Research on the Impact of Community Opening on Roads Based on Machine Language Algorithm Model

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Abstract: With the continuous development of urban construction and the increase of the road traffic , public pay more attention to the capacity of the vehicle traffic. Therefore, closed residential quarters and opened residential quarters have become a hot point of the discussion. The article focuses on the impact of community opening on the traffic of the surrounding roads, and establishes a suitable, comprehensive and systematic impact evaluation model, and evaluates the impact reasonably, to give reasonable suggestions base on different types of communities that whether the community is open or not.

1. Introduction

Select an appropriate evaluation index system to evaluate the impact of community opening on the traffic of surrounding roads. Establish a mathematical model of vehicle traffic to study the impact of community opening on the traffic of surrounding roads. The effect of the opening of the community may be related to the structure of the community, the structure of the surrounding roads, and the traffic volume. Then select or construct different types of communities and apply the model that have established to quantitatively compare the impact of each type of community on road traffic before and after the opening. Based on the research results, from the perspective of traffic flow, propose to the urban traffic management departments some reasonable suggestions on the opening of the community.

2. Research Method

Firstly, we select the influencing factors of the community opening on surrounding road traffic and use the cluster analysis method to classify each influencing factor into three more systematic evaluation indicators, which named road traffic capacity, safety and convenience. Then use the analytic hierarchy process to select the one that play a relatively key role. Finally, t is concluded that the road capacity is determined by the number of lanes, congestion coefficient, roadside interference coefficient and the saturation of branch roads in the area, and safety is determined by the number of intersections, and convenience is determined by accessibility. Base on that, we have established a suitable evaluation index system.

Secondly, based on the evaluation index system above, we have established relevant models to analyze the impact of traffic capacity, safety and convenience. For road capacity, based on the cellular automata model and the NS model, we analyze the relationship between the density of vehicles and the average speed of vehicles, and then compare the changes in the “traffic flow” of the roads around the community before and after the opening, which reflects Draw out the degree of influence on road capacity. Regarding safety, we have established a vehicle traffic model at the intersection to define the degree of potential danger, so as to quantitatively analyze the impact of community opening on safety. For convenience, we define accessibility (the ratio of the sum of the branches from one end of the cell to the other end of the cell and the sum of the shortest path in the cell and its surrounding area) to reflect the change of convenience. The shortest path is obtained by

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establishing the shortest path model and using Dijkstra's algorithm. Next, we establish a fuzzy comprehensive evaluation model, take the factor set as the above 3 evaluation indicators, and then determine the comment level, and then give the weight by judging the influence of the factor set on the surrounding road traffic, and finally analyze and calculate it. Out of influence. Thirdly, we select five communities with different characters randomly, and according to the results of the above model, we can divide the communities into three types: suitable for open quarters, unsuitable for open communities and whether they are open or not has little influence on road traffic. Then, in the analysis and testing of the model, we used actual cases and the traffic simulation software VISSIM to simulate the traffic system to give the evidence for the reliability of the model. Finally, in the evaluation and optimization of the model, we evaluated the rationality of the model used and improved its shortcomings. Among them, we have established an improvement to the method of determining weights in the cluster analysis method, using the “nine quantile method” to make the determination of weights more scientific and reliable; established an analytic hierarchy process model combined with principal component analysis; The fuzzy comprehensive evaluation model improves the factor set, comment set and weight determination method.

3. Model Assumptions

1)Assume that the shortest headway distance is outside the safe distance.

2)Assume that traffic lights are installed at each intersection.

3)Assume that the intersection is a crossroad or a T-shaped intersection.

4)Assume that vehicle driving is not affected by oncoming traffic.

5)Assumption car accidents only happen at intersections, and the accident rate of other road sections is negligible.

6)This article only considers small vehicles.

4. Establishment and Solution of Model

4.1 Question1:Selection of Appropriate Evaluation Indicators

4.1.1 Application of Cluster Analysis Method in the Classification of Influencing Factors

The R-type clustering method can study the similar relationship between variables and aggregate the variables into several categories according to the mutual relationship between the variables, so that the main factors affecting the system can be easily found.

1)Let the variable be $\left(x_{1j}?, x_{2j}?, \ldots, ?x_{219j}\right)^{\mathrm{T}} \in R^{n}\left(j=1,2,\ldots,11\right)$, then the sample correlation coefficient of the two variables x_j and x_k can be used as their similarity measure,

as: $$r_{jk} = \frac{\sum_{i=1}^{n}\left(x_{ij}-\overline{x_j}\right)\left(x_{ik}-\overline{x_k}\right)}{\left[\sum_{i=1}^{n}\left(x_{ij}-\overline{x_j}\right)2\sum_{i=1}^{n}\left(x_{ik}-\overline{x_k}\right)?= 2?\backslash *?\text{Arabic}?2\right]\frac{1}{2}}$$

2)Secondly, we use variable clustering method to classify the above influencing factors. In this article, the longest distance method is adopted to solve the variable clustering problem. The specific process is as follows: In the longest distance method, the distance between two types of variables is defined

as: R $(G_1,?G_2)$= $\max\left\{d_{jk}\right\}?\ x_j \in G_{1??}\mathrm{x} \in k \in G_2$

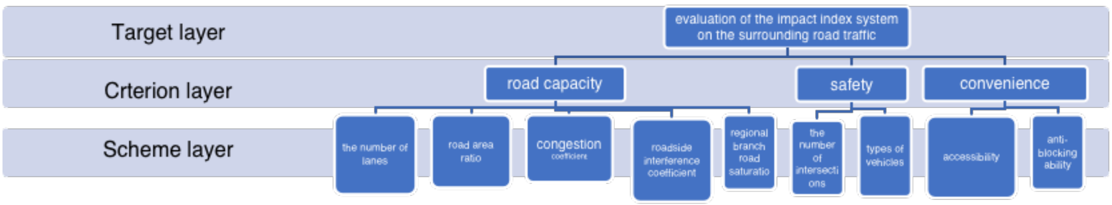
among it , $d_{jk}=1-\left|r_{jk}\right|$ or $d_{jk}{}^{2}$=1- r_{jk}^{2} ,at the same time, R(G_1, G_2)

is related to the similarity measure between the two variables with the smallest. similarity in the two categories.

