Spatial Pattern and Transportation Accessibility of Architectural Heritage in Chengdu, China

Liang, W., Ahmad, Y.* and Mohidin, H. H. B.
Faculty of Built Environment, University of Malaya, Kuala Lumpur, Malaysia
E-mail: yahaya@um.edu.my*
Corresponding Author

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Abstract

Architectural heritage is an important cultural resource in the city, and its macroscopic spatial pattern and accessibility are important for the conservation of architectural heritage and the development of heritage tourism. This paper explores the spatial pattern and accessibility of architectural heritage in Chengdu by using spatial analysis of 308 declared national, provincial, and municipal cultural relic protection units in Chengdu as the object of architectural heritage research. The results showed that: (1) The distribution of architectural heritage was generally clustered, and the clustering areas of various types of architectural heritage differ significantly, with architectural heritage mainly concentrated in the central urban areas; (2) The integration value of various road networks connecting architectural heritage in the central urban area were significantly better than those in other areas; (3) The transportation accessibility index of architectural heritage in the central urban areas was higher, while the transportation accessibility index of architectural heritage in the surrounding areas was lower.

Keywords: Architectural Heritage, Chengdu, Space Syntax, Spatial Analysis, Spatial Pattern

1. Introduction

Architectural heritage is an indispensable part of the history of human society. It has witnessed the development of the whole human civilization, leaving a historical mark and valuable spiritual and cultural wealth for future generations. Architectural heritage is also a part of the material cultural heritage and an indispensable and essential resource for every city. It is not only the cultural symbol of a city but also a local characteristic. Architectural heritage is now regarded as a social fabric that shifts across time and space in response to various social, economic, and political forces. The management of change at the urban level is now a concern in the conservation of architectural heritage, in addition to the preservation of historical assets [1] [2] and [3]. To prioritize initiatives and guide decision-making, UNESCO recommended using both conventional and innovative instruments [4] that capture the various cultural values ascribed by various stakeholders. With the continuous updating and development of the architectural heritage conservation process, the concept of architectural heritage has been complemented and expanded, gradually moving from a regional level to an urban perspective [5]. Today, architectural heritage conservation is no longer understood from a single perspective, as the historical and cultural environment is no longer a single entity separate from the city. We should study the conservation of architectural heritage in a larger regional context.

Architectural heritage is a non-renewable historical and cultural resource, a microcosm of social history and culture, and a carrier of cultural memory as a way to show the continuity of human vitality and express the interaction between the human spirit and material space. The Venice Charter defines the architectural heritage as not only individual buildings but also urban or rural environments from which a unique civilization, a meaningful development, or a witness to a historical event can be discerned [6], and it focuses on the significance of the development. The European Charter of the Architectural Heritage explores the societal importance of architectural heritage conservation in detail and promotes the notion of holistic conservation [7]. The Charter of Machu Picchu states that the conservation, restoration, and reuse of existing historical sites and buildings must be integrated with the urban construction process [8], linking the conservation of architectural heritage to urban development. The Washington Charter establishes a clear link between historic cities, urban conservation, and urban development and states that historic city conservation should be part of a broader social and economic development strategy [9]. According to the Vienna Memorandum, the critical challenge facing architectural heritage is the harmonious interplay with development dynamics [10]. According to the Recommendation on the Historic Urban Landscape, active conservation of urban heritage and sustainable management is a necessary condition for development [4], change is beginning to be recognized as part of urban heritage, and conservation has become a strategy for achieving a sustainable balance between urban growth and quality of life [2]. From The Venice Charter to the Recommendation on the Historic Urban Landscape, people's perceptions of the relationship between architectural heritage and contemporary times have shifted from an initial emphasis on harmony between contemporary times and architectural heritage to a gradual and profound recognition that architectural heritage is an essential resource for contemporary development. The conservation of architectural heritage changes, from one-sided conservation to comprehensive conservation, from static conservation to dynamic conservation, and from destructive to sustainable [11] [12] [13] and [14]. Furthermore, it indicates a greater emphasis on the overall conservation and activation of architectural heritage.

Theoretically, architectural heritage is significant for history, documentation, archaeology, economy, society, politics, and spirituality or symbolism [15]. Architectural heritage can serve as a physical representation of cultural identity and continuity [16]. However, it can also serve as a social, cultural, and historical sponge, absorbing all aspects of a society's history, culture, customs, beliefs, and ideologies. Heritage, like history, is a modern application or depiction of the past to the present rather than a mirror copy of it [17] and [18]. Thus, architectural heritage plays an essential role in the city. When space syntax is used for heritage buildings, they not only analyze the road network structure of the city at a macro level but also understand the physical quality of the architectural heritage from a quantitative perspective. The theory of spatial syntax assumes that the spatial configuration of buildings and cities determines the functional and social properties of space, which determines human activities in space [19] and [20]. Its basic principle combines the view of graph theory, which partitions space into a system consisting of several nodes. It explores the topological relationships between spatial nodes to analyze the structure of space itself and the characteristics of human activities in it [21] and [22]. Based on many empirical studies, Turner argued that there is a connection between urban imagery and axial diagrams, which can be used for spatial cognition studies in the spatial syntax model [23]. Ajza Shokouhi et al., [24] pointed out that the salient elements of the city are the key to interpreting the city by comparing the spatial syntax analysis and imagery maps of different cities [24]. Thus, this paper relates spatial syntax to architectural heritage to have a macroscopic view of the city-wide architectural heritage.

