it is considered that the first floors are mainly non-residential and are used to accommodate public institutions (shops, cafes, recreation areas, etc.). The design of the windows of these establishments is an important part of changing the appearance of the facades. To create a unified image, designers use a uniform design of shop windows throughout the entire area (Fig. 4).



Figure 3. Finishing of facades of the residential building at 12 Abylai Khan Avenue



Figure 4. Window decoration in a unified coloristic style on the first two floors of the residential building

2.1. Analysis of the Current State of the Color Plan of Almaty

The quality of mass residential buildings' architecture has recently improved significantly, as modern finishing materials provide architects with great opportunities to decorate facades. This makes it possible to modernize facades and increase the aesthetic value of obsolete residential buildings [11].

According to the analysis of literature sources, two main techniques of changing the appearance of facades that increase their aesthetic value have been identified:

- changing the texture and color of the wall surface;
- changing the silhouette and plasticity of the facade [12].

The building's limiting elements significantly influence the exterior appearance of a building. Some of the most common techniques for creating the crowning part of modernized houses include:

- expressive solution of the silhouette (gables);
- use of extensive plastic (ledges, terraces);
- rhythmic highlighting of the window openings of the upper floors;
- use of color and texture to highlight the top part of the planisphere [13].

The color and texture of facades play an essential role in the perception of the building in development [14]. Over time, protective and aesthetic qualities are lost, and energy efficiency decreases [15]. These problems are solved by modern facing and painting materials, increasing thermal insulation. External finishing of the facade is used:

1. plastering;
2. cladding (bricks, tiles, etc.);
3. hinged panels (ventilated facade, decorative panels).

This allows you to change the texture and color of the facade. Color allows you to highlight the main thing and divert attention from the secondary. The color solution should correspond to the color concept of the settlement and be justified by the formed environment [16].

Residential faade finishings consist of two positions:

1. Finishing of the exterior surface of building envelopes with textured mortars and coloring compounds (painting, plastering, texturing);
2. cladding of enclosing structures with face-facing elements made of materials different from the main structural ones (new dimensional plates - ceramic and glass tiles, plates made of natural and synthetic materials, sheet facing and enclosing elements) [17];

By analyzing the literature sources, the main techniques of color solution of buildings are revealed:

1. separating the old and new parts of the building with color;
2. painting the main and courtyard facades with different colors;
3. color-coding of communication links;
4. forming spot color accents;
5. identifying vertical and horizontal directions with color;
6. formation of pixel facades;
7. visual division of a single volume into several volumes by color.

Sometimes, part of the exterior wall, roof, and plinth are highlighted on the facade as a horizontal line. A pitched roof is highlighted in a darker color about the building. Fragmentary or along the perimeter of the entire building, strips are formed along the exterior walls at the height of the windows or the dimensions of the floors. These bands come in one or more colors. Rows of balconies, loggias, and windows stand out as vertical [18]. They are united by material and color (Fig.5).



Figure 5. Pioneer Residential Complex, 132 Dostyk Street

According to the results of the analysis of existing buildings in the residential area of Almaty city, a histogram was constructed, which illustrates the color characteristics of historical and modern buildings in the central part of the city. The histogram is based on the percentage ratio of color filling of architectural objects with the identification of characteristic colors. On the horizontal axis are the periods of construction, and on the vertical - is the intensity (Fig. 6). The boundaries of the activity of color used for newly erected buildings for the background development were identified. Exceeding the boundaries is inappropriate [19].