We take the correlation coefficient matrix between the influencing factors as. input parameters, and after clustering analysis, the influencing factors with a relatively large degree of correlation are taken as output. Thereby, the influencing factors under the three types of evaluation indicators are obtained. One is the factors that affect the capacity of the main road, including the number of lanes, road area ratio, congestion coefficient, roadside interference coefficient and regional branch road saturation. The second is the factors that affect safety, including the number of intersections and the types of vehicles; the third is the factors that affect the convenience, including accessibility and anti-blocking ability.

4.1.2 Analytic Hierarchy Process to Build an Evaluation System

1). Establish a hierarchical structure model. The decision-making problem is decomposed into three levels. The top level is the target level M, which is to select the most appropriate key indicators for evaluating the impact of the open community on the surrounding road traffic; the bottom level is the plan level, that is, the nine influencing factors P1, P2, P3 , P4, P5, P6, P7, P8, P9; the middle layer is the criterion layer, including traffic capacity C1, safety C2 and convenience C3 (as shown in Figure 1) :



2). Model solving.

(1). Construct the judgment matrix M-C: Compare the three elements C1, C2, C3 in the base layer C in pairs to obtain a pairwise comparison matrix.

M	C1	C2	C3
C1	1.0000	3.0000	4.0000
C2	0.3333	1.0000	2.0000
C3	0.2500	0.5000	1.0000

Solving the eigenvalues of M-C, we can get $\lambda_{max} = 3.0184$ and the weight. vector is : $\omega_i = (0.6250, 0.2385, 0.1365)^T$

According to the formula CI= $\frac{\lambda_{max} - n}{n-1}$ and CR= $\frac{CI}{RI}$,we can get CR=0.0176<0.1,which passes the consistency test.

(2). Construct the judgment matrix C1-P, C2-P and C3-P.

	C2		P1	P2 P3	P4	P5
	P1		1.0000	0.5000 0.5000	0.4000	0.6000
	P2		2.0000	1.0000 2.0000	1.0000	0.2534
	P3		2.0000	0.5000 1.0000	2.0000	0.2550
	P4		2.5000	1.0000 0.5000	1.0000	3.0000
	P5		1.6667	1.0000 0.5000	0.3333	1.0000
				C1-P		

C_4	p_{10}	p_{11}
p_8	1.0000	5.0000
p_9	0.2000	1.0000

C2-P C3-P

C_3	P_8	P_9
P_6	1.0000	3.0000
P_7	0.3333	1.0000

(3) Consistency test of hierarchical sorting and total sorting.

The weight vector calculated by the above three judgment matrices, the maximum eigenvalue λ_i and the consistency index CR_j are listed in the table.

layerC	C		layerC	C		layerC	C3
layerP	q1		LayerP	q2		layerP	q3
P1	0.1010		P6	0.7500		P8	0.8333
P2	0.2534		P7	0.2500		P9	0.1667
P3	0.2550		□*i*	2.0000		□*i*	2.0000
P4	0.2455		*CRj*	0.0000		*CRj*	0.0000
P5	0.1450						
□*i*	5.3515						
CRj	0.0785						

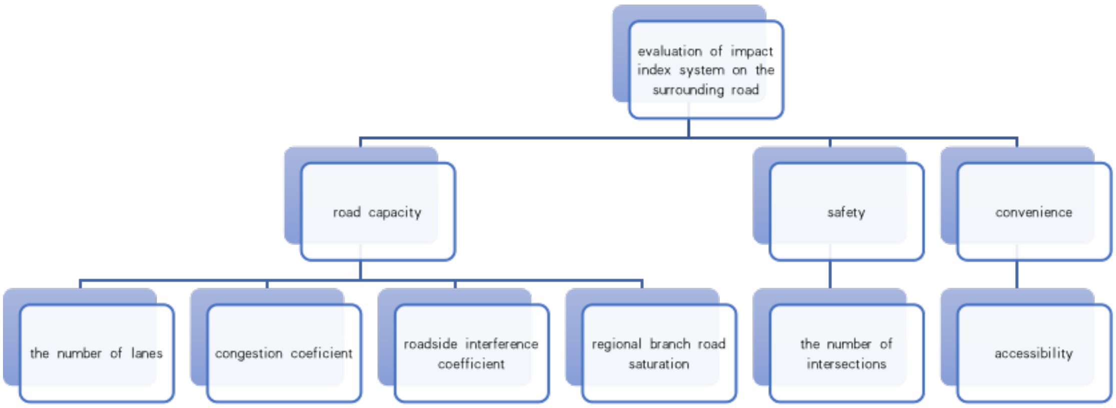
From the value of CR_j in the table, the matrices C1-P, C2-P, and C3-P all pass the consistency test.

4.1.3 Model Conclusions and Analysis

According to 4.1.2, we calculated the total weight of each influencing factor in the P layer. Summarize the final table into the following table 7:

Evaluation index		Weight
The number of intersections		0.1789
Congestion coefficient		0.1594
Roadside interference coefficient		0.1584
regional branch road saturation		0.1535
accessibility		0.1137
The number of lanes		0.0906
Road area ratio		0.0631
Types of vehicles		0.0596
Anti-blocking ability		0.0227

Sort the proportions of the three indicators that affect the layout of underground parking spaces in descending order. We choose the first six major factors as the branches of the indicator system, namely: the number of intersections, congestion coefficient, and roadside interference coefficient, Saturation, reachability and number of lanes of the branch in the area. So far, we have established an index system to evaluate the impact of community opening on the surrounding main roads, as shown in Figure:



4.1.4 Analysis of Results

1)Factors affecting traffic capacity:

(1). Number of lanes: After the opening of the community, the number of lanes in the road network increases, which relieves the congestion of the main road under certain conditions and reduces the vehicle load on the main road quantity.