At present, architectural heritage research has focused on architectural heritage values [25] [26] and [27], industrial heritage conservation planning [28] [29] and [30], and vernacular architectural conservation practices [31] [32] and [33]. However, no statistics on architectural heritage in cities have been conducted, nor have city-wide studies been conducted. Most of the architectural heritage is based on single or homogeneous material architectural heritage, focusing on the conservation path of architectural heritage based on a microscopic perspective, and relatively few of them study the spatial pattern from a macroscopic level. Furthermore, as modernization continues to advance, various modes of transportation are becoming more and more mature, and road network facilities are gradually improving. The importance of various transportation route networks for inter-regional connection and development is self-evident. Transportation accessibility not only profoundly affects heritage tourism and heritage conservation but also contributes to the national prediction and regulation of heritage tourism [34]. In this study, national cultural relic protection units, provincial cultural relic protection units, and municipal cultural relic protection units in Chengdu are used as the objects of architectural heritage research, and the spatial analysis function of ArcGIS software (Geographic Information System Company, Environmental Systems Research Institute, West Redlands, CA, USA) to study the spatial distribution pattern of existing architectural heritage in Chengdu and the accessibility of architectural heritage in the city from a macroscopic scale [35] [36] and [37], to provide a reference for the conservation and utilization of architectural heritage in modern society and contribute to the conservation of architectural heritage with different accessibility [38]. In addition, this study is an important guideline for developing architectural heritage tourism and other related industries in Chengdu and promotes the conservation and development of architectural heritage.

2 Data Source and Research Method

2.1 Study Area

Heritage is the material and spiritual resources of a place and is divided into world heritage, industrial heritage, agricultural heritage, mining heritage, cultural heritage, religious heritage, etc. Cultural relics are an object concept unique to China’s cultural heritage and refer to cultural relics left over from history. Cultural relics are divided into movable and immovable cultural relics. Immovable cultural relics include ancient sites, ancient tombs, ancient buildings, grotto temples and stone carvings, important historical sites and representative buildings in modern times, which belong to architectural heritage in a broad sense.

This paper takes Chengdu as the study area. Which is located in the southwest of China and the western part of the Sichuan basin and is one of the first national historical and cultural cities with a long history and rich architectural heritage resources. In this study, 33 ancient sites, 19 ancient tombs, 140 ancient buildings, 21 grotto temples and stone carvings, 88 important historical sites and representative buildings in modern times, and 7 other types of cultural relic protection units are taken as the objects of architectural heritage conservation in Chengdu (Table 1). Statistical results show that ancient buildings and important historical sites and representative buildings in modern times are the main types, accounting for 74.02% of the total architectural heritage. This is followed by ancient sites, which account for 10.71% of the total architectural heritage.

2.2 Data Source

The research object of this paper is 308 published architectural heritages in Chengdu, namely 41 national cultural relic protection units, 106 provincial cultural relic protection units, and 161 municipal cultural relic protection units. The data were obtained from the official website of the Ministry of Culture and Tourism of the People's Republic of China (https://www.mct.gov.cn/), the official website of the Sichuan Provincial People's Government (http://www.sc.gov.cn/), and the official website of the Chengdu Municipal People's Government (http://gk.chengdu.gov.cn/govInfo/). The spatial coordinates of the architectural heritage were calibrated with the help of Google Earth map coordinate picker. Chengdu railroad data, major road data, highway data, and subway data were obtained from Google Maps and were aligned and digitized.

2.3 Research Method

This study delineates the architectural heritage of Chengdu in the form of points and uses ArcGIS as an analysis tool to study the spatial distribution pattern of architectural heritage in Chengdu at the municipal macro scale. The accessibility of the overall road network in Chengdu was evaluated using the near analysis and spatially integrated analysis variables [39] to study the accessibility of architectural heritage at a citywide scale.

2.3.1 Nearest neighbor index analysis

The nearest neighbor index is a geographical indicator that describes the degree of spatial proximity of point geographical objects to each other by using the ratio of the actual nearest distance to the theoretical nearest distance [40], the calculation formula is:

$$N = \frac{\overline{R}_1}{\overline{R}_2} = \frac{2\sqrt{n/A}}{n}\sum_{i=1}^{n} R_i$$

Equation 1

Where N is the nearest neighbor ratio, $\overline{R}_1$ is the actual nearest distance, $\overline{R}_2$ is the theoretical nearest distance. n is the number of points; R_i is the distance from i to its nearest point; A is the whole area of Chengdu. When $N = 1$, the points are randomly distributed. When $N < 1$, the points are clustered. When $N > 1$, the points are uniformly distributed.

Table 1: Classification and number of the architectural heritage in Chengdu

Types	**Amount**	**Percentage /%**
Ancient sites	33	10.71
Ancient tombs	19	6.17
Ancient buildings	140	45.45
Grotto temples and stone carvings	21	6.82
Important historical sites and representative buildings in modern times	88	28.57
Others	7	2.27

2.3.2 Coefficient of variation analysis

The coefficient of variation is used to analyze the degree of data dispersion and to test for the type of spatial distribution. The calculation formula is as follows:

$$CV(\%) = \left(\sigma / s\right) \times 100$$

Equation 2

Where σ is the standard deviation of the Thiessen polygon area, and s is the average value of the thiessen polygon area. When $CV \leq 33\%$, the point set tends to uniform distribution. When $33\% < CV < 64\%$, the point set tends to be randomly distributed. When $CV \geq 64\%$, the point set tends to cluster distribution [41].

2.3.3 Kernel density estimation

Kernel density estimation is a non-parametric method used to estimate the probability density function. The core idea is to simulate the distribution of spatial point data continuously, and reflect the distribution of spatial midpoints with the kernel density value and is widely used in the detection and research of urban spatial hotspots [42], as shown in the formula:

$$f(x) = \frac{1}{nh} \sum_{i=1}^{n} k\left(\frac{x - x_i}{h}\right)$$

Equation 3

Where $k\left(\frac{x - x_i}{h}\right)$ is the kernel function; h is the threshold radius; n is the number of points within the threshold; $(x - x_i)$ is the distance at the point event.

