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Research Article

Optimization of Emergency Transportation Organization of Holiday Tourism Traffic

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The purpose of the optimization of holiday traffic emergency traffic organization is to solve the problem of serious traffic jams in holiday scenic spots. Based on the prediction of traffic volume and traffic mode division in the future years of the scenic spot, the traffic accident route is analyzed to provide theoretical support for the emergency traffic organization and planning of the scenic spot. This article takes the Shijiazhuang Jinta Bay scenic area as the research object, based on the traffic volume of the Jinta Bay tourist scenic area from 2009 to 2016, analyzes the traffic environment of the scenic area, predicts the traffic demand, and builds a one-way traffic organization double-layer optimization model. The simulated annealing algorithm is used to solve the model, an emergency transportation organization optimization plan is formulated, and the feasibility of the plan is verified through VISSIM simulation. The results of the study show that the one-way traffic organization method reduces the average vehicle delay by 32.2% and the average queue length by 14.5%. The one-way traffic organization based on branch diversion can more effectively solve the main road jamming and congestion caused by traffic accidents, prevent the occurrence of secondary accidents, and reduce the economic losses of scenic area managers. At the same time, the purpose of ensuring the tourist quality of tourists and the economic interests of scenic spot management departments is ensured.

1. Introduction

With the rapid development of social economy, the number of tourists in China is increasing and tourists are pursuing a higher travel experience. In 2019, the number of trips per capita in China reached 4 times, and large passenger flow has gradually become a common and normal phenomenon [1–4]. Especially in the peak tourism period such as holidays and weekends, the tourists in the scenic spot are not evenly distributed, which leads to the overload of popular scenic spots and the congestion of traffic arteries and nodes. Therefore, the value of tourists' tourism experience is not high. The size of the market continues to grow, increasing the contradiction between supply and demand. Short-term tourist gathering caused by emergencies such as large-scale tourism festival activities, sudden natural disasters, traffic, and transportation accidents of tourists, and the breakdown of scenic facilities not only leads to the decrease of tourists' satisfaction and experience but also induces safety accidents, which puts the scenic spot management and tourism safety guarantee system under great pressure. Therefore, the research on holiday transportation emergency transportation organization becomes more and more urgent.

Scholars at home and abroad have conducted a lot of research on holiday tourism transportation. Crouch et al. have made it clear that traffic factors have a more obvious impact on the overall travel experience. With the deepening of the research on traffic behavior in scenic spots, the research on the combination of transportation infrastructure layout and travel flow theory has become a new development direction [5]. Jameel and Boopen used the gravitational model to prove the important influence of scenic traffic infrastructure on the flow of tourists and explored the mechanism between the travel destination choice of tourists and the spatial distribution of scenic traffic infrastructure [6]. Smallwood et al. studied the dynamic model of tourist flow and found that tourist flow strongly depends on the scenic transportation infrastructure network [5]. Lv et al. studied the recreational spatial relationship of scenic spots through network analysis and GIS geographic analysis methods [7–9]. Brida et al. believed that no matter in the whole road network or in a single section or intersection, there was a location with the highest probability of traffic congestion, which was the root cause of traffic congestion [10]. Feng et al. studied the effect of the main traffic roads around the scenic spot on the evolution of regional tourism spatial structure [11]. Pei and Lang studied the emergency traffic evacuation method from the three aspects of accident section restriction, optimal evacuation path selection, and minimum vehicle circumambulation time and found that there was a certain internal relationship among the three [12]. They solved the optimal emergency traffic evacuation method by establishing a two-layer optimization model. Chen and Wang studied the spatiotemporal changes of the formation and dissipation of road network congestion and proved that the CTM-based quasidynamic traffic allocation method can quantitatively evaluate the effectiveness of traffic organization schemes under emergencies [13].

