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Analysis of Spatial-Temporal Accessibility in Huizhou West Lake Scenic Spot Using Big Data for Smart City

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Abstract

This study aims to propose a new concept schema for implementing smart cities and big data applications by analyzing the spatial-temporal accessibility of various traffic modes. Which study area is Huizhou West Lake’s Scenic Area, and the purpose is as the basis for the government decision support. The results show that the average driving time is 25 minutes and 28 minutes in the off-peak and peak hours, and 10% and 8% of the area can reach the scenic spot within 15 minutes. There is no difference obviously between the off-peak hours and peak periods of cycling to travel. The average time is about 41 minutes, and about 30% of the area can reach the scenic spot in 30 minutes. Overall, the analysis indicates West Lake’s Scenic Area has a better regional transportation system and accessibility. Tourists can arrive at West Lake’s Scenic Area by taxi/online car from the primary transfer stations nearby in about 30 minutes. Due to the many residential, commercial, and public stations around the scenic area, citizens can have a good sense of experience when traveling by bike.

Keywords: Big Data; Spatial-Temporal Analysis; Traffic Accessibility; Inverse Distance Weight (IDW); Smart City

1. INTRODUCTION

In the context of urban development in the new century and era, the concept, technology, and infrastructure of smart cities are in full swing. It is the current and future trend to provide comprehensive application capabilities in urban governance, emergency management, public transport, ecological protection, infrastructure governance, urban services, and other aspects in combination with the development of the Internet of Things (IoT), big data, and the metaverse. Its critical benefits are usually shown in that through the real-time collection, monitoring, governance, and analysis of the overall urban operation data, it can fully perceive the vital signs of the city, assist in macro decision-making and command, predict and early warning of major events, allocate and optimize public resources, ensure the safe and orderly operation of the city, and support the government’s digital transformation, for developing the social, and economic.

Under the trend of smart and intelligent development, the wave of smart city construction has laid a solid foundation for green traveling of people and low-carbon living with new infrastructure such as big data centers and urban static transportation. Urban governance with the urban brain as the core will comprehensively improve the livability, employability, and mobility of the city, and improve people's happiness and satisfaction. The continued, long-term operation data will inject a constant stream of energy into the digital transformation of economic society and ultimately benefit the people. With the development of network technology and the improvement of the infrastructure of the IoT, research on the accessibility of urban transportation with big data as the core has become the focus of people's attention. Because whether the traffic is smooth or not involves the perception of residents and non-local residents coming to this activity, affects the psychological, economic, livable, and other aspects of urban development, and is also one of the indicators of comprehensive urban governance.

Traffic accessibility research was proposed firstly by Hansen (1959). Its primary definition is the ease of moving from one place to another, which is significant to regional economic development. Since then, traffic accessibility research has been widely used in various fields of geography as urban planning, traffic planning, landscape planning, location analysis, and location evaluation, and has become a research boom in many academic realms. In recent years, many scholars in China have carried out relevant traffic accessibility research. For example, some scholars have summarized several main spatial distribution characteristics of tourist attractions above the 3A level in China; or used the Gini coefficient, kernel density analysis, and accessibility model to analyze the aggregation and road network density of 4A tourist attractions in the Pearl River Delta (Li et al., 2018; Li et al., 2020). In addition, applying big data to analyze the urban traffic, analyzed the accessibility of Wuhan's external traffic, and the strength of regional links from a macro perspective. Analyze the structure of the urban traffic circle from the meso perspective, and analyze the characteristics of commute between work and residence from the micro viewpoint (Luo et al., 2020). The static traffic data also applies to delimiting isochronous zones for scenic spots, conducting space-time analysis, and verifying the analysis results with the kappa coefficient (Liu et al., 2022). Analyze and clarify the relevant concepts of accessibility, and explore the spatial pattern and accessibility of scenic spots (Deng, 2016).

In short, various forms of traffic accessibility research and big data applications have been proposed in recent years. However, there are generally the following deficiencies. At first, the research data mostly used static data for building research models, so using real-time dynamic data is relatively deficient. Due to the complexity and diversity of urban traffic system conditions, thus the use of real-time dynamic travel data is more practical and authentic for traffic planning and construction. Second, the research objects are almost at the macro level, and the practical applicability is poor. Therefore, it is not easy to provide supporting data and make ancillary decisions for the city’s traffic planning and improving the service scope of a scenic spot.