2.3.4 Space syntax

Space syntax, as one of the accessibility research methods, is mainly applied in the research of urban road networks and urban rail transit [43] [44]. A series of morphological analysis variables based on topological calculation can be derived from the spatial topology analysis of each road network through the axis method. The primary variables have connectivity value, control value, depth value, and integration value. In this study, variables including connectivity value, control value, mean depth value, and global integration value are selected, as shown in the formula:

$$C_i = k$$

Equation 4

Where C_i is the number of spaces attached to the i th space. The higher C_i value indicates the higher spatial permeability.

$$ctrl_i = \sum_{j=1}^{k} \frac{1}{C_i}$$

Equation 5

Where k is the number of nodes connected to the i th node, and $ctrl_i$ represents the degree of control a space over the space intersected with it.

$$MD_i = \frac{\sum_{j=1}^{n} d_{ij}}{n-1}$$

Equation 6

Where n is the sum of the connection points, d_{ij} is the shortest distance between any two points i and j on the connection graph, and MD_i represents the average minimum number of connections needed to travel from one space to another in the system.

$$I_i = \frac{2\left\{n\left[\log_2\left(\frac{n+2}{3}\right) - 1\right] + 1\right\}}{(n-1)(n-2)}$$

Equation 7

Where I_i is the degree to which a space in the system is clustered or discrete with all other spaces. The higher the I_i value, the higher the integration, and the higher the accessibility.

3. Analysis of the Spatial Pattern of Architectural Heritage

3.1 Spatial Distribution Types of Architectural Heritage

Based on the spatial distribution of architectural heritage in Chengdu, the spatial distribution status of architectural heritage was analyzed by the nearest neighbor index method using ArcGIS software. The results showed four spatial distribution types of significant agglomeration, insignificant agglomeration, significant uniformity, and insignificant uniformity, to determine the spatial distribution type of architectural heritage. The results show (Table 2) that the N of the nearest neighbor index of architectural heritage is 0.531, the Z is -15.74, and the P is 0.00, showing a spatially significant agglomeration distribution trend. In order to verify the accuracy of the results, the overall spatial distribution characteristics of architectural heritage in Chengdu were further verified using the Voronoi polygon area coefficient of variation method. The results showed that the CV of architectural heritage was 1.56. With reference to the findings of Duyckaerts [41], the coefficient of variation was greater than 0.64, which belonged to the strong variation type, and verified the results of the nearest neighbor index of architectural heritage, indicating that in general, architectural heritage showed a significant clustering trend in spatial layout.

3.2 Spatial Distribution Characteristics of Architectural Heritage

Architectural heritage is clustered from a general point of view. Next, the spatial structure of architectural heritage in Chengdu is further explored, and the spatial distribution characteristics of manifesting point-like geographical phenomena are more intuitively seen. The kernel density calculation was carried out using ArcGIS with the point data of Chengdu municipal-level and above cultural relic protection units, and the kernel density distribution map of each type of architectural heritage in Chengdu was obtained, as shown in Figure 1. The overall distribution type of architectural heritage resources in Chengdu is group-like, forming a high-density circle with the central urban area, namely Jinjiang District, Qingyang District, Jinniu District, Wuhou District, and Chenghua District, as the core. The other areas sharply contrast to the high-density central urban area due to the low density of architectural heritage. The distribution pattern of central concentration-periphery dispersion is formed in the whole study area, and the density of architectural heritage decreases from the urban center to the periphery, with an uneven spatial layout pattern. The ancient buildings are distributed in bands and clusters, with the central urban area as the core of the cluster-like high-density circle radiating the surrounding areas and the secondary Dujiangyan City and Chongzhou City as the core of the band area. Qionglai City and Qingbaijiang District also have a small number of ancient buildings distribution. The rest of the region is a very low density of ancient buildings. Ancient sites, ancient tombs, important historical sites and representative buildings in modern times, and other architectural heritage are distributed in clusters, with the density circle centered on the urban area. Grotto temples and stone carvings are mainly distributed in the southwest of Chengdu, with a few in the city’s eastern part.

3.3 Transportation Accessibility of Architectural Heritage

Traffic mileage reflects the ability of traffic accessibility to a certain extent. Geospatial data of railroads, major roads, expressways, and subways are overlaid with architectural heritage, and the near analysis tool is applied to obtain the distance between architectural heritage and traffic. A score is assigned according to the distance value. The spatial syntactic variables of railroads, major roads, expressways, and subways were then analyzed and scored according to the values of the variables. The distance value score and the syntactic variable value score each account for half of the total score, resulting in a total score that leads to the classification of the accessibility index.

3.3.1 Transportation accessibility based on railroad network

Rail transportation or travel has been the preferred mode for medium- and long-distance travel. Its low price, convenient route, and fast characteristics have made railroads a significant contributor to tourism development [45]. In accessibility studies, railroads are regarded as a critical element of transportation network research while tourism development. The relationship between the architectural heritage and railroad distribution in Chengdu is shown in Figure 2. The regional structure of the dense railroad layout in Chengdu varies widely, with the network scale relatively saturated in the central and eastern regions and relatively lacking in the western region. The minimum value of the distance between architectural heritage and the railroad is 13.44m, and the maximum value is 32,680.84m. The spatial syntactic analysis of the variables of the railroad network in Chengdu is shown in Figure 3. The railroad cluster in the central city becomes a very striking area of high integration. However, the lowest value is only 0.06, which is very different from the highest value. The control and connection values of railroads are relatively average due to the difference in the layout of the east-west areas of the railroad network, the peripheral areas have higher values of railroad depth, with a maximum value of 132.15. In contrast, the depth value of the central city, where the railroad is very dense, is only 24.26, and the traffic influence of the central city spreads to all areas of the city.

Table 2: Statistical result of nearest neighbor index and coefficient of variation

Nearest neighbor index	P-value	Z-score	N
	0.00	-15.74	0.53
Coefficient of variation	Standard deviation /m^2	Average /m^2	CV
	73.21	47.02	1.56

Figure 1: (a) Kernel density of totality; (b) Kernel density of ancient sites; (c) Kernel density of ancient tombs; (d) Kernel density of ancient buildings; (e) Kernel density of grotto temples and stone carvings; (f) Kernel density of important historical sites and representative buildings in modern times; (g) Kernel density of others

