

Study of the Impact of Natural Factors on the Color of a City

With Local Materials as the Example

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Abstract—The Color of a city means the appearance of a city and the first impression on the city in people's mind. In the study of the color of a city, cities are definitely the material carriers of colors. Different cultures are attached to different cities, so the colors of cities are different, too. From the perspective of geographical locations, color of a city is influenced by factors of natural environment, including geographical conditions, climates and local materials. Based on examples of local materials, the paper focuses on analyzing impacts of materials on the color of a city.

Keywords—Color of a City; The Impact of Natural Factors; Local Materials

I. INTRODUCTION

The Color of a city means its appearance and people's first impression on it. The uniqueness of the dominated tone of a city may improve the popularity and attractiveness of the city. As history of city, the color of a city is also a treasure of the city thanks to its development. "As long as color of city is formed by its history and development, it is a carrier of city culture. [1]" With the development of city and deepening of international communication, city culture has been influenced by other cultures, so the regional uniqueness of a city has been being reduced gradually, so does the traditional culture of the city. Therefore, maintaining and returning to the original image of the city play a significant role in finding out the identity and features of the city. An important factor in building the image of a city is about the presentation of its regional features. Thus, regional study on the planning of city color is an effective way combining culture and the background of a city.

II. THE FACTORS INFLUENCING THE COLOR OF A CITY

In the study of the color of a city, cities are definitely the material carriers of colors. Different cultures are attached to different cities, so the colors of cities are different, too. From the perspective of geographical locations, the color of a city is influenced by factors of natural environment, including geographical conditions, climates and local materials. From the perspective of development, it is affected by ethnical cultures, religious cultures, science and technologies, as well as city development. Based on examples of local materials,

the paper focuses on analyzing the impacts of materials on the color of a city.

Human beings have been using building materials for a long history. From the caves of primitive society to skyscrapers of modern society, all these buildings are unique due to their textures, performances and colors. In terms of the usage, building materials can be divided into natural ones and artificial ones. In the paper, local material only refers to natural building materials.

III. NATURAL BUILDING MATERIALS

Natural building materials refers to those maintaining the original characters after processing, mainly including natural stone, brick, wood, earth, etc. Due to the rich textures, the color effects reflected by natural materials are gentle and implicit. In addition to the instinct of human beings to get closer to the nature and the physiological property of perceiving colors, buildings built by natural materials are more harmonious with natural environment and offer more pleasures to people. Before entering the industrial society, local materials were mainly from natural materials, which would be simply processed later. In his *The Timeless Way of Building*, Christopher Alexander has mentioned that "adjusting measures to local conditions, using local materials." In the 1st BC, Marcus Vitruvius Pollio, a Roman Architect, had wrote *De Architectura*, the earliest book recording the evolution of buildings, and also the only book on architecture kept from the ancient times. The book recorded that the early architects could only use the branches and withes to make the wall of buildings, and then shaped the structures by painting mud, which is now known as wattle and daub. In early times, color was not a part of buildings. It appeared naturally later.

During the long history of development, local materials and resources have offered important sources for corresponding buildings, which allowed the popularity of cheap and convenient original or slightly-processed natural materials. Residents determined the fundamental structures of buildings based on local materials and resources. In such way, the traditional color of a city is determined by cheap and convenient materials, such as clay, natural stone, wood and other coatings. Therefore the color of a city is reflected by the combination and integration of proper colors of building

[1] Youhua Chen, Min Zhao, Introduction to Urban Planning. Shanghai, Shanghai Scientific and Technological Literature Press. 2000

materials. Local materials are important material elements forming the color of a city.