The measurement of spatial-temporal accessibility can effectively and accurately reflect the spatiotemporal characteristics of individual travel (Tong et al., 2022). By the application theory of big data, this study uses Python programming to collect the travel time data on Gaode API, then carries out data cleaning, and uses the Inverse Distance Weight (IDW) of the spatial analysis tool of ArcGIS to calculate the spatial accessibility. Its characteristic is the immediacy and timeliness of big data, which aims to provide scientific references for Huizhou West Lake’s scenic spot. It also can improve the service scope for planning and constructing relevant traffic networks.

2. STUDY AREAS

West Lake’s Scenic Spot is a famous 5A tourist attraction in Guangdong Province, which is located in the Huicheng District of Huizhou and has a total area of 20.91 square kilometers and a history of more than 1600 years. The scenic spot is dominated by natural landscape types, with more than 10,000 rare animals and plants and high appreciation value. In addition, there are also numerous historical and cultural relics in scenic spots. Such as Dongpo Su, a famous poet who lived here once, and has been leaving behind a thousand years of glory, thus is become the focal image to attract tourists. Huizhou West Lake has always adhered to the specific characteristic tour of combining ecological and environmental protection with human history. It has also Insist in creating landscape gardens, diverse ecosystems, and urban mosaic landscape patterns that improved the urban environment and provided a comfortable leisure and living environment for citizens and tourists. Huizhou will also take this opportunity to make every effort to build a first-class nationwide tourism destination, and become a dazzling pearl in the Great Bay Area of Guangdong Harbour.

Thus, Huizhou West Lake Scenic Spot not only can attract a large number of tourists from around or outside to come here for leisure or tourism every year but also can bring immeasurable social and economic value to the development of Huizhou City. For example, during the Spring Festival in 2021, the number of reserved tourists in the scenic spot ranks second in the province (Huizhou Municipal People's Government, 2021), which brings not only economic benefits but also significant benefits in cultural publicity, urban transportation, ecological protection, and other aspects.

Overall, Huizhou West Lake’s Scenic Spot is of great research value. Therefore, this study is based on the background of smart city development, combined with big data analysis and GIS application, and other relevant theories, to analyze the space-time accessibility of transportation in the study area. The accessibility of scenic spots directly affects the willingness of citizens to arrive, so it is of great value and practical significance to analyze the space-time accessibility of scenic spots under various modes of transportation and observe the convenience of arriving at the scenic spots through different modes of transportation during normal and peak hours. Meanwhile, this can provide great valuable information for promoting the development of urban tourist attractions and improving the relevant road network traffic planning.

The study area designated is enclosed by Guangzhou-Longzhou Expressway, Guangzhou-Huizhou Expressway, Jizhou-Guangzhou Expressway, and Huizhou-Dalian Expressway in Huicheng District. This area is the main gathering of Huizhou's economy, transportation, culture, science and technology, tourism resources, etc. It mainly includes Jiangbei Street, Jiangnan Street, Qiaodong Street, Qiaoxi Street, Henan Street, and Shuikou Street. Huizhou West Lake’s Scenic Spot is located on Qiaoxi Street, which is in the southwest of the study area (shown in Figure 1).

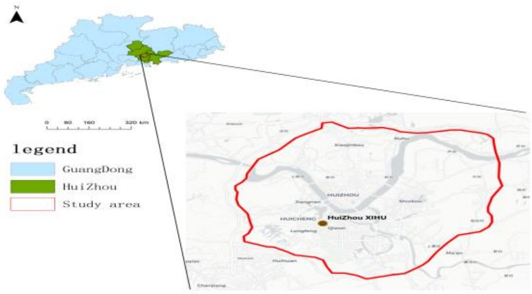

Figure 1 the location of the study area in Huizhou, Guangdong.

3. LITERATURE REVIEW

3.1. Conceptual model

The combination of "smart cities" and "big data" makes transportation a key driving force for human productivity, leisure activities, and economic development. It provides more effective ways of connecting people and urban systems and further promotes plans aimed at improving traffic and road safety, reducing urban traffic congestion, and eliminating harmful emissions. The most cutting-edge plan for the future encourages citizens to adopt alternative, climate-friendly, and more active modes of travel, such as walking and cycling. From the overall point of view, the effective operation of urban transportation also represents the economic development of sustainable urban development, leisure and livability, business and transportation, and low-carbon ecology. Therefore, the purpose of this study is to use the perspective of the combination of "big data", "smart city" and "transportation accessibility" to understand the flow mechanism of the urban transportation system as a whole, thereby serving as the basis for planning and decision-making (show as Figure 2).