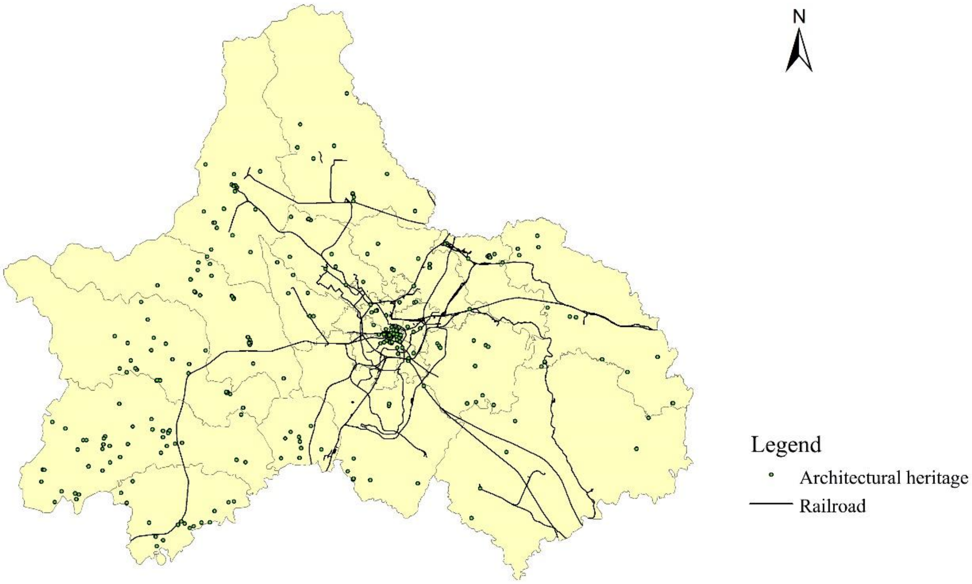

Figure 2: Relationship between architectural heritage and railroad distribution

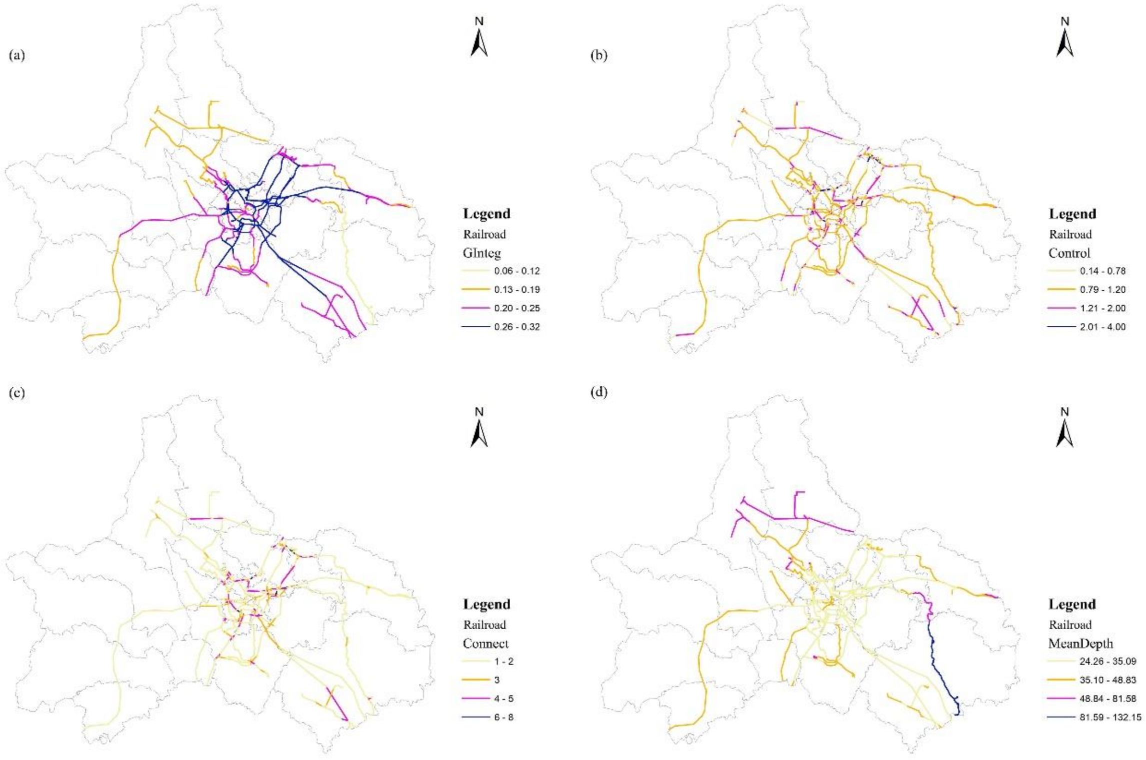

Figure 3: (a) Global integration of railroad network; (b) Control of railroad network; (c) Connectivity of railroad network; (d) Mean depth of railroad network

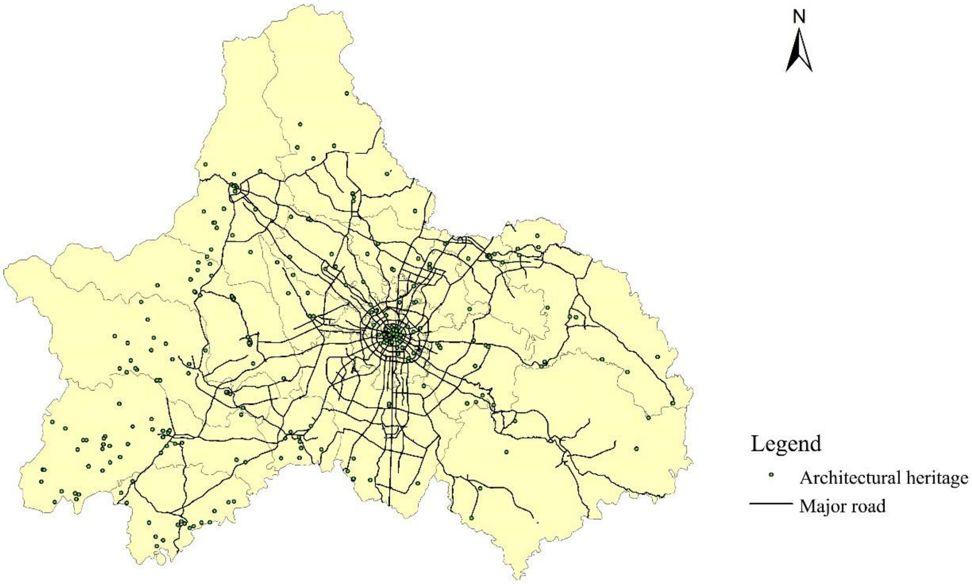

Figure 4: Relationship between architectural heritage and major road distribution