It can be seen from this that the domestic and foreign scholars' research on the emergency traffic organization scheme of tourism traffic mostly focuses on the urban road network and expressway network and rarely involves how to comprehensively construct road accident traffic accident emergency transportation organization schemes in tourist attractions. Therefore, on the basis of urban road network and expressway network traffic accident emergency traffic organization plan, combined with the characteristics of the scenic spot network, so as to build a holiday scenic spot network traffic accident congestion evacuation method [14], this article takes the Shijiazhuang Jinta Bay tourist scenic spot as an example, analyzes the traffic profile of the scenic spot, and predicts the traffic demand of the scenic spot during the peak holiday season. Then, this was used as a benchmark to establish a one-way traffic organization double-layer optimization model, formulate an emergency traffic organization optimization program, and verify its feasibility with simulation software, so as to provide a reference for the administrative department of the scenic spot to adopt emergency traffic organization scheme and emergency rescue measures after traffic accident and congestion occurs in the scenic spot in the future.

2. Traffic Demand Forecast for Jinta Bay Scenic Spot during Holidays

2.1. Traffic Environment of the Scenic Spot. The specific location of Jinta Bay Scenic Spot is shown in Figure 1. The road network of Jinta Bay Scenic Area is shown in Figure 2. The scenic road network is formed by the intersection of four main roads and four branch roads. The four two-way driving roads outside the scenic area are the main road sections in the scenic area (the thick red line section in Figure 2 and are also the main evacuation paths for the traffic volume in the tourist area in Table 1. The branch road section (the thin green line section in Figure 2 inside the scenic area is prohibited from entering vehicles and is the main path for tourists to walk and ride. The part enclosed by the main road and the branch road is Jinta Bay Flower Sea, which is the main scenic spot of Jinta Bay Scenic Spot.

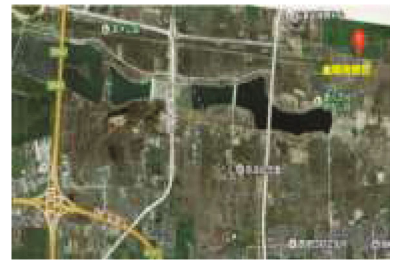

Figure 1: The specific location of Jinta Bay Scenic Spot.

Figure 2: The overall road network of Jinta Bay Scenic Spot.

2.2. The Forecast of Annual Traffic Volume. Based on the traffic volume of Jinta Bay Scenic Spot in each month from 2009 to 2016, the traffic volume of Jinta Bay Scenic Spot in the future was predicted by the combined forecasting method. The prediction model is shown as follows in Formula (1).

$$Y = \sum_{i=1}^{n} w_i y_i. \tag{1}$$

In the formula, Y represents predictive value. w_i represents the weight coefficient of the i model, $\sum_{i=1}^{n} w_i = 1$. y_i represents the predicted value of the i model. n represents the number of models.

The combined forecasting method is used to combine the forecasting results of the four models of growth method, regression forecast method, moving average method, and quadratic exponential smoothing method [15]. The weight coefficients of these four models are 0.15, 0.35, 0.25, and 0.25, respectively.

2.3. Peak Day Traffic Forecast. There are obvious seasonal divisions in the tourist form of Jinta Bay Scenic Spot, which can be divided into the peak season of spring and autumn and the low season of winter and summer. According to the "Shijiazhuang Tourism Master Plan," the proportion of tourists in the peak tourist season accounts for 80% of the annual tourist reception [16]. At the same time, considering the theory of life cycle of tourist destinations and the tourism capacity of Jinta Bay Scenic Spot, and considering the ratio of peak sunrise travel scale of scenic spot tourists to the total travel volume of the whole year under the current holiday management system in China, the peak daily traffic flow of Jinta Bay Scenic Spot in different years is predicted. The predicted results are shown in Table 2.

Table 1: Forecast value of annual traffic volume of Jinta Bay Scenic Spot (vehicles).