(2). Congestion coefficient of the main road around the community: The degree of congestion of the main road determines the traffic capacity of the road to a large extent, which is a key influencing factor.

(3). Roadside interference coefficient: For general urban roads, in the road section Vehicles will be interfered by pedestrians and non-motorized vehicles. The greater the roadside interference, the faster the speed drops and the lower the road capacity.

(4).The saturation of the branch road in the area: The saturation of the branch road in the area describes the capacity of the cell the maximum rate of the vehicle (the ratio of the maximum traffic volume to the maximum capacity). When the vehicles in the community reach this value, the vehicles outside the community cannot enter the branch road, and most of the vehicles in the branch cannot merge into the main road.

2). Factors affecting safety:

(1).Number of intersections: Safety is a key indicator for residents to evaluate road traffic. Its meaning is not only reflected in safety during driving, but also in the ability to remove obstacles in emergencies. We know that intersections are the most dangerous areas in road driving. Therefore, as the number of open intersections in the community increases, safety needs to be improved.

(2). Factors affecting convenience: Accessibility refers to the ratio of the sum of the branches from one end of the cell to the other end of the cell to the sum of the shortest path. This indicator can better reflect the degree of development and convenience of branch roads in the community.

4.2 Establishment and Solution of the Second Problem Model

4.2.1 Establishment of a Vehicle Traffic Model Based on Cellular Automata

1) Traffic flow analysis based on cellular automata model

In the description parameters of traffic flow, daily traffic volume, vehicle density, and average vehicle speed, we noticed that daily traffic volume has a great correlation with vehicle density and average vehicle speed. The relationship between vehicle density and average vehicle speed is relatively weak. Therefore, we consider using the latter two parameters as the main descriptive parameters of traffic flow. Furthermore, we combine the cellular automata model to give the vehicle density and average vehicle speed under the NS rule and obtain the relationship diagram between vehicle density and vehicle average speed based on this, to analyze the traffic situation of vehicles. Whether the community is open or not will have a certain impact on the traffic situation by affecting the road distribution. We consider that whether the community is open or not will change the initial parameters in the model, thereby affecting the density of vehicles and the average speed of vehicles. Based on this, we modify the initial parameters, and through comparison, we can get the influence of the community opening on the traffic flow of the surrounding roads.

2) Descriptive parameters of traffic flow

(1).Traffic flow: the number of vehicles passing through a certain cross section of the road within a unit time. The units of traffic volume include annual traffic volume, quarterly traffic volume, monthly traffic volume, weekly traffic volume, daily traffic volume and so on. The main research focus of this article is daily traffic volume.

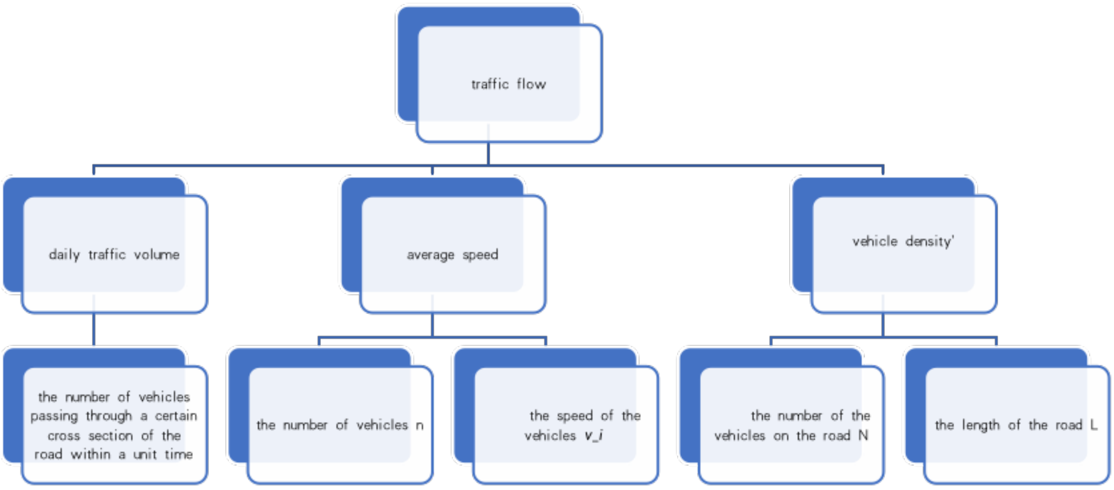
(2). Average vehicle speed: the arithmetic average of the vehicle speed in the traffic flow. Generally divided into time average speed and space average speed. The focus of this paper is the spatial average speed, which is the average value of the instantaneous speeds of all vehicles at a certain moment. The calculation formula is as follows: $v = \frac{\sum_{i=1}^{n} v_i}{n}$ (n means the number of the vehicles, v_i means the of the instantaneous speed of the i^{th} car.

(3). Vehicle density: the number of vehicles existing at a certain moment per unit length, the formula is as follows:

$$p = \frac{N}{L}$$

N means the number of the vehicles on the road.

L means the length of the road.



3). Establishment of vehicle traffic model based on cellular automata

The model rule of the NS model is supposed that the speed and position of the n^{th} vehicle are represented by v_n and x_n respectively. Among that, the speed v_n can be within 0, 1, 2, ..., v_{max} .And $d_n = x_{n+1} - x_n - l$ means the distance between the n^{th} car and the $n+1^{th}$ car (l is the length of the car). Then the states of all vehicles are calculated in parallel according to the following evolution rules.