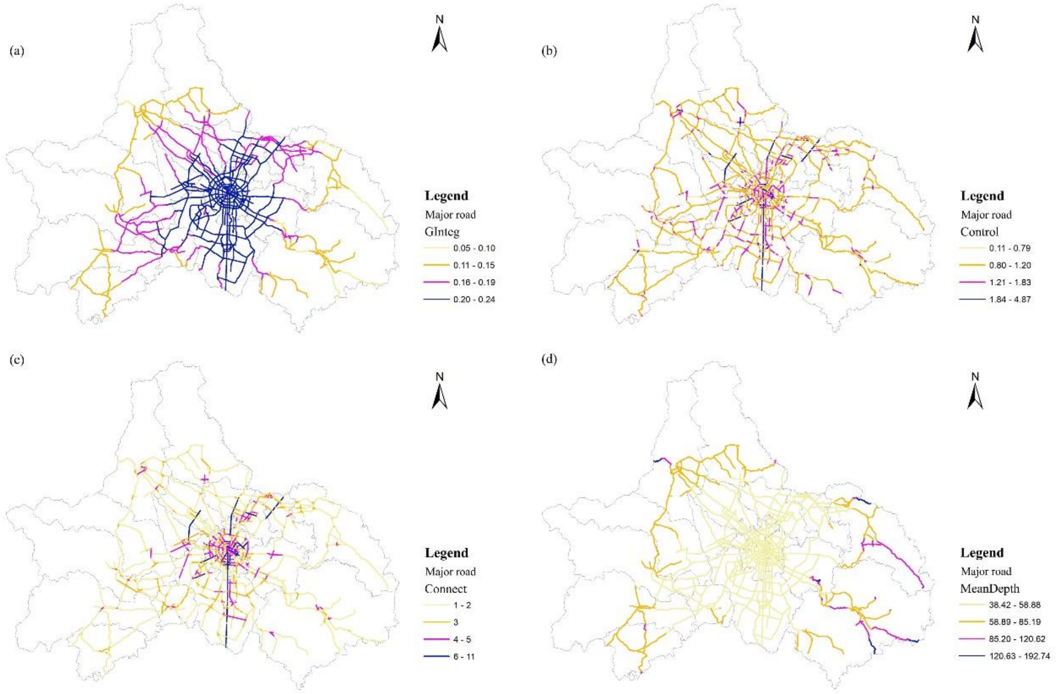

Figure 5: (a) Global integration of major road network; (b) Control of major road network; (c) Connectivity of major road network; (d) Mean depth of major road network

3.3.2 Transportation accessibility based on the major road network

The tourism industry is a highly interrelated and integrated industry, and road traffic is an important thrust in the evolution of the tourism economic pattern and a measure of the degree of development of the regional tourism economy [46]. In this study, the major road was selected for the near analysis (Figure 4). The minimum value of the distance between architectural heritage and major roads is 0.80m, and the maximum value is 26390.28m. The syntactic variables of the major roads are shown in Figure 5. Both the control and connection values of the road network show slight variation across the city as a whole. The majority of the control values of the road network are 0.80-1.83, and very few of them are above 2. The connection values are basically 1-3, with a maximum value of 11, but their distribution is scarce. The road integration in the central city is significantly better than in the rest of the city, forming a striking blue area with a maximum value of 0.24 and a minimum value of 0.05. The depth and integration of the road network are reversed, with a minimum value of 38.42 in the central area and a maximum value of 192.74 in the peripheral areas where the road network is sparse.

3.3.3 Transportation accessibility based on the expressway network

The relationship between architectural heritage and expressway distribution in Chengdu is shown in Figure 6. The minimum distance between architectural heritage and expressway is 28.46m, and the maximum is 24354.36m. The results of the spatial syntactic analysis of expressways are shown in Figure 7, where the construction of expressways in the central city contrasts with that in the surrounding areas. In terms of integration, the expressways in the central city are highly concentrated, forming a through-ring highlighting area, while the surrounding areas are relatively sparse. The overall control values are good, with many expressways from 0.84 to 1.17, with a maximum value of 2.67. This indicates that the architectural heritage of the central city has excellent accessibility; however, grotto temples and stone carvings are relatively distant from the central city and perform relatively poorly in terms of expressways. In terms of connection values, many expressway connection values are 2, with a maximum value of 4. In terms of depth values, the central area outperforms the surrounding areas. However, the maximum value is still located in the surrounding areas, confirming the transportation advantage of architectural heritage in central urban areas.

3.3.4 Transportation accessibility based on subway network

With the introduction of green mobility, the subway network has impacted the accessibility of architectural heritage. The relationship between architectural heritage and subway distribution is shown in Figure 8. The minimum distance between architectural heritage and subway is 0.04m, and the maximum value is 64627.15m. The results of the spatial syntactic analysis of the subway are shown in Figure 9. The subway network is distributed in the central urban areas and the surrounding areas immediately adjacent to the central urban areas, and both the control and connection values of the subway network show slight overall variation.