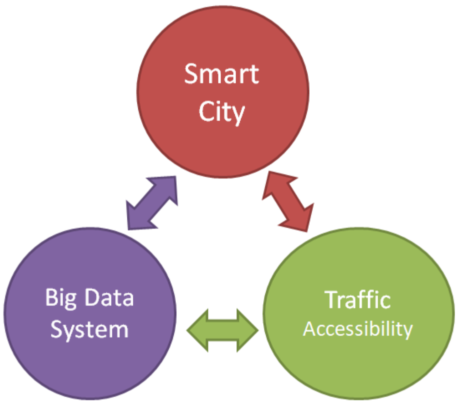

Figure 2 Conceptual model

3.2. Smart City

The concept of the "smart city" has become a prominent factor in urban sustainable development. It is a compilation of urban planning strategies, including efficient allocation of resources, speed of policy implementation, seamless communication, and a series of environmental benefits. The new application of the IoT has enabled smart cities to be put into practice worldwide. Its primary forms include enabling cities to remotely monitor, control and manage urban facilities and equipment, and to dig new insights and operational information from quantitative real-time data streams. The IoT has potential significance in the overall development of smart cities, especially in enhancing urban connectivity. These IoT devices include smart sensors, actuators, monitoring devices, and Artificial Intelligence (AI) projects. Through these facilities, cities can significantly improve their accessibility and mobility, promote social inclusion, and improve energy efficiency to achieve the goal of sustainable development.

Mobility is the heartbeat of the city. Intelligent city transportation and transportation networks have become the focus of many intelligent city initiatives, and related concepts include multimodal transport, intelligent parking, and intelligent traffic lights. This approach is based on a rethinking of the transportation infrastructure used in daily life, including not only traditional cars, electric vehicles, and public transport, but also new and innovative forms of transportation, such as on-demand carpool services (e.g. Uber and Didi) and car-sharing plans. Through these plans, the accessibility and livability of the city can be further determined.

A complex traffic network includes a combination of many systems, such as a highway monitoring and consultation system, green road determination system, intersection electronic eye, traffic scanning, parking guidance system, electronic road toll collection, intelligent bus stop, etc. The task of the transportation system is to use the latest Intelligent Traffic System (ITS) projects and transportation technology breakthroughs to optimize the transportation network, and improve the commuter travel experience. Based on this, this study explores the analysis mode and feasibility of smart city construction with the analysis support of real-time dynamic big data provided by Gaode API (Application Programming Interface).

3.3. Transportation big data application

With the rapid growth of the number of motor vehicles in cities, a series of problems of traffic congestion and traffic pollution have become significant issues restricting urban development. Constructing the city's slow-moving systems as bicycles and electric bicycle lanes can solve the above problems effectively. Especially in the current wave of digitalization and the IoT, it is also a critical part of building the smart city for taking good planning by using big data technology to meet and serve the smooth needs of citizens.

Urban development has entered the era of big data. The geospatial attributes carried by big data undoubtedly provide new opportunities for urban traffic planning, especially for smooth and efficient urban traffic planning. For example, a series of information on terminal devices, such as the real-time positioning system of smartphones; sensors, and cameras hanging on walking and cycling traffic arteries, can capture a large amount of data. Through in-depth mining of these data, combined with GIS technology, which can more clearly understand and observe the development, role, and change process of human elements, promote the transformation of traditional urban space and place research theories to people, activities, space, and their relationships, and promote the people-oriented intelligent city construction. That also lays the foundation for the green, low-carbon, and sustainable development of urban road traffic. In the face of all kinds of transportation planning big data in smart cities, we can give full play to the advantages of cloud computing, focus on the research of urban public transport and smooth traffic data, mining theories, effectively store and manage big data, give full play to the value of big data, and make the urban transportation system truly reach the intelligent state.

The big data of travel used in this paper comes from the real-time navigation data of the Gaode map. Firstly, the data advantage lies in a large amount of data and the processing capacity. The server has collected exceed 100 billion location services and processed hundreds of billions of requests for location and path planning daily, with highly real-time dynamics. Now, it has achieved the minute-level update of domestic POI (Point of Interest) point data (Huang et al., 2018). Secondly, the products of the Gaode series have a huge user base, which also means that the background of the database has a large amount of LBS (Location Based Services) data/mobile phone signaling data. Every user who applies the navigation service in the city will generate a distance information data parameter with OD (Origin-Destination) points. In short, Gaode API data has high authenticity, high accuracy, and better reliability data parameters are easy to collect and use.