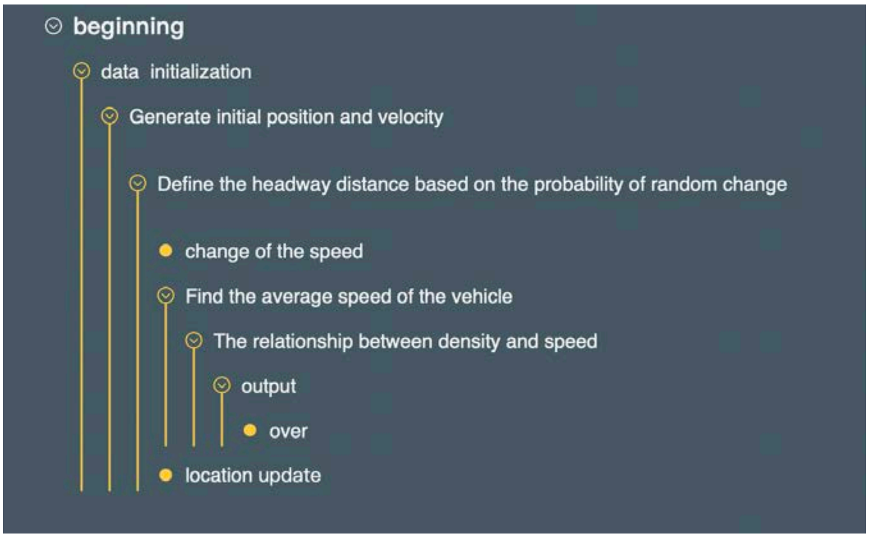
(1). Acceleration process: $v_n^{(t+1)} = \min(v_n^{(t)+1}, v_{max})$

(2). Safety brake: $v_n^{(t+1)} = \min\left(v_n^{(t+1)}, d_n\right)$

(3). With known probability p, random slowdown: $v_n^{(t+1)} = \max\left(v_n^{(t+1)} - 1, 0\right)$

(4). Location update: $x_n^{(t+1)} = x_n^{(t)} + v_n^{(t+1)}$

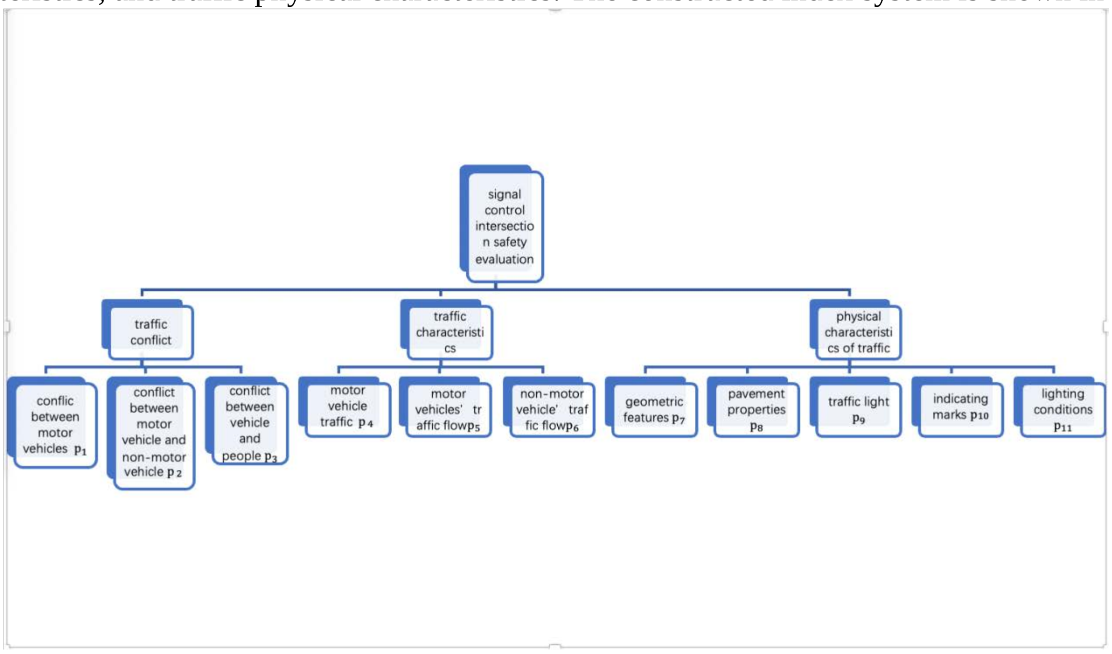
Next, we simplify the vehicle capacity into the calculation of vehicle density and average vehicle speed. According to the cellular automata model theory and related parameters of traffic flow, we give the model code of vehicle traffic,(the code flow chart is shown in Figure). Through the cellular automata-based vehicle traffic model and input the relevant parameters of the community, we can get the influence of the community opening on the traffic capacity of the surrounding main roads.



4.2.2 Construction of Safety Evaluation Model for Signalized Intersections

1) The construction of the intersection safety evaluation index system

We consider the relatively fixed physical characteristics of the intersection, the traffic conflict that implies the traffic safety performance characteristics, and the traffic characteristics with spatial and temporal variability, which will be based on safety services. The evaluation index system for traffic safety at horizontal intersections is divided into three categories: traffic conflict, traffic characteristics, and traffic physical characteristics. The constructed index system is shown in Figure