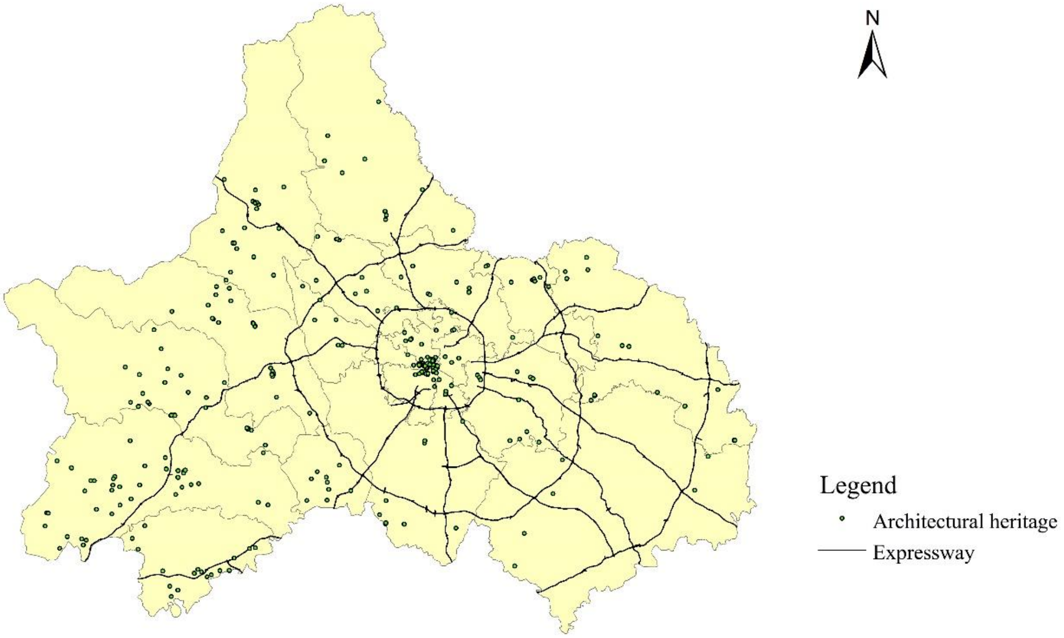

Figure 6: Relationship between architectural heritage and expressway distribution

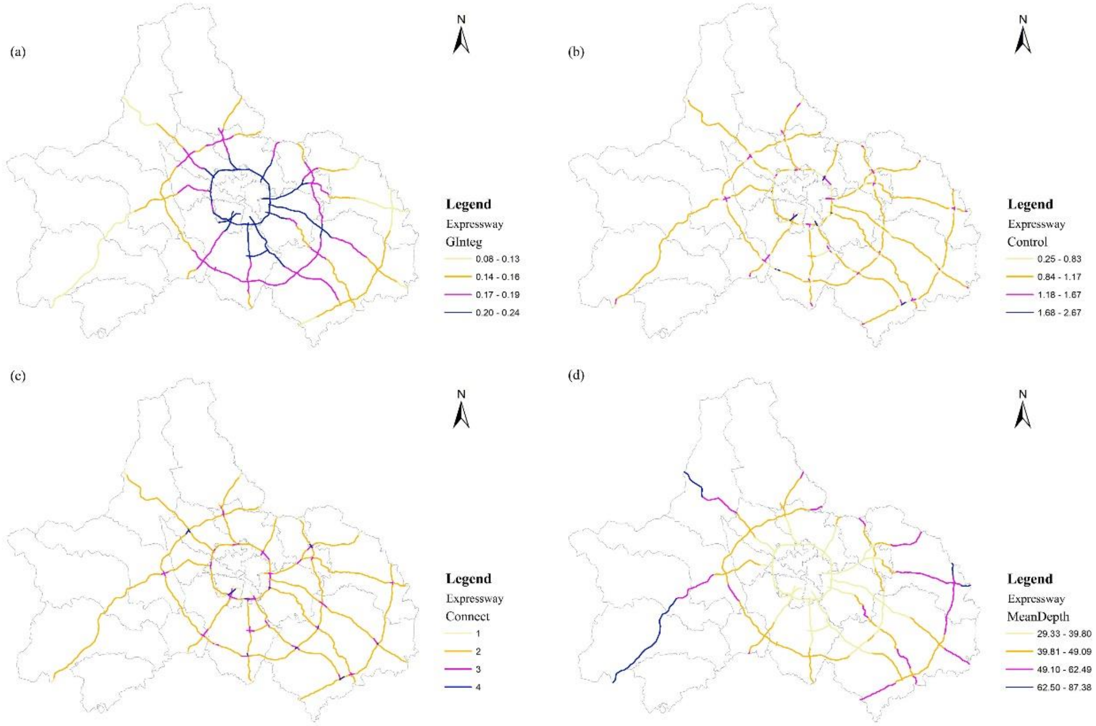

Figure 7: (a) Global integration of expressway network; (b) Control of expressway network; (c) Connectivity of expressway network; (d) Mean depth of expressway network

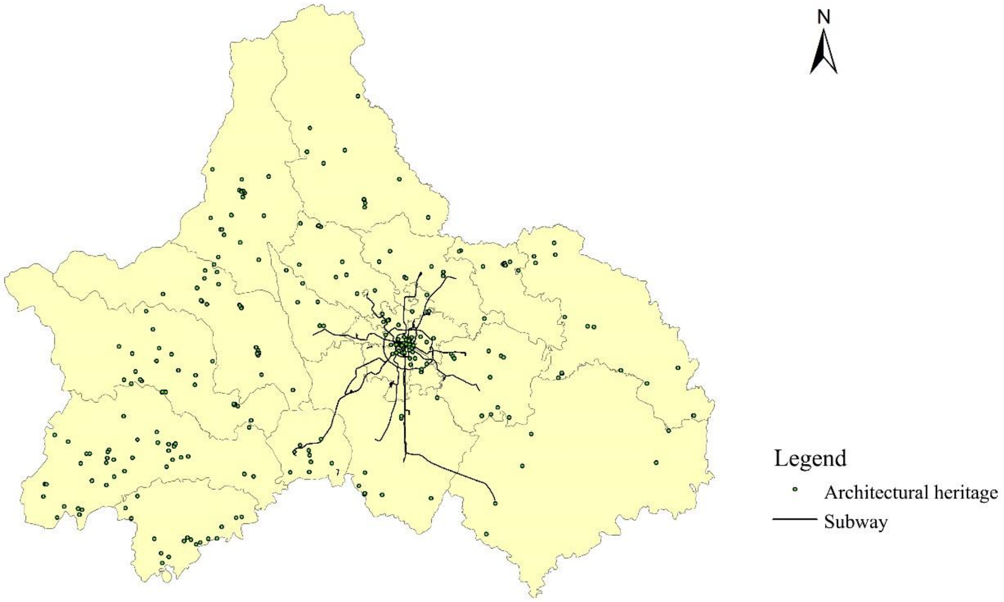

Figure 8: Relationship between architectural heritage and subway distribution

Most of the control values of the subway network are 0.76-1.08, while the connection values are basically 2, with a maximum value of 5, but their distribution is relatively small. The closer to the center, the better the subway integration is, forming a striking blue area with a maximum value of 0.44 and a minimum value of 0.12. The opposite is true for the depth and integration of the subway network, with a minimum value of 14.82, which is located in the center. The higher the value, the farther it is from the central urban areas.