3.4. Traffic accessibility analysis

Traffic accessibility analyzes whether people can easily reach their work units, service institutions, and destination and how much time and cost it takes to reach a specific place by bus. Accessibility is affected by travel time, travel cost, location of the destination, and service facilities. Meanwhile, it is also related to people understanding of services and facilities, willingness to choose a constant mode of travel, service providers, and institutions. The planning of accessibility is very significant. It should ensure that those who need to use public transport can easily reach their destination and facilitate tourism, rest, shopping, and various activities. The analysis process used in this paper (shown in Figure 3) is based on the application level of big data to analyze the traffic accessibility of Huizhou West Lake Scenic Area, which is real-time dynamic and can differentiate traffic accessibility during off-peak and peak hours.

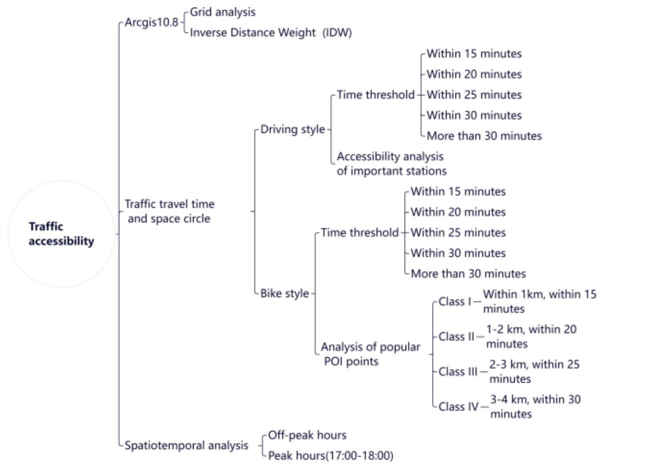

Figure 3 the flow trees of traffic accessibility analysis

4. METHODS

4.1. Vector data processing

In the analysis process of this study, firstly, the longitude and latitude of any location in the study area are obtained as the starting point, and using the grid analysis tool of ArcGIS 10.8 to segment the study area. After consideration of the road network density, the reliability of navigation data, and the purpose of this study, the study area is divided into several 500m × 500m grid cells (shown in Figure 4). The grid divided in the study area is applied to generate feature points, and these points of the river, mountain, and highway boundaries are eliminated. We sorted out at least 1237 feature points as the base materials for the accessibility study. Then, using GIS to calculate the longitude and latitude coordinates of the feature points and convert from CGS1984 to the Amap coordinate system through the GIS projection toolbox as the preparation for data acquisition in the next step.

In addition, this paper also records four important transfer stations for passengers in the study area to enter Huizhou, namely Huizhou North High-speed Railway Station, Huizhou Station, Huizhou South Line Bus Station, and Huizhou Bus Passenger Station. These four POI points are recorded separately to observe the accessibility of important transfer stations in the area to West Lake's Scenic Area.

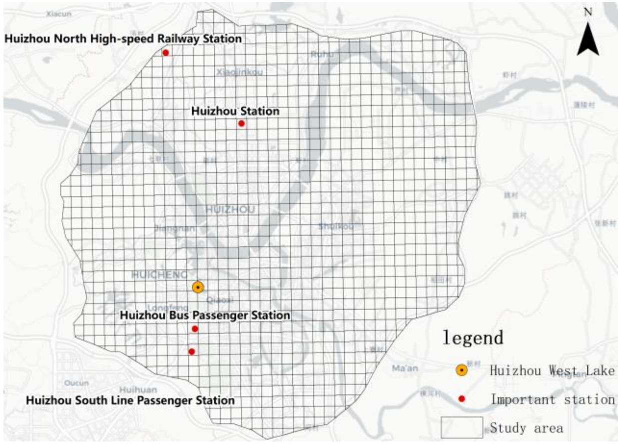

Figure 4 the Grid division of the study area

4.2. Capture and processing of traffic big data source

The analytical model used in this study can be roughly divided into four stages, namely data acquisition, data cleaning, spatial analysis, and traffic accessibility analysis (shown in Figure 5).