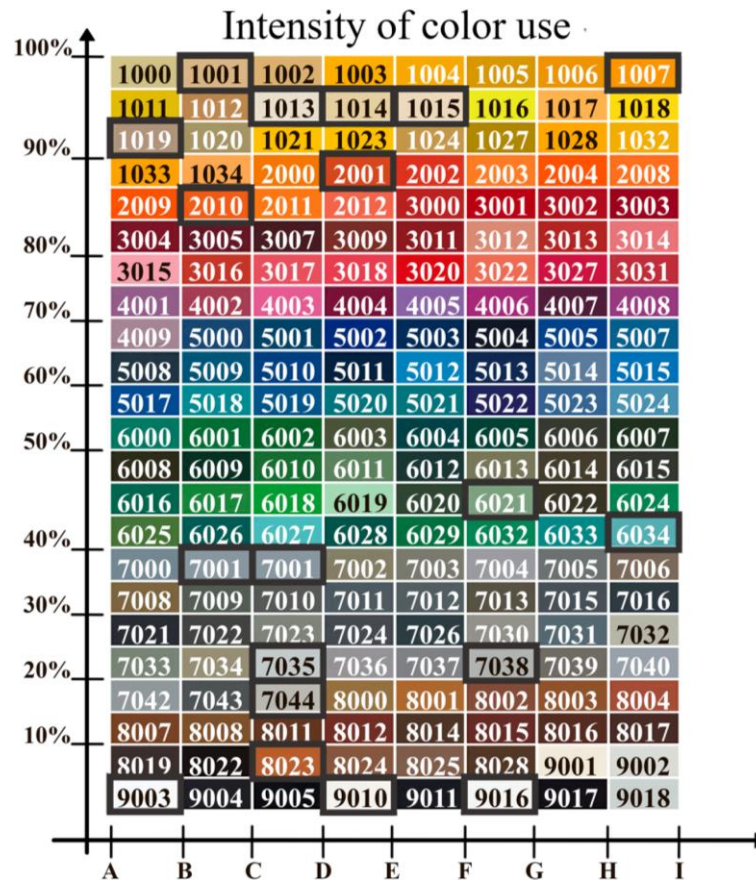


Figure 6. Intensity of color use in the residential area of Almaty

Seyfullin Avenue was chosen between Abaya and Makatayev Streets for the coloristic organization of the residential area. Four residential buildings were chosen because they are at the same distance and set the rhythm for the composition.

The houses selected for modernization belong to different series of standard construction, so they look different [20]. Therefore, the main goal of the design concept is to create a unified image for the residential buildings. The new look of the facades of the buildings was chosen for aesthetic reasons [21].

2.2. Options for Facade Modernization

Two modernization options are proposed. For the first variant, the following techniques are used: coloristic selection to create a visually comfortable environment, increasing the area of balconies in different degrees (cascade), and the device of superstructures for the upper apartments to increase the living space (Fig. 7 a, b). Also, the device of superstructures is necessary for apartments on the last floor because the increase of balcony area is the least [22]. The added area of balconies can be used as a terrace. The superstructure of the apartments does not go along the whole line but only along the vertical of the balconies to emphasize the rhythm.



Figure 7 (a). Option 1



Figure 7 (b). Increasing the area of balconies and installing a superstructure

The formation of residential architecture occurs due to the vertical division of facades with continuous ribbons of balconies [23]. Changing architectural elements such as balconies, terraces, and window sashes help improve the aesthetic qualities of residential architecture (Fig. 8).

There are no residential apartments on the first floors of

the houses; they are used as public spaces, but now they are all decorated in a different style, so it is proposed to unite them with a single line and decorate them in a single style (Fig. 9).