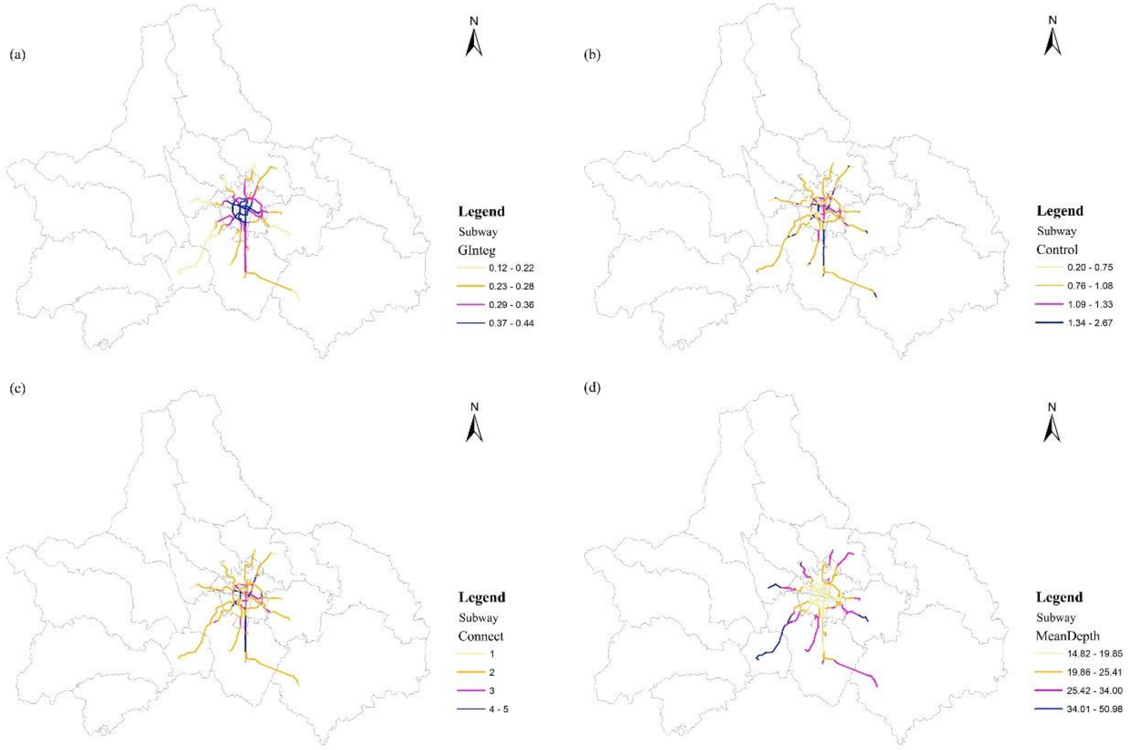

Figure 9: (a) Global integration of subway network; (b) Control of subway network; (c) Connectivity of subway network; (d) Mean depth of subway network

3.3.5 Classification of transportation accessibility

According to the near analysis and syntactic analysis of the above types of traffic, the architectural heritage is divided into four classes according to the traffic index. According to the distance of each type of road network, more than 15,000m is recorded as 1 point, 10,000-15,000m as 2 points, 5,000-10,000m as 3 points, and less than 5,000m as 4 points. The mean depth value and the global integration are inversely proportional to each other, and one indicator can be selected. Since this paper studies the accessibility of city-wide traffic, the control value reflects the degree of local control, so the eight indicators of global integration and connection value of railroads, major roads, expressways, and subways are selected. The integration of the railroad is 1 point below 0.12, 2 points from 0.13 to 0.19, 3 points from 0.20 to 0.25, and 4 points over 0.26. The connection value is 1 point below 2, 2 points for 3, 3 points from 4 to 5, and 4 points over 6. The major road integration is 1 point below 0.10, 2 points for 0.11-0.15, 3 points for 0.16-0.19, and 4 points for more than 0.20; the connection value is 1 point below 2, 2 points for 3, 3 points for 4-5, and 4 points for more than 6. Expressway integration is 1 point below 0.13, 0.14-0.16 is 2 points, 0.17-0.19 is 3 points, over 0.20 is 4 points; connection value is graded according to 1, 2, 3, and 4 and scored 1, 2, 3, and 4 points, respectively. Subway integration was graded according to 0.22, 0.28, 0.36, and 0.44 and scored 1, 2, 3, and 4 points, respectively, while connection values were graded according to 1, 2, 3, and 5 and scored 1, 2, 3, and 4 points, respectively. The scores of near analysis and syntactic variables each accounted for 50% of the total score of 7.5-20.5, divided into 4 grades, and the final results are shown in Figure 10.

The accessibility of architectural heritage distributed in the central urban area, which is the transportation center of Chengdu, leads the city, and the accessibility of architectural heritage in the multi-center urban area, such as Du fu thatched and Wangjianglou ancient architectural complex, is most prominent. The traffic network in the central city of Chengdu is dense, with various modes of transportation, and each type of architectural heritage is close to each other, for example, Jiulidi and Wang Jian's tomb are located in the same district, and the clusters of each type of architectural heritage are in good condition, and the transportation accessibility index of architectural heritage in the central city is high.