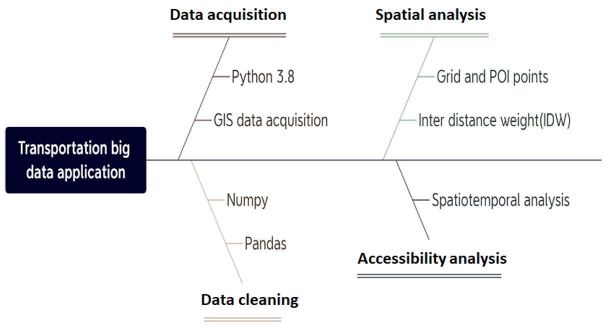

Figure 5 the flow tree of traffic big data application

Data Acquisition, The travel time data in this paper is accessed to the URL port of the open platform of the Gaode Map API through the Request function module of Python 3.8 to obtain real-time navigation travel time. This method can initiate route planning requests based on real-time road conditions and traffic modes. The generated 1237 feature point coordinates are written to the API port circularly, and the requests are sent to return the navigation data. The spatial data with time attribute is generated, that is, which are during off-peak hours and peak hours (17; 00-18:00). The URL port will finally return the JSON file data containing grid ID, travel time, travel distance, and other fields. The time of the planning request initiated by the Gaode API used in this study is 10:00 on December 30, 2022, and 17:00 on December 30, 2022. The acquisition process step is shown as Figure 6.

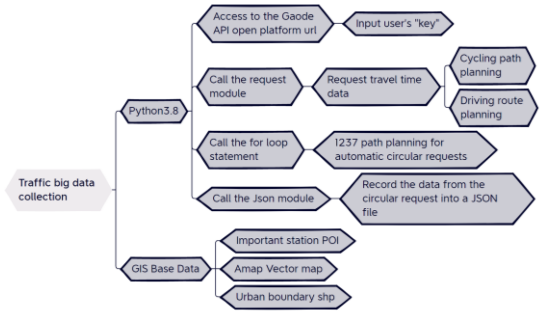

Figure 6 the flow chart of traffic big data collection

Data cleaning: since the data obtained from Python programming cannot apply for application analysis, we must conduct data cleaning at first, and the transit time data must be cleaned initially using Python's Pandas and Numpy tool libraries. Pandas and Numpy are powerful tools for Python to process data tables automatically. The Pandas are derived from the terms "panel data" and "Python data analysis" (Yu, 2022). The basis of its analysis of the structured data tool set is Numpy (providing high-performance matrix operations). Pandas can import data from various file formats, such as CSV, JSON, SQL, and Microsoft Excel.

Data cleaning process (shown in Figure 7), the first step is to convert the data format type from str type to float 64 types. The second step is to clear the unnecessary data fields and reduce the space and memory occupied by the file. The third step is to adjust the format of the field content, only retaining the fields that need to be used in the analysis. Finally, combine multiple data tables and output them as CSV files for the next step of application analysis (shown in Table 1).

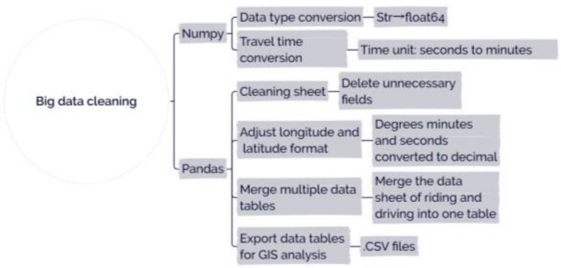

Figure 7 the flow trees of data cleaning

Table 1 list of travel time data after cleaning

Start longitude	Start latitude	Travel time/Min	Travel distance/M
114.446603	23.07875874	21.15	8491
114.413328	23.03308225	25.68	10532
114.4156997	23.16401156	25.88	12931
114.3491579	23.0726393	16.53	7984
114.4311998	23.1191304	22.63	7546
114.435649	23.14177034	25.15	9960
114.4790552	23.16955247	42.2	18070

4.3. Spatial accessibility analysis (IDW)

This study uses the cleaned travel time data to draw the accessibility space-time circle, mainly using the Inverse Distance Weight (IDW) method in the spatial analysis toolbox in ArcGIS 10.8, which is a common analysis method for spatial analysis of data with spatial information attributes. The IDW interpolation method assumes that each input point has a local influence, which decreases with the increase of distance. Their calculation steps such as follows: First, calculate the distance from unknown points to all points. Secondly, calculate the weight of each point; the weight is a function of the reciprocal of the distance. Its advantage is that the algorithm is simple, and all local geographic/terrain changes that may affect the GDD value and its "neighbors" can be ignored. Thirdly, scatter data can be faceted to study the relationship between the sampling point and the object.