2) Construction of the main model

In order to better express the importance of traffic conflict points to traffic safety, we use the meaning of potential hazard to evaluate the safety status of intersections. The greater the degree of potential danger, the more serious the traffic accident that may occur at the intersection, and the less safe the intersection. Signalized intersections are controlled by traffic lights. On the one hand, the number of conflict points at the intersection will decrease. On the other hand, the conflict points at the intersection cannot play a role at the same time. The actual transit time obtained by the phase is weighted to calculate the total number of conflict points in a signal period. The transit time is the sum of the yellow light and the green light time. Therefore, the calculation model of the potential hazard caused by the conflict point of the intersection is shown in the formula:

$$\text{P}D_s = \sum_c w_c \times PD_{sc}$$

Among that, $\text{P}D_s$ are the potential danger of signal-control intersections; c is the type of intersection conflict point; w_c is the weight of different types of conflict point; PD_{sc} is the potential hazard degree of signalized intersection caused by c-type conflict point, which can be calculated according to the following formula:

$$D_{sc} = \sum_i N_i \times \frac{g_r + y_r}{T} \times GM$$

Among that, i is the type of c-type conflict point; N_i is the number of the i-type point; g_r is the green light time of the r phase (s); y_r is the yellow light time of the r phase (s); T is the period length of the phase signal (s); GM_i is the degree of malignancy of the conflict point of category i.

4.2.3 Convenience Impact Analysis Based on the Shortest Path Model

1) Establishment of the shortest path model

When considering the time taken by residents from the elevator entrance to their own parking spaces, we set the shortest time as the optimal objective of the objective function. For this problem, the optimization model we adopt is the Dijkstra algorithm for solving the shortest path problem in graph theory. V and E are respectively the set of vertices of the graph $V = \{v_1 ?, v_2, \cdots, v_n, v_1 ?, v_2, \cdots, v_n\}$

Set of edges: $E = \{e_1, e_2, \ldots, e_m\}$

Set of arcs: $A = \{a_1, a_2, \ldots, a_m\}$

2) Algorithm for solving the shortest path model Dijkstra's algorithm is a labeling method.

```
while   ePnt ∉ S
    ∀v_j ∉ S:
    if    P(v_c)+W(v_c,v_j)<T(v_j)
        T(v_j)=P(v_c)+W(v_c,v_j)
        λ(v_j)=v_c
    end

    if    min_{v_j∉S} T(v_j)=T(v_{j0})
          v_c=v_{j0}
          P(v_c)=P(v_{j0})
          S=S ∪ {v_c}
    end
end
```

In this problem, the shortest path is solved by the shortest path s_1 from one end of the cell and the surrounding area to the other end, and then the sum of the branches s_2 from one end of the cell to the other end of the cell in the cell and the surrounding area is obtained. Calculate the accessibility $\frac{s_2}{s_1}$, from which the influence of the opening of the cell on the convenience is obtained.

4.2.4 Establishment of Fuzzy Comprehensive Evaluation Model

1). Determine the set of factors. Vehicle traffic is nothing more than the three factors of road traffic capacity, safety and convenience. Therefore, we take the factor set as:

U = {road capacity, safety , convenience}.

2). Determine the set of comments. We take the comment set as:

V = {outstanding v_1,?$good\ v_{2,?}normal\ v_3$,?$bad\ v_{4,}\ awful\ v_5$ }

3). Determine the weight of different factors. According to public's level of attention that pay to the factors, we set the weight as:

A = {0.6,0.2 ,0.2}

4). Determine the fuzzy comprehensive judgment matrix. The evaluation of index u_i is recorded as R_i □ $[r_{i1}, r_{i2}, r_{i3}, r_{i4}, r_{i5}]$, then the fuzzy comprehensive judgment matrix of each index is:

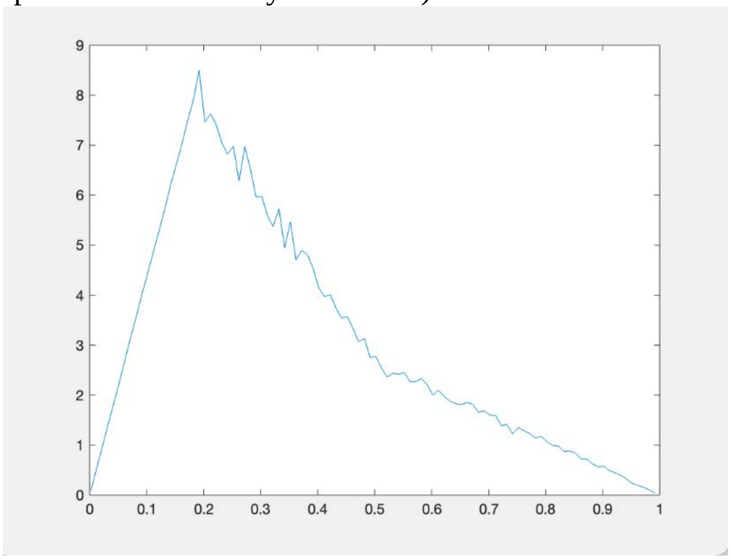
$$R = \begin{bmatrix} r_{11} & r_{12} & r_{13} & r_{14} & r_{15} \\ r_{21} & r_{22} & r_{23} & r_{24} & r_{25} \\ r_{31} & r_{32} & r_{33} & r_{34} & r_{35} \end{bmatrix}$$

5). Fuzzy comprehensive evaluation. Perform matrix synthesis operation: B= AR and takes the comment with the largest value in B as the comprehensive evaluation result. From the above steps, we have established a fuzzy comprehensive evaluation model, which can carry out a reasonable qualitative analysis of the degree of impact: the degree of impact is divided into very large impact, large impact, small impact, small impact, and no impact.