Traditional Chinese residences are varied. They also have their own features in terms of color. All of such consists of the profound and extensive residential culture in China. The walls of residences are mainly built by local materials. Due to the differences in geology and climate, materials in difference regions have different colors. Owing to the choices of long-term and stable dwellers, the regional colors with their own features were eventually formed. The stable and harmonious color of a city maintained during the long-term urban development because the preference of natural building materials is long lasting. Color will be analyzed based on the materials' own features:

A. Natural stone

Natural stones have features like various categories, abundant colors, rough surface, less saturation, disunity of hue and lightness, and heavy color and texture. In Qinghai-Tibet Plateau, due to the high altitude, there are little wood in access. Therefore, the main materials are abundant stones from the mountain\ areas. The main parts of the buildings are constructed with gray stones, forming a cold regional color. Guangzhou locates in subtropical monsoon climate zone with plentiful rainfalls and high temperature. In order to adapt to the climate of south of the five ridges, "Fig. 1" Guangzhou arcades have solved the regional environment problems by traditional construction technologies from the aspects of thermal environment, luminous environment and acoustic environment. The main tone of such traditional buildings is light white. Egypt is rich in building stones. In history, various stones were main materials of traditional Egyptian buildings. There are various categories of stones produced in Egypt, including marble, granite, limestone, etc. However, Egyptians prefer marble in yellowish brown in general, which is very close to the color of deserts. In Egypt, ordinary residences are mainly built by common stones or mud brick, which is made of sludge from the Nile and plant fiber. Therefore, In Egypt or even the entire Middle East area, the color of a city and building is mainly the highly saturated yellow gray. The yellow gray Islamic buildings in the background of blue sky is very powerful and well-bedded; while with the shine of sunset glow during the dusk, these buildings are splendid and magnificent.

B. Bricks

China has a long history in baking bricks. In traditional buildings, materials have the features including low cost, implicit color and simple texture. There are two types of baked bricks----- black brick and red brick. With different constructing methods, these bricks may have different effects. Compared with red brick, black brick is superb thanks to its small opening, corrosion resistance, weather resistance, and other advantages. As long as economic and technological conditions allowed, black brick was the first choice generally. Even though the color of brick and tile is steel gray in both southern and northern China, earth texture, climate, and baking technology are greatly different between the south and north of China. That's why the tone of black brick the south of China is darker than that in the north. For example, black tile

and steel-gray brick in the region of lower reaches of Yangtze River and steel-gray brick and tile of in Sichuan area have dark tone, while bricks in Hebei and Beijing are quite light. Kailuan brick produced in Tangshan is featured small size, thin thickness and light weight, which is great in seismic performance, so it was widely used as building materials in rebuilding after Tangshan Earthquake. Such determines the color of city in some way.

C. Wood

Wood is fine and gentle in both color and texture, so it is perfect to be the structural unit or the plane material after processing. Wood enables buildings to be various. In later processing, varnish can be applied to reflect the original color and vein of wood. Or colored paintings can be applied to represent different colors. Wood is an important natural building material. It is abundant in the north of China, so timber structure in beam-column style dominated the area. In terms of color, units such as beam and column are covered by paintings, which are also decorated by color paintings in different levels, presenting enriched and gorgeous colors. Besides wood, the southern part of China is also rich in bamboo wood. For buildings in the south of China, combination of wood and bamboo wood demonstrates the original colors of wood and bamboo wood, or simple and elegant paintings in the color similar to that of wood. In some ethnical regions, bamboo wood is very popular. Xishuangbanna of Yunnan Province, with plentiful sunshine, sufficient heat and rainfalls, is a good example. In Xishuangbanna, there are only rainy season and dry season during a year. In line with hot, humid, and rainy ecological environment with luxuriant bamboo, "Fig. 2" Dai people mainly live in hanging attics. Because of the impact of hot and humid weather in the southern part of China, buildings of plain areas are constructed by brick, stone and wood. For instance, Suzhou locates in temperate zone. "Fig. 3" Taking conditions like the abundant rainfall, hot summer and distinguished four seasons into consideration, buildings mainly have two stories with the lower one built by brick and stone and the upper one by wood to ensure that the buildings are damp-proof.