Year	Growth method	Regression prediction	Moving average method	Quadratic exponential smoothing	Average value	Combined forecast
2017	2 073 187	1 914 522	2 012 173	1 916 115	1 985 116	1 961 247
2018	2 298 182	2 009 281	2 143 894	2 011 527	2 115 453	2 084 342
2019	2 545 177	2 101 817	2 282 295	2 113 606	2 260 724	2 216 388
2020	2 820 056	2 195 465	2 422 901	2 216 795	2 413 804	2 351 345
2021	3 124 622	2 289 672	2 563 506	2 319 985	2 574 446	2 490 951
2022	3 462 081	2 376 391	2 704 112	2 423 175	2 741 440	2 632 871
2023	3 835 985	2 501 252	2 844 717	2 526 365	2 927 080	2 793 606
2024	4 007 514	2 617 813	2 984 212	2 628 444	3 061 485	2 922 515
2025	4 187 881	2 762 712	3 124 817	2 731 634	3 201 761	3 061 243
2026	4 376 386	2 872 812	3 265 423	2 834 824	3 337 356	3 187 016
2027	4 574 484	2 980 129	3 407 139	2 939 125	3 475 219	3 315 784
2028	4 780 336	3 155 382	3 547 745	3 042 315	3 631 084	3 468 888

Table 2: Forecast value of peak day traffic volume in Jinta Bay Scenic area (vehicles).

Year	2016	2018	2023	2028
The peak day traffic volume	21,183	23,461	30,058	38,336

2.4. Forecast of Traffic Division. No vehicles are allowed to enter the subroads of the Jinta Bay Scenic Spot road network. Therefore, when traffic jams occur on the main road, tourists on foot or by bike can enter the subroad section of the road network to make a detour, so as not to affect the emergency traffic organization on the congested road section.

Considering the growth of private car ownership and utilization rate in the planning years, as well as the improvement of bus service level, the structure of passenger flow in different years was predicted based on the current situation survey [17]. The predicted results are shown in Table 3.

Table 3: Prediction of peak tourist flow pattern structure in Jinta Bay Scenic Spot (%).

Year	Passenger car	Small car
2018	10	90
2023	14	86
2028	22	78

The above takes the Jinta Bay tourist area as an example to predict the traffic demand and obtains the specific traffic volume and traffic mode division data of the scenic area in the future years.

3. One-Way Traffic Organization Model

3.1. Construction of a Two-Layer Optimization Model for One-Way Traffic Organization. Holiday travel season network congestion has the traffic accident in the scenic spot, in order to at the same time guarantee the quality of tourist scenic area management and economic benefit, for traffic road network based on branch shunt one-way traffic organization is a good way to evacuate congestion, reduce the economic loss of the scenic area management, and ensure that visitors can enjoy the scenic spots in the shunt branch road. The optimization of one-way traffic organization should carry out optimization research for two goals at the same time, and finally reach a comprehensive optimal goal. The specific objectives are optimized as follows:

(1) The primary goal of implementing one-way traffic organization is to minimize the average saturation of main road sections and the average saturation of branch roads

(2) Congestion evacuation time is as little as possible

When establishing the optimization model of one-way traffic organization, the organization plan of emergency traffic organization in the road network of tourist attractions can be used as the upper decision-making variable, and the ultralimited saturation of the road network and the minimum vehicle running time can be used as the optimization objectives of the upper decision-making variables [18]. For the lower level optimization, the user equilibrium assignment model is used. The specific modeling process is shown as follows in the following:

Average maximum saturation of arterial road sections:

$$\frac{\sum_{a\in A} l(a) \max \{S_x(a) - S_0(a), 0\}}{\sum_{a\in A} l(a)}. \quad (2)$$

The average overlimit of the branch road section about the maximum saturation:

$$\frac{\sum_{a\in B(x)} l(a) \max \{S_x(a) - S_0(a), 0\}}{\sum_{a\in B(x)} l(a)}. \quad (3)$$

Figure 3: Example road network diagram.