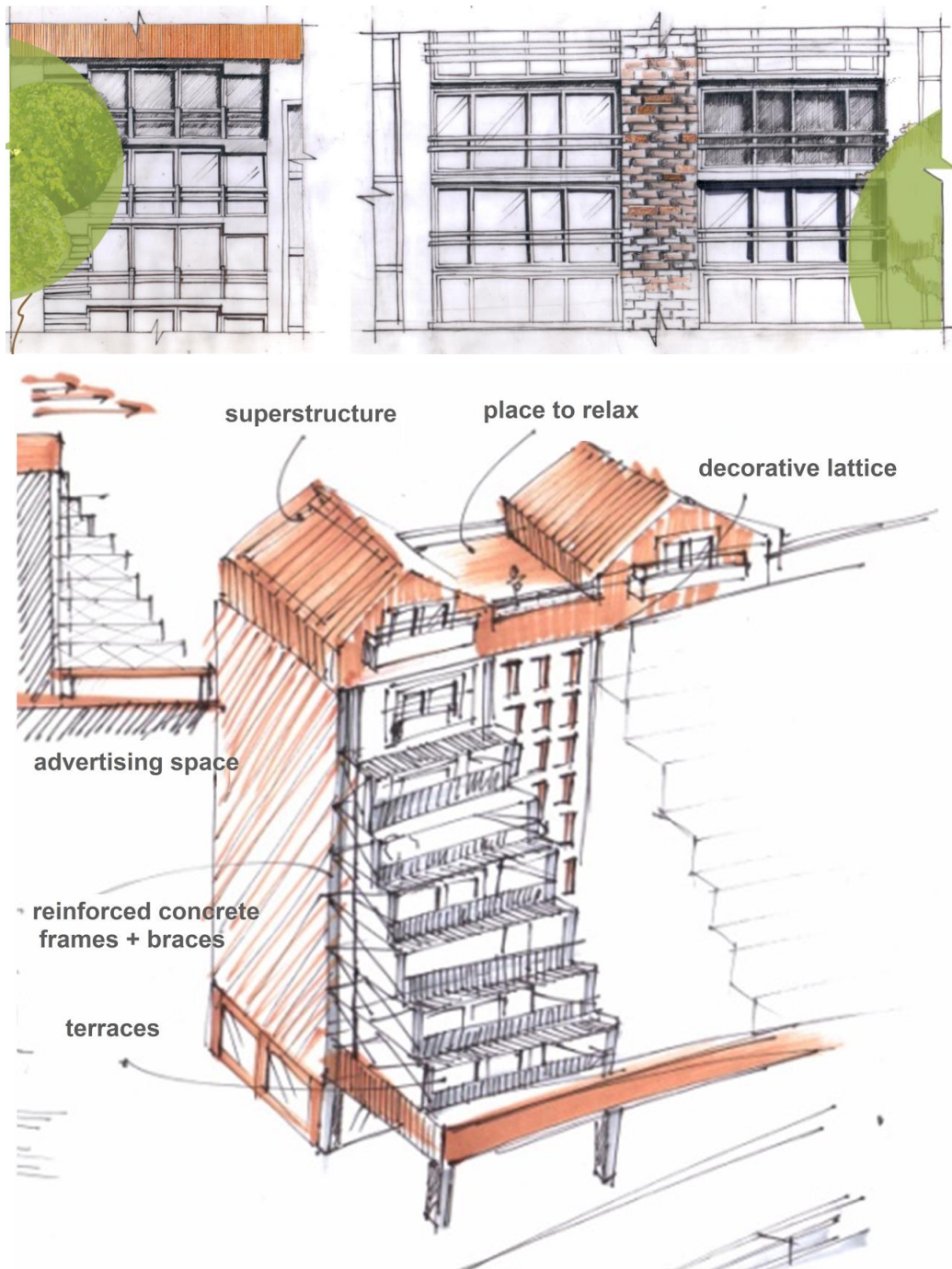


Figure 8. Options for modifying architectural elements



Figure 9. Design option for shop windows on the first floors

The color scheme involves the use of two colors. White symbolizes lightness and simplicity, which "lightens" the houses and makes them less massive [24]. To prevent excessive whiteness, it is necessary to dilute with bright accents in the form of color spots and elements of landscaping [25]. Terracotta color is used to generalize and create a "single line" for all houses. It is proposed to use fiber cement panels for finishing facades. This is not only an aesthetic component but also the extension of service life, preservation, and protection from the destruction of the material from which it was built. Due to its physical properties, the panel facade has a number of advantages:

1. additional thermal insulation;
2. absolute fire safety;
3. environmentally friendly;
4. due to its low weight, it does not create a heavy load on the frame and the building itself;
5. temperatures, ultraviolet light, and destructive effects of atmospheric factors [26].

The shape of the roof structure is gable, one of the most common forms. Profiled sheets with the effect of tile masonry are used for covering [27]. This type of roofing has several advantages:

1. a wide variety of colored polymer layers;
2. uncomplicated installation procedure;
3. high anti-corrosion quality indicators, resistance to ultraviolet radiation, ignition, and atmospheric phenomena [28].

Seifullin Avenue is very busy; here passes a lot of transportation and pedestrian connections. The individual character of the architecture of the facades of residential buildings facing the highway is promoted not only by the decoration of the facades, the organization of the entrance group of public places located on the ground floor but also by elements of graphic design - trademarks, signs, banners and new types of advertising. Advertising can be located not only on the front facade but also on the side (Fig. 10).



Figure 10. Advertising on the facade of the building

Option 2. The construction of mansards with the same color scheme and erecting of a second facade.