Fig 1. Guangzhou arcades^[1]

^[1] Investigation report of Architecture Physics. Investigation report of Architecture Physics.

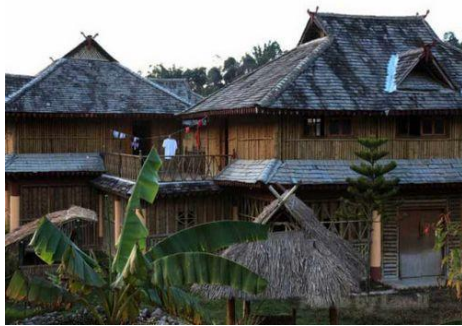


Fig2. Xishuangbanna bamboo building



Fig 3. Suzhou locates building

D. Earth

In the history of world's architecture, earth is the most popular building material, and most of the buildings in the world are built by earth. The original bricks are nearly naturally formed. There is so much ooze on banks of the Nile, the Tigris, and the Euphrates. People shaped the dry and crack ooze and then used it to make bricks. In Mesopotamia, buildings on the flood plain between the Euphrates and Tigris were built by clay and stones. Nowadays, such materials are still used in the Middle East. Also, in Morocco, Tunisia and other countries in the northern Africa, clay in different colors and with different texture is directly used as building materials after being backed by the sun. The fences outside the buildings are built by local adobe bricks, representing the warm and soft color of local earth: ochre, brown, red and mustard. Before the industrial age, roof of Japan, an important part of traditional Japanese houses and temples, was made of the same clay in gray color. Owing to various natural environments in different regions, the colors of earth and stone are also different. For example, earth in the northeast China and some part of steppe is in black color; earth in Shandong Province and Hebei-Beijing area is in light brown, earth in Yunnan Province, Guizhou Province and Hubei Province is in red, while earth of Shanxi Province, Shaanxi Province and the western China is in yellow. Buildings built by raw soil are usually in arid and semi-arid zones. With such material is made of local earth, its color is thus harmonious with the natural environment, leaving us a simple and plain impression. When the local materials such as soil, stones are used to construct buildings, the specific colors are represented. For example, in Shanxi Province and Shaanxi Province, Loess Plateau features plentiful sunshine and less rainfall. Water and soil loss and insufficient woods result from years of massive

falling, leaving ravines and gullies crisscross. In addition, the quality of earth of Loess Plateau is great and the level of underground water is low. Local buildings are dominated by arch cave dwellings built by local loess, "Fig. 4" a building material to build, or those constructed and packed by mud bricks. The corresponding color of city is mustard.

IV. THE PERSPECTIVE OF MATERIALS COLOR

From the perspective of color, the nature may bring numerous harsh changes, including long-time wind, sun, rain, sand etc., which create the instinct colors of local materials. They are also parts of geography and nature. Colors are abundant and various. Colors of material are usually highly harmonious with those of natural environment. [1] Owing to the different climates and environments in different regions, optimization of colors for different buildings shall take the maintaining effect of colors into consideration. When the colors of local materials are used in urban buildings by modern technologies, these colors can be stored and upgraded as it's presented. From the perspective of architecture, materials used in buildings are the eventual matters of artificial elements (buildings, structures). The colors of outside buildings shall be reflected by the building materials in the end. Performance of building materials covers the texture, quality, shape, color, etc., which are limited in some degree. In general, using local materials is easier to be harmonious with the architecture's surrounding environment so as to create the material and color scenery favored by dwellings. Therefore, local materials are important carriers of the color of a city.

V. CONCLUSION

In general, different materials are produced by different places. "Using local materials" is valid all over the world and through the ages in terms of material using. Nowadays, even using materials are no longer limited with the development of technology, transportation and economy local materials are still the carriers of corresponding culture and spirits. For various conditions like culture, geology and earth, building material is an important factor representing the color of a city.



Fig 4. Dwelling cave of Linfen among hills of Loess Plateau^[2]

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