The shortest average time required for a vehicle to travel out of an accident is

$$\frac{\min \sum_{a\in A\cup B(x)} q_x(a) R_x(a) l(a)}{\sum_{a\in A\cup B(x)} l(a)}. \quad (4)$$

By assigning objective Formulas (2), (3), and (4) to different weight parameters ξ, a bilevel planning model optimized for one-way traffic organization can be obtained:

$$\min Z(x) = \xi_1 \frac{\sum_{a\in A} l(a) \max\{S_x(a) - S_0(a), 0]}{\sum_{a\in A} l(a)} + \xi_2 \frac{\sum_{a\in B} l(a) \max\{S_x(a) - S_0(a), 0]}{\sum_{a\in B} l(a)} + \xi_3 \frac{\sum_{a\in A\cup B(x)} q_x(a) R_x(a) l(a)}{\sum_{a\in A\cup B(x)} l(a)} .s.t \quad (5)$$

$$S_x(a) = \frac{q_x(a)}{C_x(a)}, a \in A \cup B(x),$$

$$C_0(a) \le C_x(a) \le C_{\max}(a),$$

$$l_{rs} = \sum_{a\in A\cup B(x)} l(a)\delta_{ak}^{rs}; r, s = 1, 2, \cdots, n.$$

Among them, the flow of the road section $q_x(a)$, $a \in A \cup B(x)$ meets the following plan:

$$\min \sum_{a\in A\cup B(x)} \int_0^{qx} t_a(w)dw, \quad s.t \quad (6)$$

$$\sum_{k=1}^{L(r,s)} f_k^{rs} = q_{rs}; r, s = 1, 2, \cdots, n, \quad (7)$$

$$q_x(a) = \sum_{r=1}^{n}\sum_{s=1}^{n}\sum_{k=1}^{l(r,s)} f_k^{rs}\delta_{ak}^{rs}, a \in A \cup B(x), \quad (8)$$

$$f_k^{rs} \ge 0, r, s = 1, 2, L, n, k = 1, 2, \cdots, L(r, s). \quad (9)$$

In Formulas (6) to (9), $L(r, s)$ represents the number of paths between OD pair (r, s). f_k^{rs} represents the traffic of the k path between OD pairs (r, s). δ_{ak}^{rs} represents link-path-related variables. If the link a is on the k path between the OD pairs (r, s), it is 1; otherwise, it is 0. $t_a(q_x(a))$ represents the road resistance function, which is a strictly increasing function of the road section flow $q_x(a)$.

Table 4: Distribution of traffic demand (OD) between nodes.

Node	1	2	3
1	0	592	616
2	483	0	562
3	708	953	0

Table 5: Main parameters of each main road section.

Section	Capacity (pcu/h)	Length (m)	Free flow time (min)
(1-5)	2 500	578	0.868
(5-6)	2 500	562	0.842
(6-2)	2 500	238	0.353
(2-10)	2 500	524	0.787
(10-14)	2 500	437	0.607
(14-4)	2 500	196	0.296
(4-16)	2 500	211	0.314
(16-15)	2 500	533	0.800
(15-3)	2 500	505	0.758
(3-11)	2 500	519	0.775
(11-7)	2 500	458	0.636
(7-1)	2 500	507	0.763

Table 6: Main parameters of each branch road section.

Section	Capacity (pcu/h)	Length (m)	Free flow time (min)
(5-8)	1000	607	0.913
(6-9)	1000	583	0.873
(7-8)	1000	556	0.846
(8-9)	1000	590	0.880
(9-10)	1000	273	0.434
(8-12)	1000	387	0.557
(9-13)	1000	405	0.575
(11-12)	1000	532	0.822
(12-13)	1000	608	0.898
(13-14)	1000	315	0.466
(12-15)	1000	408	0.578
(13-16)	1000	352	0.592

3.2. Algorithm for Solving Bidirectional Optimization Model of Unidirectional Organization. The simulated annealing algorithm can be used to simulate the bilevel programming problem with the thermal equilibrium of statistical mechanics, and the objective function can be used as an energy function to solve the problem according to the annealing treatment principle of solid matter in physics. The algorithm

Table 7: Comparison of various optimization schemes and their evaluation index values.