In this paper, IDW is used to interpolate and calculate the travel time data into grid data, and the re-classification tool of the GIS toolbox is used to classify the travel time data according to a time threshold for color. Then, the spatial visualization method is used to analyze the space-time traffic accessibility from the study area to Huizhou West Lake’s Scenic Area. The calculation formula is as follows:

$$W_i = \frac{h_j^{-p}}{\sum_{j=1}^{n} h_j^{-p}} \quad \text{.................................(1)}$$

P is an arbitrary positive real number, usually p=2;

Hi is the distance from the discrete point to the interpolation point;

$$h_i = \sqrt{(x-x_i)^2 + (y-y_i)^2} \quad \text{……………………………(2)}$$

(x , y) is the interpolation point coordinate;

$(x_i\ ,\ y_i)$ is the discrete point coordinate;

$$W_i = \frac{[\frac{R-h}{Rh}]^2}{\sum_{j=1}^{n} [\frac{R-h}{Rh}]^2} \quad \text{.. (3)}$$

R is the distance from the interpolation point to the farthest scattered point;

N is the total number of discrete points.

5. ANALYSIS OF SPATIOTEMPORAL ACCESSIBILITY

5.1. Analysis of spatiotemporal accessibility of driving

According to the analysis of relevant data, local tourists can drive to Huizhou West Lake in the study area, which can be divided into 15, 20, 25, and 30 minutes, as well as more than 30 minutes of self-driving routes, respectively (Zhang et al., 2022; Jia et al. 2022). It is forming an obvious space-time circle structure, and the closer it is to the West Lake Scenic Spot, the shorter it takes (Shown in Figure 8 and 9).

During the non-peak period, the average time to reach West Lake’s scenic spot is about 27 minutes, in addition about 10% of the area can be reached in 15 minutes, 16% of the area can be reached in 20 minutes, 22% of the area can be reached in 25 minutes, 19% of the area can be reached in 30 minutes, and 33% of the area can be reached in more than 30 minutes. Nevertheless, during peak hours, it takes about 29 minutes to reach West Lake’s Scenic Spot on average, about 8% of the area can be reached in 15 minutes, 13% of the area can be reached in 20 minutes, 18% of the area can be reached in 25 minutes, 21% of the area can be reached in 30 minutes, and 39% of the area can be reached in more than 30 minutes. (Shown in Figure10)

Out-of-town tourists usually arrive at West Lake by self-driving, high-speed rail, and bus, etc. thus, the study of the traffic accessibility from the station to the scenic spot is of observation significance (Dou et al. 2022). Under the condition of good traffic accessibility, it can achieve a seamless connection between traffic and high-speed rail, which greatly improves the travel experience of tourists. In general, the main transfer stations in the analysis time and space circle are including Huizhou North Station, Huizhou Railway Station, and Huizhou Bus Terminal of the Ganzhou-Shenzhen High-speed Railway.

Analysis shows that it takes about 28 minutes to arrive at the scenic spot from Huizhou North Railway Station, about 30 minutes to arrive at the peak hours; about 26 minutes to reach from Huizhou Railway Station, about 28 minutes to arrive at the peak hours; about 12 minutes to reach from Huizhou Bus Station, about 13 minutes to arrive at the peak time; about 14 minutes to arrive at from Huizhou South Railway Station, and about 14 minutes to arrive at the peak time (Shown in Figure11).