The second option involves changing the plastic using mansards for the upper floors, creating a single-color accent "cap" for all houses, uniting them, and changing architectural elements (new glazing of balconies and change of window bindings) (Fig. 11 a, b).



Figure 11 (a). Option 2

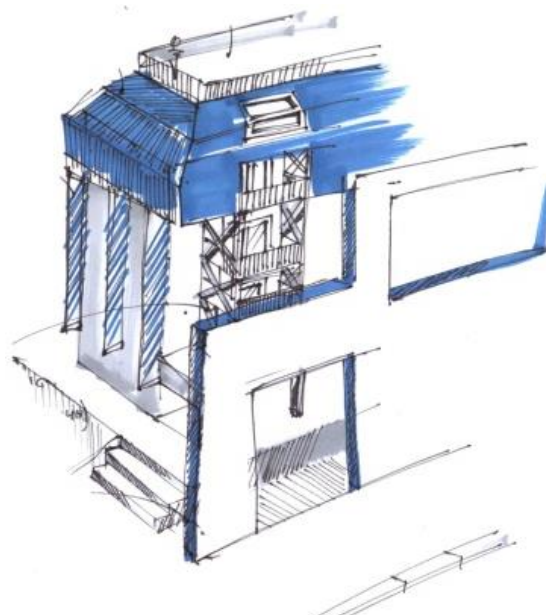


Figure 11 (b). Construction of the second facade and equipment of the attic

As with the first variant, the architecture of residential buildings is shaped by the vertical division of the facades with continuous ribbons of balconies. Architectural elements such as balconies and bindings are modified. For this purpose, metal panels with different perforation patterns are used on the facade. A perforated sheet is a metal sheet obtained by perforating metal on special equipment—coordinate-punching presses [29]. This material's main feature is through holes of various shapes and sizes (Fig. 12).

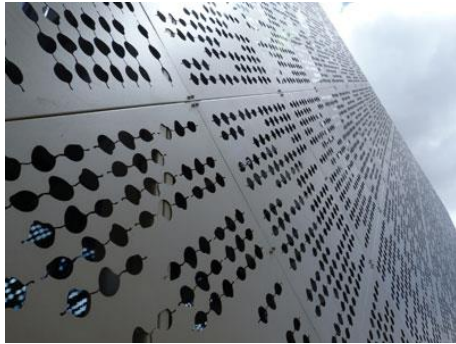


Figure 12. Perforated metal sheets

Cantilever signs can often be seen on city streets—they are one of the most effective types of outdoor advertising [30]. The console is attached to the wall of a building or other objects using a special bracket, which is why the cantilever sign is often called a "panel bracket." Cantilever signs are located perpendicular to the traffic and pedestrian flow, allowing you to attract enough attention to the advertising and occupy a small facade area (Fig. 13).



Figure 13. Installing signage using a bracket on the facade

The coloristic organization of facades also includes the organization of the entrance group to the entrance and the design in the general style of the facade (Fig. 14). The organization of the entrance group includes the following elements:

1. visor;
2. entrance facade;
3. steps;
4. illumination;
5. front door;
6. vestibule;
7. informational signs.



Figure 14. The entrance to the house from the courtyard side

Visual communications are one of the main elements in the organization of the entryway entrance. They are necessary for easy orientation. The information signs of the entrance group of the entrance of a residential building include the number of the house, the number of the entrance, and the number of apartments located at this entrance [33].

Formed over a long period, the central zone of Almaty is a historically established territory with a dense architectural environment. The city's central zone's most significant colorists are light (pastel) colors with the inclusion of individual colors of other color groups, as well as white colors present in the decoration elements [31]. Others, less critical, are groups of bright, saturated, and grayish (Art Nouveau style) and achromatic (constructivism) colors. As a rule, areas of the central zone formed historically are more integral in terms of creating a coloristic environment of a particular emotional significance [32].

A color palette was formed for different architectural styles, consisting of preferred primary colors and colors of architectural details (Fig. 15).