Plan number	Value range of ξ_3	Main road average saturation limit	Branch saturation average over limit	Road network saturation total average over limit	Average evacuation time per vehicle/min
1	[0,2.5)	0.063 2	0.007 4	0.068 3	19.652 2
2	[2.5,14.5)	0.067 8	0.008 2	0.073 1	14.677 1
3	[14.5,56)	0.081 2	0.012 3	0.087 4	8.846 5
4	[56,+∞)	0.089 3	0.016 5	0.099 2	0.000

Table 8: Road network flow and saturation distribution corresponding to option 1.

Arterial road section	Flow/veh	Saturation	Main branch road section	Flow/veh	Saturation
(1-5)	332.7	0.693	(7-8)	257.7	1.074
(5-6)	590.4	1.230	(8-5)	257.7	1.074
(6-2)	590.4	1.230	(10-9)	115.5	0.481
(2-10)	556.8	1.160	(9-13)	115.5	0.481
(10-14)	441.3	0.919	(13-12)	115.5	0.481
(14-4)	410.7	0.856	(12-15)	115.5	0.481
(4-16)	445.5	0.928			
(16-15)	445.5	0.928			
(15-3)	647.1	1.348			
(3-11)	597.9	0.831			
(11-7)	597.9	0.831			
(7-1)	374.7	0.521			

can make most of the random heuristics on the outer surface of the feasible solution set acceptable and guarantee that all the heuristics are feasible solutions, which can improve the reliability and computational efficiency in the solving process. Therefore, this paper decided to use simulated annealing algorithm to solve.

The neighborhood system construction of the solution is one of the key problems in the implementation of the simulated annealing algorithm [19]. For a given one-line plan x, $J = \{a | a \in B(x), S_x(a) \geq \eta\}$ is the set of accident-congested road segment under road network $N(x)$. For any accident congested section $a = (v_i, v_j) \in J$, $\bar{a}[v_i, v_j]$ is the undirected section corresponding to a in branch set $B(x)$, and its adjustment state $x(\bar{a})$ can be determined by $x'(\bar{a})$. If $\bar{a}$ was originally a single line from v_i to v_j, adjust $\bar{a}$ to a single line from v_j to v_i. Traverse all accident congested road sections $a = (v_i, v_j) \in J$ in J and their adjustable state $a = (v_i, v_j) \in J$ to get the neighborhood system $X = \{x'_a\}$, where $x'_a = x - \{x(\bar{a})\} \cup \{x'(\bar{a})\}$. Then, the neighborhood solution x' is constructed with random probability.

4. Formulation and Verification of Optimization Plan for Emergency Traffic Organization

4.1. Formulation of Optimization Plan for Emergency Traffic Organization. Take sections 1-5 as the accident section for analysis. The road network is shown in Figure 3. Only considering that the traffic flowing in the clockwise direction

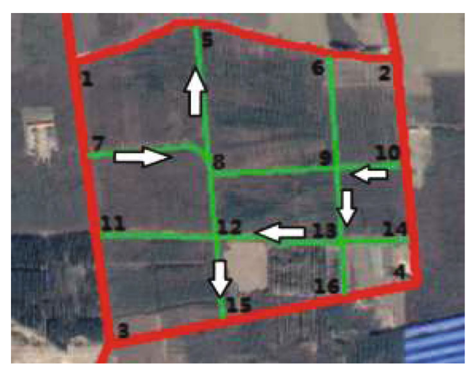

Figure 4: Optimization plan diagram (arrows indicate branch road sections with one-way diversion, and non-arrow main road sections are driven in both directions).

on the main road in the scenic area can be diverted by the branch road, and the maximum expected saturation $S_0(a) = 0.85$ of the main road. $C_2(a) = 1000$ pcu/h represents the one-way traffic capacity of each branch, and $S_0(a) = 0.75$ represents the maximum expected saturation of the branch. Other relevant parameters are shown in Tables 4–6.