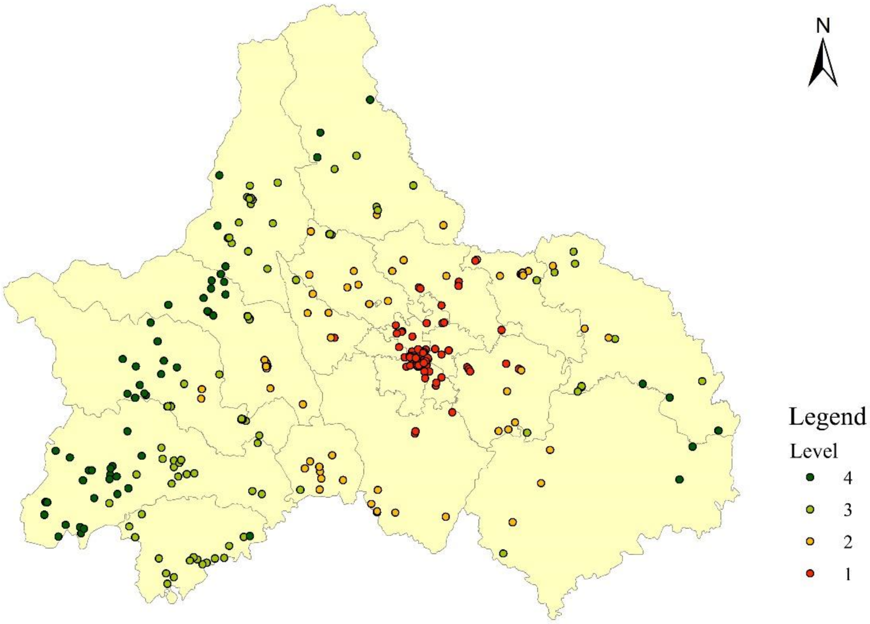

Figure 10: Classification of architectural heritage transportation accessibility index

The cave temples and stone carvings such as the cliff statues of Sanfodong cave and Pujiang grottoes are mostly located in the western region where the transportation network is relatively sparse, and the locations of the heritage projects are far apart, with the transportation index mostly located at the third or fourth level. It is evident that the accessibility is related to the local economic development and also has an important impact on the development of local heritage tourism.

The study’s findings reflect the spatial distribution pattern of architectural heritage in Chengdu. The clustered distribution pattern of architectural heritage in Chengdu favors the area conservation of architectural heritage and the development of a unified conservation plan. In addition, the dense areas of architectural heritage distribution are areas with high accessibility, high level of economic and social development, and profound cultural heritage. This study analyzes the spatial distribution characteristics of architectural heritage in Chengdu from a macroscopic perspective. It strengthens the comprehensive study of architectural heritage, which makes the study’s findings enlightening for the conservation and development of architectural heritage in different regions.

4. Discussion

Architectural heritage is distributed in clusters and unevenly, so transportation has an important influence on the development of architectural heritage. A wide variety of transportation provides people with more convenient tools to go out and travel, and transportation plays a vital role in tourism activities. The analysis of the accessibility of architectural heritage can promote the development of heritage tourism because of the following three main aspects:

(1) Transportation accessibility is an important factor in destination selection for travelers during the travel decision phase. In general, more remote areas often require significant investment in time, money, and physical effort to overcome this transportation inconvenience. This makes transportation a critical factor in determining travelers' travel decisions.

(2) The convenience and speed of transportation significantly impact on tourist satisfaction. Transportation is a carrier of several influences on tourism quality, such as string environment and behavior. It is an important link for tourists, so the improvement of transportation can significantly increase tourist satisfaction.

(3) The impact of traffic on the development of tourism resources. Traffic, to a certain extent, affects the strength of the attractiveness of tourism resources, the lack of sound transportation infrastructure means that tourists cannot quickly and smoothly reach the destination to carry out tourism activities and the attractiveness of tourism resources

is challenging to play, the tourism industry and potential advantages will not be able to expand. Therefore, transportation is a critical factor in the development of tourism resources.

5. Conclusion

Spatial analysis was used in this paper to analyze and explore the spatial pattern, and transportation accessibility of architectural heritage in Chengdu, based on the 308 national, provincial and municipal cultural relic protection units announced so far in Chengdu as the object of architectural heritage research, and the following conclusions to be obtained:

(1) In terms of space, the spatial distribution of each type of architectural heritage is characterized by clusters, and the differences in their regional distribution are pronounced. The primary manifestation is that there are more central urban areas but fewer peripheral areas, forming a high-density area with Jinjiang District, Qingyang District, Jinniu District, Wuhou District, and Chenghua District as the core. In terms of types, ancient buildings dominate, and most of the grotto temples and stone carvings are located in the southwest of the city; ancient sites, ancient tombs, ancient buildings, important historical sites and representative buildings in modern times and other architectural heritage are concentrated in the area with the central urban area as the core.

(2) In terms of traffic accessibility, the central urban area has a wide variety of road networks with high integration, control, and connection values. In contrast, the road networks in the peripheral areas are relatively sparse, with higher depth values for each type of road networks and significantly weaker accessibility than the central city. The traffic access index shows that the architectural heritage located in the central urban area with a dense road network is mostly in the first and second ranks, while the traffic access index of the architectural heritage in the peripheral areas is in the lower rank.

The architectural heritage in Chengdu is assessed by focusing more on the heritage itself. There are significant differences between the various categories of architectural heritage in terms of tourism planning, tourism resources, and transportation conditions. The investigation of the spatial-geographical characteristics of architectural heritage in macro-spatial patterns will be beneficial for the comprehensive implementation of heritage tourism planning in Chengdu, the development of the advantageous and disadvantaged areas before the drive, and the preservation of the originality of heritage culture.

This study applied Geographic Information System (GIS) to analyze architectural heritage conservation. GIS has outstanding geospatial information processing, event interpretation, outcome prediction, and strategy planning. GIS can play an essential role in architectural heritage conservation research. Applying GIS to the morphological study of architectural heritage is possible and essential. The morphological database of architectural heritage is established using GIS spatial database technology in response to the demands of morphological research. The storage and management of characteristic morphological data of architectural heritage are scientifically realized to serve as a foundation and guide for morphological research. Heritage data can also be maintained scientifically and used more effectively with GIS. It not only supports heritage conservation but also gives academics a place to conduct a study in subjects linked to architecture, cultural geography, settlement geography, sociology, history, and other related fields.

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