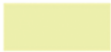
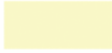
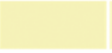
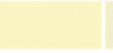
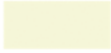
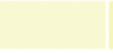
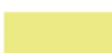
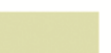
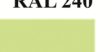
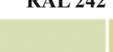
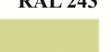
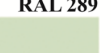
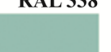
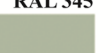
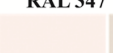
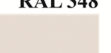
Basic color	Colors of new development in the historical center	Background colors (background development)
221 	   RAL 203 RAL 215 RAL 214	   RAL 217 RAL 218 RAL 248
230 	   RAL 226 RAL 227 RAL 230	   RAL 225 RAL 237 RAL 224
231 	   RAL 232 RAL 233 RAL 234	   RAL 235 RAL 236 RAL 232
238 	   RAL 238 RAL 239 RAL 240	   RAL 241 RAL 242 RAL 243
272 	   RAL 273 RAL 274 RAL 275	   RAL 276 RAL 278 RAL 279
283 	   RAL 284 RAL 285 RAL 286	   RAL 287 RAL 288 RAL 289
332 	   RAL 333 RAL 334 RAL 335	   RAL 336 RAL 337 RAL 338
334 	   RAL 340 RAL 344 RAL 345	   RAL 346 RAL 347 RAL 348
350 	   RAL 351 RAL 352 RAL 353	   RAL 354 RAL 355 RAL 356
361 	   RAL 362 RAL 363 RAL 364	   RAL 365 RAL 366 RAL 367

Figure 15. Recommended color palette for architectural structures in Almaty

The choice of the leading color group for the residential area depended on the specific coloristic environment in which the object was placed [34]. In this case, two solutions are possible: fitting into the development of the object expresses the historically established color of a particular site of a particular zone of the city and creating an accent in the architectural environment, which ignores the existing color environment, because it is the dominant of the site. Thus, a creative interpretation is required in the formation of the color scheme of the development based on history, color preferences of its time, the function of the development site, etc.

The creation of style palettes makes it possible to vary the color of the residential area within the palette of the style since, often, even the original color of the architectural monument was defined conventionally [35]. In this sense, observing the palette and the main color combinations of facade elements inherent to the style is essential.

The main principles of choosing coloristic solutions by the developed methodology are as follows:

- determination of the planning zone of Almaty in which the building being restored or newly constructed is located;
- defining the role of the building: central frontage development or background development;
- definition of the architectural style restored or of a building being restored or newly constructed;
- selection of appropriate primary colors of facades and complementary colors of details;
- selection of optimally suitable materials and textures for finishing the buildings' facades in the city's historical part.

The developed methodology of coloristic organization of buildings in the city's residential area allows us to look at the city's prospective development and highlight the existing development's features.

3. Conclusions

Based on a residential area located in the city of Almaty, the problems of forming the color scheme of a modern city were analyzed. The main trends were identified and systematized, and the basic principles of the formation of color architectural space based on design code in the cultural development of the city were identified and recommended. The dependence of the factors influencing the color image of the city on its cultural development has been established. An approach to the formation of urban polychromy has been defined, which is based on the color pool of the natural environment, the functional-spatial

structure of the city, the historical and cultural diversity, and the preferences of residents, the features of which are determined by the laws of the cultural evolution of society as a whole. Systematized main directions of development and formation of color architectural space in the city's cultural development act as recommendations for organizing the urban environment through color modeling.

The identified main trends characterize the regularities of developing a comfortable coloristic environment in Almaty. They focus on the main problems of organization and regulation of its coloristic environment and indicate the need for harmonization and ordering. The principles of the formation of color residential space in the cultural development of the city are the necessary fundamental, guiding basis in architectural and urban planning and design activities.

After analyzing the current state of residential space in Almaty, it becomes evident that an environmental approach to its formation is needed. This approach would consider not only standard functional requirements but also options for interacting with all components and their harmonious perception, creating a holistic color image.

In residential areas of Almaty today, as a rule, components of the first type of environment organization prevail. There are practically no equally essential components of the second type - navigation elements, elaborate advertising, and unique symbols of the place. This is especially noticeable in neighborhoods that lack the inclusion of a large number of small businesses on the first floors of buildings. Thus, there is a bias towards the utilitarian organization of the residential environment due to the lack of elements of social activity that create a sense of identity with a particular place among the district residents.

It becomes evident that a medium approach to solving the current problem of color organization of living space and systematization in Almaty, taking into account the principles of architectural design code, is needed. This approach allows the creation of a visually comfortable environment and the introduction of an element of uniqueness, which will affect such characteristics as recognizability, memorability of the environment, and its identity.

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