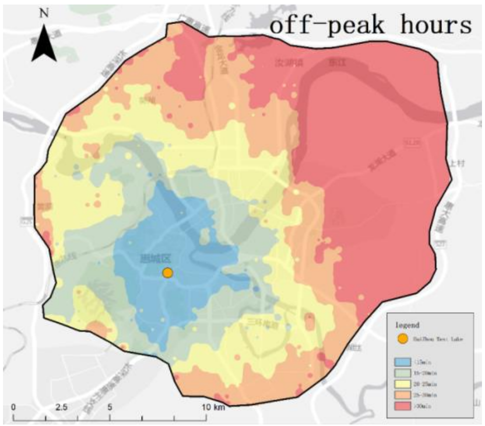

Figure 8 Hierarchical map of driving to West Lake at an off-peak time

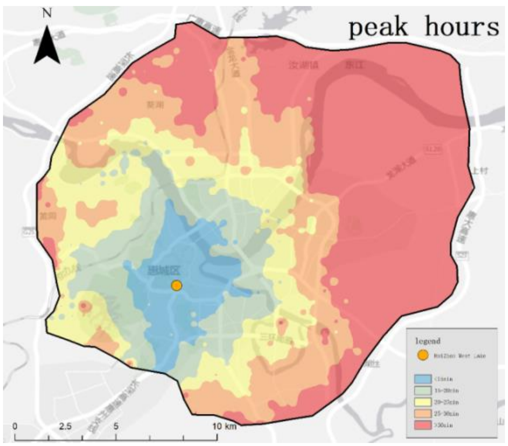

Figure 9 Hierarchical map of driving to West Lake at peak time

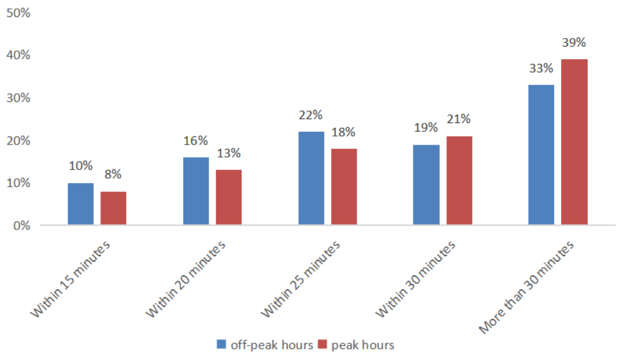

Figure 10 Time consumption interval of driving to West Lake

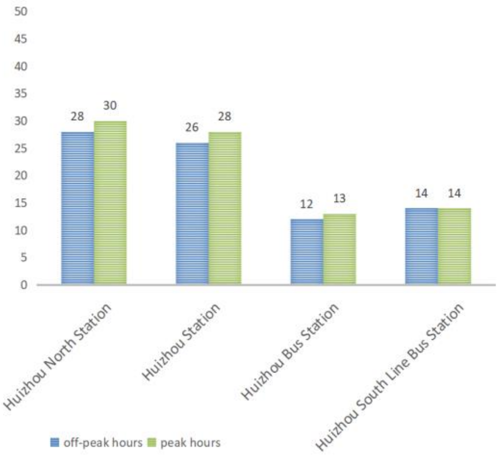

Figure 11 Spending time driving to West Lake from the nearby station

5.2. Analysis of spatiotemporal accessibility of cycling

According to the research data, when the starting point is 0-4km away from the destination and the riding time is less than 30 minutes, people will prefer to go on a bike trip (Wang, 2021). This study analyzes the accessibility of a bike trip. According to the time threshold of 15, 20, 25, 30 minutes, and more than 30 minutes, there is a significant space-time structure. The closer it is to West Lake's scenic spot, the shorter it takes to get to the scenic spot by riding in the southwest of the study area, and the longer it takes to the east and north (Shown in Figure 12 and Figure 13).

During off-peak hours, the average time to reach the scenic spot in the study area is about 41 minutes, about 7% of the area can reach West Lake's scenic spot in 15 minutes, 7% of the area can reach it in 20 minutes, 7% of the area can reach it in 25 minutes, 9% of the area can reach it in 30 minutes, and 70% of the area needs more than 30 minutes. Compared with non-peak hours, the time consumption required for cycling to the scenic spot during peak hours has no significant change.