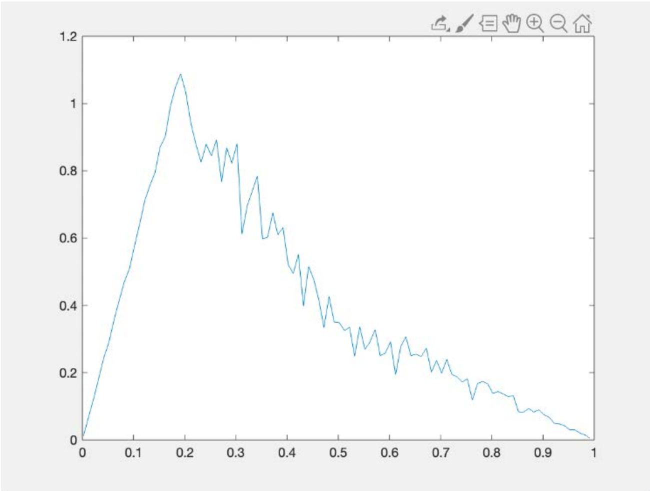
4.2.5 Case-Based Result Analysis

we set an example to analysis a community:

Before open: (the graph was calculated by MATLAB)



After open: (the graph was calculated by MATLAB)



First, from the result diagram, we can see that the average vehicle speed increases rapidly as the vehicle density increases, and then decreases, and as the vehicle density approaches 1, the average vehicle speed tends to 0. From a practical point of view, this relationship is established. Based on a certain vehicle density, as the vehicle density increases, the probability of blocking phenomenon increases, and the vehicle speed will also decrease. On the other hand, in the comparison of the two pictures before and after the opening of the community, we can see that after the opening of the community, when the vehicle density is between 0.2 and 0.3, it can be clearly seen that the average speed of the vehicles after the opening of the community is high. As a result, the traffic volume at this time has also increased a lot. According to the previous analysis, we have obtained that the road traffic flow can be measured by vehicle density and average speed. Based on this, we can conclude that the traffic condition of the community after the opening is better than before the opening. When the vehicle density increases again, this advantage is not so obvious. The opening of the community is not a panacea and can only have a positive impact on road traffic under certain conditions.

4.3 Solving the Third Question

We select three representative plot diagrams, use the model of the second question, take the driving speed, the number of lanes in the plot, the road area rate, the congestion coefficient and the saturation of the branch road in the area as input parameters, and integrate Analyze the relationship between various parameters and the impact of each parameter on vehicle traffic, so as to obtain the degree of impact of different structures, different surrounding road structures, and different traffic flows on the traffic of vehicles [11]. In the actual situation, we also need to consider the road capacity correction coefficient, including the influence of roadside interference coefficient and road width and lateral clearance correction coefficient.

4.3.1 Road Capacity Correction Coefficient

A. Roadside interference coefficient α .

We use the speed drop rate as the roadside interference coefficient, that is, the roadside interference coefficient $\alpha = v_a / v_b$, where v_a is the speed of the disturbed vehicle and v_b is the speed of the undisturbed vehicle. Therefore, we divide the disturbed roads into the following seven categories:

(1) Lanes that are not interfered by non-motor vehicles and pedestrians: four-slab roads and two-slab motor vehicle lanes separated by pedestrians.

(2) Lanes not interfered by non-motor vehicles and pedestrians: two-slab motor vehicle lanes without pedestrian separation.

(3) Lanes that are interfered by non-motor vehicles and not interfered by pedestrians: two boards have a pedestrian-isolated machine-non-combined road.

(4) Lanes interfered by non-motor vehicles and pedestrians: two truck-mounted non-mixed roads. Based on a series of vehicle speed observations, the analysis of the speed reduction rate of various roads shows that the roadside interference coefficient is:

1). $\alpha_1 = 11$.

2). $a_2 = 1 - 0.00054p$;

3). $a_3 = 1 - 0.0027q$;

4) $a_4 = (1 - 0.00201x)(1 - 0.00054p)$

In the formula: p means pedestrian flow/3 minutes

X means bicycle flow/(10min/m).

B. Road width and lateral clearance correction.

Design Traffic capacity should enable the road to reach the traffic capacity under the premise of a certain service level. Then the design capacity is:

$$C_d = C_{ap} \times \frac{v}{c} \times \alpha \times \omega \times \gamma$$

where: C_{ap} means corresponds to the saturation at a certain design speed; $\frac{v}{c}$ *means* corresponds to the saturation at a certain service level.

α means roadside interference correction coefficient.

γ means lateral clear width correction coefficient.

4.3.2 The Impact of Community Opening Based on Examples to Road Traffic

Based on the analysis above, we consider that the link capacity and the intersection capacity can be summed with appropriate weights, that is:

$y = \rho_1 . C_d + \rho_2 . N$

where: ρ_1 is the weight of the link capacity

ρ_2 is the intersection capacity When the number of intersections increases, the weight decreases accordingly.

Case 1: positive impact on traffic after opening the community

(The table quotes from:Renmin University of China, community open road traffic impact)

And the result is:

```
>> yunxing

y =

  480.7520
```

```
>> yunxing

y =

   1.0817e+03
```

Judging from the results of the operation, the road capacity has improved a lot after the opening of the community. From the actual situation, first, we noticed that the internal roads of the community are relatively wide, which is almost the same as the roads outside the community; secondly, the internal roads of the community can directly connect to the outside world; in addition, the road network outside the community has a simple structure and will be opened after opening. Which is equivalent to an increase in road area, which can effectively alleviate traffic pressure. Therefore, only in terms of road capacity, such communities are better open.