In the process of one-way traffic organization optimization, in order to investigate the influence of each evaluation index value, the values of ξ_1 and ξ_2 were fixed as 1, and ξ_3 comparative test was conducted by changing the values. Table 7 lists the size of each one-way organization

Table 9: Simulation results of one-way traffic organization.

Arterial road section	Flow/veh	Vehicle delay (s)	Average queue length (m)	Main branch road section	Flow/veh	Average delay/s	Average queue length (m)
(1-5)	332.7	23.5	0	(7-8)	257.7	30.4	11.5
(5-6)	590.4	32.8	0	(8-5)	257.7	30.4	11.2
(6-2)	590.4	32.8	13.2	(10-9)	115.5	10.7	3.7
(2-10)	556.8	31.7	12.5	(9-13)	115.5	10.7	3.7
(10-14)	441.3	29.6	11.2	(13-12)	115.5	10.7	4.5
(14-4)	410.7	26.5	10.5	(12-15)	115.5	10.6	3.9
(4-16)	445.5	30.5	11.8				
(16-15)	445.5	30.8	11.8				
(15-3)	647.1	34.9	16.7				
(3-11)	597.9	23.8	0				
(11-7)	597.9	32.8	13.2				
(7-1)	374.7	32.8	13.0				

optimization plan and its corresponding evaluation index value in different ranges of ξ_3.

It can be seen from Table 7 that with the increase of the interval value of ξ_3, the average overrun of the saturation of arterial and branch roads corresponding to each one-way traffic organization scheme is increasing, while the average driving time per vehicle is decreasing. When ξ_3 increases indefinitely, the average saturation limit of the road section in the corresponding scheme 4 reaches the maximum, but the evacuation time is zero. At this time, the road network is the original road network without any one-way traffic settings. Compared with option 4, the decrease in the average overrun of main road and branch saturation in option 1, option 2, and option 3 are: 29.2% and 55.1%, 24.0% and 5 1.5%, and 9.3% and 25.1%. It can be clearly seen that the degree of decline in the saturation limit of the branch road is higher than that of the main road.

In option 1, the main road and branch road saturation limit is the largest. Although the average driving time per car reached 19.652 3 min at this time, for the sake of travel safety, this driving time is not long, and tourists are still acceptable. Based on the above analysis, choose option 1 as the recommended option for the one-way traffic organization of the road network. The road network flow and saturation distribution corresponding to Scheme 1 are shown in Table 8. The recommended scheme for one-way traffic organization optimization is shown in Figure 4.

4.2. Establishment of Traffic Simulation Model. Based on MAC bay scenic area road network in the research of the tourist season, the scenic spot most of the traffic accident congestion occurs in four road sections of road network, and each road section traffic accident frequency and number of similar. Combined with the four road sections of roads and road structure are all the same, therefore, to 4 network of 1 ~ 5 section of the road section, take 1 ~ 5 segments within a circumference of lanes as simulation object, using the VISSIM simulation software simulation of the one-way traffic organization way, road network model uses the model shown in Figure 4, each branch distributor roads and traffic as shown in Table 9. The duration of the accident is 200 s, and the proportion of cars and buses is 1 : 9. Traffic accident congestion traffic flow operation diagram is shown in Figure 5. The simulation results are shown in Figure 6. The data results are shown in Table 9.