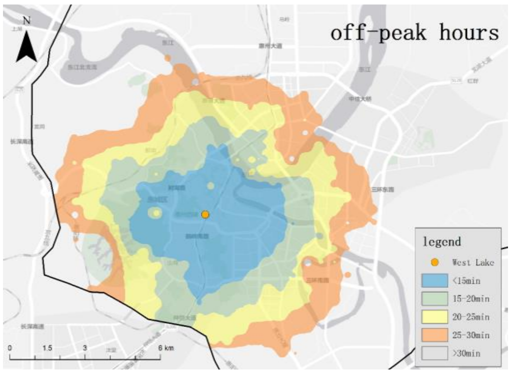

Figure 12 Hierarchical map of cycling to West Lake at Off-peak hours

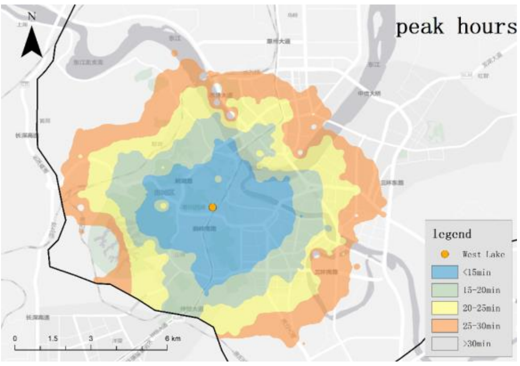

Figure 13 Hierarchical map of cycling to West Lake at peak hours

In the case of a perfect urban slow-moving system, tourists prefer to ride from the business district or residential area to the scenic spot. The distance between the starting place and the destination is 0-4 kilometers, and the riding experience is better within 30 minutes (Du et al., 2022: Wu and Lan, 2014); Therefore, this paper analyzes the accessibility of popular POI points in the space-time circle by combining the buffer zone with a radius of 0-4 km and the popular POI points in Gaode, and divides the POI points into four categories. Class I refers to POI points that meet the requirements of a distance of 1 km and time consumption within 15 minutes, Class II refers to a distance of 2 km and time consumption within 20 minutes, Class III refers to a distance of 3 km and time consumption within 25 minutes, and Class IV refers to a distance of 4 km and time consumption within 30 minutes.

Overall, Class I POI points mainly include Huizhou People's Hospital, Liri Lakeside Business District, Yinshan Building, etc.; Class II gathering points mainly include The 7-day Hotel, Meibo Mall, etc.; Class III gathering points mainly include World Trade Center, Huizhou Bus Station, etc.; Class IV gathering points include Huizhou Botanical Garden, Ganghui Xintiandi, etc. (Shown in Figure 14 and Table 2).

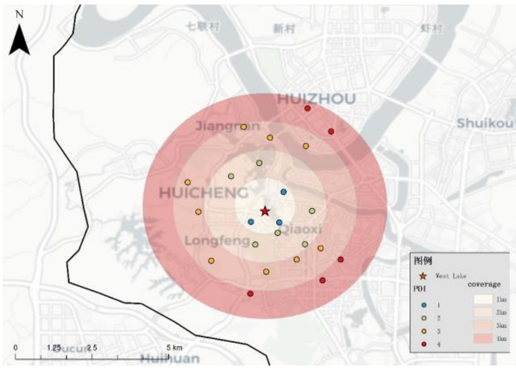

Figure 14 Accessibility of POI points in cycling time and space circle

Table 2 .list of distance and time of popular POI points in the cycle of cycling time and space

Area	***Distance(m)***	***Time(min)***	***POI type***
Liri Lakeside Business District	451	3	Class 1
Meibo MAall	1900	10	Class II
World Trade Center	2300	15	Class III
Ganghui Xintiandi	3200	17	Class IV

6. CONCLUSION

This study shows that Huizhou West Lake's Area has good spatial-temporal accessibility in the downtown area of Huizhou. In addition, the overall road network in the study area operates smoothly and stably. The spatial-temporal circle of driving travel has a significant circle structure in the spatial distribution. Compared with the non-peak period, the peak period changes significantly but is relatively stable. The overall trend surface of the study area to reach the West Lake's Scenic Area does not change much, compared with the non-peak period, the average time spent in peak hours has increased from 27 minutes to 29 minutes, and the area of more than 30 minutes has increased from 33% to 39%. The time-space circle of driving to West Lake's scenic spot shows that the time spent in the urban center is short, while the time spent in the north and east is long.

From the perspective of out-of-town tourists entering Huizhou, analyze the situation of important transfer stations arriving at the West Lake's scenic spot. It takes about 30 minutes for important transfer stations to arrive at West Lake. There are Huizhou Bus Station in the blue circle of the service scope of West Lake, and Huizhou North Station and Huizhou Railway Station in the yellow circle. It is convenient for out-of-town tourists to arrive at West Lake by driving, renting/online car, tourist charter, etc. The management personnel of West Lake can also improve the service scope of the scenic area through the following ways, such as opening the station to the scenic area tourist chartered bus, the urban scenic area bus special line, and the relevant departments can also strengthen the connection of the road network in the eastern area when making traffic planning, to improve the service scope of the West Lake.

The 30-minute cycling time and space circle of West Lake covers about 21% of the area and can reach the West Lake within 30 minutes. In this 21% area, there are many popular POI points, such as bus stations, business circles, parks, residences, hotels, etc., which shows that many people flow in this time and space circle. It can hugely reduce the congestion of the road network and improve the accessibility of other transportation modes by guiding people in the ring structure to use cycling when reaching West Lake's scenic spot. In terms of relevant departments that can make strategies according to the situation of urban cycling travel, guiding citizens to travel more in greenways, promoting the development of the city's slow-moving system, strengthening the convenience of surrounding citizens to reach West Lake's scenic spot by cycling, and improving the willingness of residents to travel to the West Lake in Huizhou through greenways.

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