Case 2:

(The table quotes from:Renmin University of China, community open road traffic impact)

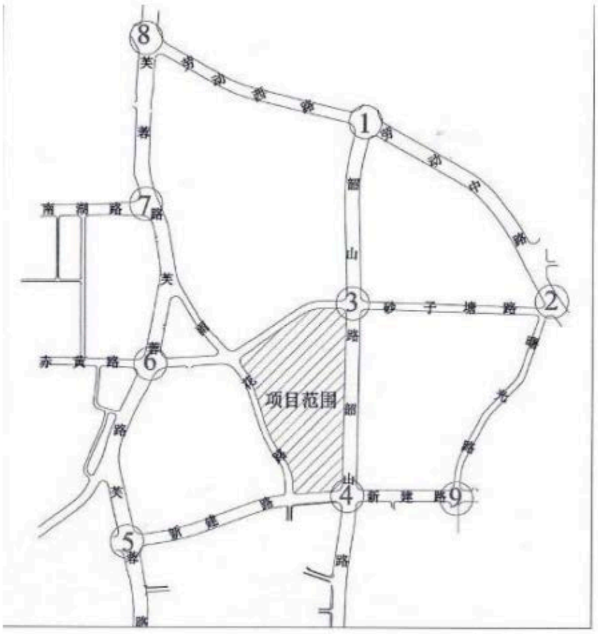
and the result is:

```
>> yunxing                >> yunxing

y =                       y =

  600.9656                  480.7722
```

Judging from the results of the operation, there are obvious signs of decline in road capacity after the opening of the community. Starting from the actual situation, first, we noticed that the roads inside the community are narrow, which will reduce the road width correction coefficient of the entire road system, and even if part of the traffic flow can be divided after opening, the effect is not significant for the entire road system. Secondly, the community

The internal road is a roundabout with several end roads, which cannot connect to the outside world. Vehicles entering the community must go round or even unable to go out. This will cause serious blockage inside the community and increase the driving time of the vehicle. Therefore, only in terms of road capacity, it is better for such communities not to be open.

Case 3:



(The table quotes from:Renmin University of China, community open road traffic impact)
and the result is:

Judging from the results of the operation, there is very little difference in road capacity before and after the opening of the community. Starting from the actual situation, first, we noticed that the community has a better road network structure and strong road digestibility. Based on the road itself, the probability of vehicle congestion is small; secondly, the community has a small area, and the surrounding roads intersect. The intersection is far from the community, and the intersection generally has more shops and places, so for passers-by, they can reach their destination quickly without detours. Therefore, it is impossible to determine whether such a community is open or not only in terms of road capacity.

4.4 Suggestions for Question

4.4.1 Consider from the Results of Our Model:

We must combine the capacity of section capacity and intersection capacity and then quantitatively compare the capacity of the surrounding roads before and after the opening of the community, and then draw a conclusion. Through the calculation formula (5) of the road section capacity and the calculation formula of the intersection capacity N, the corresponding weight is given to obtain the calculation formula of the road capacity:

$$y = \rho_1 . C_d + \rho_2 . N$$

Base on the formula, we can introduce the difference in road capacity before and after the opening of the community to tell whether it is suitable to open or not:

$$Q = y_{before} - y_{after}$$

If Q is positive and its value is large, it indicates that it is suitable for opening.
If Q is negative and its value is large, it indicates that it is not suitable for opening.
Other circumstances indicate that it needs to be judged based on other factors.

4.4.2 Suggestions to Urban Planning Departments and Transportation Departments

1).Suggestions to the urban planning department:

(1). Whether the community is open is related to the conditions of the community itself. Therefore, the number of road intersections in the open community should be as small as possible, and the road should be as straight as possible, avoiding loops, etc., so that the roads in the community can relieve traffic pressure.

(2). The location of the cell. The open community should be arranged in areas with relatively congested traffic as much as possible. The opening of the community is equivalent to increasing the road area based on the original road network structure, which can alleviate the local traffic pressure.

(3). When the opening of the community has a greater positive impact on the surrounding traffic, consider the issue of community opening. Since the opening of the community not only involves foreign vehicles and pedestrians, but also has a great impact on the community, when considering the opening of the community, we must consider all aspects.

2). Suggestions to the transportation department:

(1). Increase traffic commanders in open communities to reduce the occurrence of traffic accidents within the community.

(2). At the same time, increase penalties for random parking in large and small areas. The parking of vehicles in a small area will have a huge impact on the traffic in the community, especially the random parking of foreign vehicles may cause traffic jams, which will not serve the purpose of opening the community.