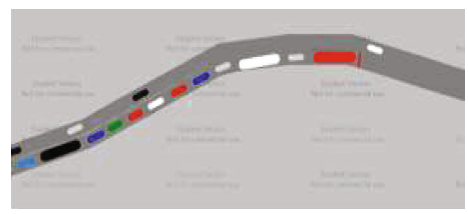

Figure 5: Traffic accident congestion traffic flow operation effect diagram.

Figure 6: One-way traffic organization simulation results.

It can be seen from the simulation results that when the branch area is evacuated in the one-way traffic organization mode, the node conflicts due to traffic accident congestion are reduced, and the conflicts with the opposite vehicles are eliminated. Vehicle delays and the average queue length of the entire scenic road network have also become very small, greatly improving the traffic capacity of each road section.

Table 10: Comparison of simulation results before and after optimization.

Measures	Traffic flow/veh	Average delay (s)	Average queue length (m)
Traffic diversion organization	300	13.9	5.2
	500	39.3	7.0
	600	61.8	12.2
One-way traffic organization method using tributary	300	10.3	3.7
	500	23.7	6.2
	600	42.6	11.8

In order to evaluate the rationality and effectiveness of the one-way traffic organization, this paper takes the Jinta Bay scenic road network as the research object and uses the VISSIM software to simulate and calculate the one-way traffic organization scheme based on branch diversion. The obtained simulation results are evaluated and analyzed and compared with the evacuation effect of the emergency traffic organization scheme based on trunk road diversion. The comparison results are shown in Table 10.

It can be seen from Table 10 that the one-way traffic organization method reduces the delay of vehicles by 32.2% and the average queue length by 14.5% compared to the traffic diversion organization method. The one-way traffic organization based on branch diversion can more effectively solve the main road jamming and congestion caused by traffic accidents, prevent the occurrence of secondary accidents, and reduce the economic losses of scenic area managers. In addition, the optimized emergency transportation organization plan does not affect the beauty of tourists visiting the scenic area, and even tourists can visit the scenery that is not seen on the main road section. Therefore, the use of tributaries to divert and organize one-way traffic can not only achieve the intended purpose but also improve the tourist quality of tourists.

5. Conclusion

According to the traffic composition and characteristics of Jinta Bay Scenic Spot, the combined forecasting method can be used to predict the traffic flow of holiday tourism scenic spots, and the method of combining analogy analysis and trend prediction can be used to predict the traffic patterns of holiday tourist scenic spots, thus, can get future year tourism scenic area of the peak day traffic flow and traffic mode structure. Solving the problem of establishing model data source, data accuracy is much higher than traditional yearbook data.

The emergency transportation organization plan in the scenic road network is taken as the upper decision variable, and the saturation limit of the tourist road network segment is minimized and the vehicle travel time is minimized as the optimization goal of the upper decision variable. The user balance distribution model is used to optimize the lower layer, which can realize the construction of a double-layer optimization model and can be solved by using the simulated annealing algorithm.

VISSIM verified the effectiveness of the emergency transportation organization plan developed by the double-layer optimization model, which can effectively reduce the delay of congested vehicles and the length of vehicle queues, and, at the same time, ensure the tourist quality of tourists and the economic benefits of scenic area management departments. The model has certain reference significance for the holiday traffic management of similar scenic spots.

The study of tourist traffic emergency traffic organization at home and abroad mostly focuses on the scenic area outside the city road network and highway network. In this paper, with scenic road network as the research object, to the profit of the scenic area management and quality of visitors travel to emergency traffic organization goals. The accident area branch shunt one-way traffic organization method for evacuation can effectively reduce the node conflicts arise from congestion due to traffic accident, to eliminate and conflict to have car, can more effectively solve the scenic area due to traffic accident main road congestion and crowding, prevent secondary the happening of the accident. Vehicle delays and the average queue length of the entire scenic road network have also become very small, greatly improving the traffic capacity of each road section. Later, studies should consider threat factors such as natural disasters, health events, and public safety events and conduct emergency traffic organization optimization studies for traffic jams caused by each type of event.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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