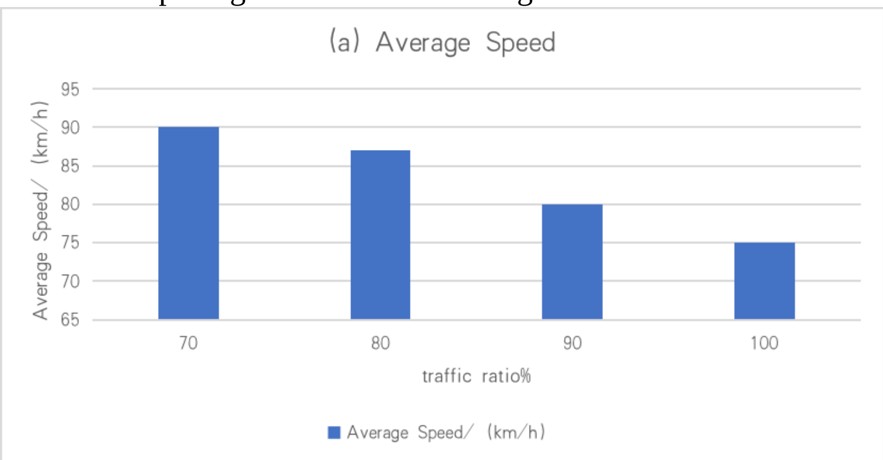
5. Analysis and Testing of the Model

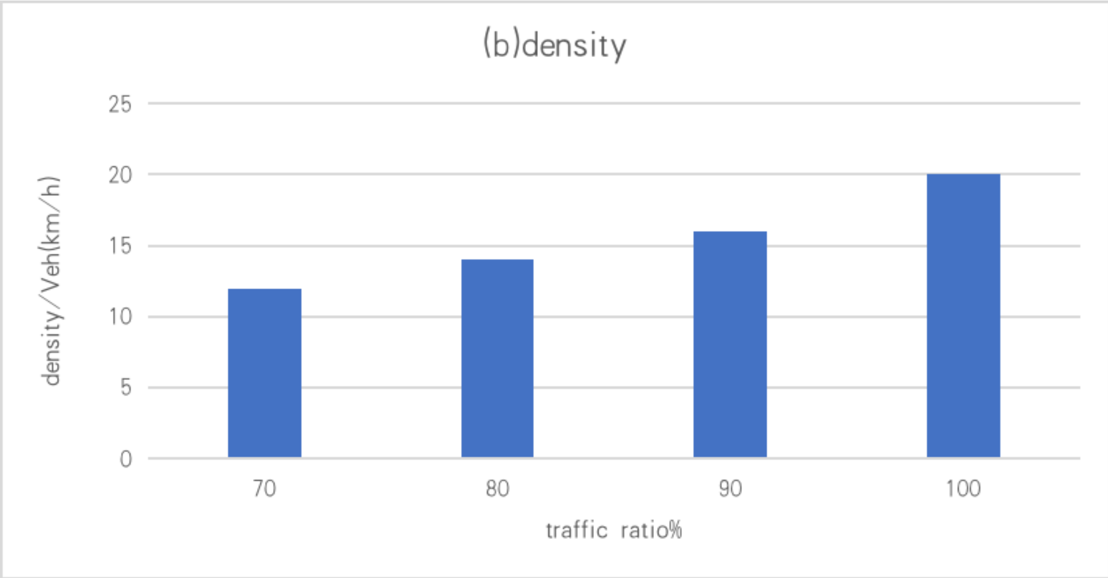
5.1 Model Checking Combined with Case Analysis

In questions two and three, we use multiple community examples as the basis for testing the correctness of the model. By applying the model to reality and obtaining reasonable results, we believe that within a certain error tolerance range, the model we build has strong reliability.

5.2 Model Verification Based on Traffic Simulation Software Vissim

We take Case 1 in 5.3.2 as an example to illustrate the simulation software. We use the VISSIM simulation software to establish a simulation model of the surrounding road sections of the community to evaluated and analyzed the running state of the simulated road section. The corresponding sensitivity analysis is carried out with 70% and 80% of the benchmark respectively, and the traffic conditions at opening time are shown in Figure below:





(The table quotes from: Renmin University of China, community open road traffic impact)

Figure(a) is the Average Speed in Different Percentage of Traffic Volume.

Figure(B) is the Density in Different Percentage of Traffic Volume.

From the figure above, it is obvious that as the road is put into operation in the future, the traffic volume is also increasing year by year, the operating status of this section of the road has deteriorated year by year , and the operating status of traffic has also significantly deteriorated. Therefore, we conclude that the opening of the community will ease the traffic pressure on the surrounding main road, thereby contributing to traffic conditions. This conclusion is consistent with our analysis in 4.2.3, so it also proves that our model has strong reliability.

6. Model Evaluation and Optimization

6.1 Evaluation and Optimization of Problem One Model

6.1.1 Evaluation of Cluster Analysis Method and Analytic Hierarchy Process

(1) Evaluation of the cluster analysis method: The advantage is that it can separate those that are not very separable. The data is clustered, but the existing traditional fuzzy clustering analysis methods often do not fully consider the correlation between the attributes of the clustering target and the importance of different feature attributes to the clustering target. The problem cannot be ignored.

(2) Advantages of Analytic Hierarchy Process: This method is especially useful for systematic evaluation of unstructured characteristics and multi-objectives, multi-criteria, etc. The results are simple and clear, and the credibility is high. However, although the analytic hierarchy process can simply refer to the comprehensive. Scaling, but the determination of weights is too subjective.

6.1.2 Improvement of Weight Determination in Cluster Analysis Method

In order to effectively reduce the subjectivity of expert evaluation and enable the quantified judgment value to reflect the actual situation more objectively, we introduce the “nine-quantile method” to allow experts to compare the relative importance of each evaluation index. Use 1, 3, 5, 7, 9, 1/3, 1/5, 1/7, 1/9 and other values to represent the relative importance.

6.1.3 Improvement and Optimization of Ahp Combined with Principal Component Analysis

Firstly, establish a new evaluative index system; secondly, simplify the three-level indicators; then, through factor analysis to detect the correlation between variables, constructed a scoring matrix constructed objectively and accurately. Finally, used the linear comprehensive evaluation method to obtain the comprehensive score value of each index, and establishing a reasonable evaluation system.

6.2 Evaluation and Optimization of Problem Two Model

6.2.1 Evaluation of Fuzzy Comprehensive Evaluation Model

Advantages: The traffic state is dynamic and uncertain, that is, it is expressed as ambiguity. We also know that fuzzy set theory plays a great role in expressing linguistic knowledge and describing the uncertainty of things, so we can better use it to describe the uncertainty of road traffic.

Disadvantages: the calculation is complicated, and the determination of the index weight vector is highly subjective; In some situations, the super-blur phenomenon will appear, the resolution is very poor; Cannot solve the problem of information duplication caused by correlation between evaluation indicators, membership function, fuzzy correlation matrix and so on.

6.2.2 Improvement and Optimization of Fuzzy Comprehensive Evaluation Model

1). Determine the membership degree $r_{ij}(i=1,2,\ldots,m; j=1,2,\ldots,n)$ of the i-th index of the sample U to j v, and get the fuzzy matrix $R_{m\times n}$

2). Determine the weight w_i of the index I, and get the weight vector :

$\mathrm{W}=(w_1, w_2, \ldots, w_m)$

3). Calculate the comprehensive membership degree: $B = W \circ R$

4). Overall score: $H = \sum_{j=1}^{n} b_j$

5) Evaluation result: According to which type of j is closest to the calculated value of H, it can be judged which type of sample U belongs to.

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