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Research on the Influence of Open Community on Road Traffic

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Abstract: This paper mainly researches on the impact of open community which provides traffic capacity to the surrounding roads. First, we set up fluid dynamics model and one-way traffic organization optimization model in microcirculation traffic network. The fluid dynamics model is used to analyze the influence on the traffic capacity to the surrounding roads once the community is open. And the optimization model of one-way traffic organization in the microcirculation traffic network is used to study the connection between the traffic capacity of surrounding roads and the internal structure of a community. We can indeed look for positive and negative influences on the openness of the community. Then we look at the road network in a community like the branches of the surrounding roads so that we can analyze its diversion capability. We can also get a variation in vehicle flow before and after the community opens. The negative numerical value means the decrease in vehicle flow, the open community can certainly reduce the pressure on the surrounding roads, which reduces the traffic time. Finally, we choose and simplify three communities in real life, perform microcirculation on the internal and surrounding roads, analyze the data by a genetic algorithm. According to the latter, we know the relation of variation of the genetic algorithm before and after the opening of the community. After a quantitative analysis of saturation, it is believed that there is a link between the internal structure of a community and its opening situation. This will affect driving time if the internal structure of the community is too complicated, it could have a negative impact on the traffic capacity of the surrounding roads. But for those communities, whose inner roads are divided obviously with clear layers and with many connectors to surrounding roads, can be opened, moreover, they can improve the congestion problem significantly in the surrounding areas.

Key Words： Hydrodynamic Model, Traffic Microcirculation, One-way Traffic Organization Optimization Model, Genetic Algorithm, Bi-level Programming.

1 Introduction

In recent years, China's government's commitment to extend the blocking system, in principle the establishment of closed residential areas, has built houses and units to gradually open up the courtyard, the internal public, solve the problems of layout of the network, promote the use of land conservation. The structure of the urban road network is a conviction that the closed communities have damaged and blocked the ‘capillary’ city, which is likely to cause traffic congestion. After the opening of the plot, the density of the road network, the road surface of increased traffic capacity will increase. Also suggested that, given the size of the community, location, external and internal factors such as road conditions and can not be generalized. Others believe that after the plot opens, although passable roads have increased, the area around the intersection of main roads within and outside the community of vehicles will also increase, also influence the speed of road traffic.

The effect of the community is open and can be associated with the cell structure and the surrounding road structure and traffic flows. In this article, different types of community models are established and quantitative comparison of different types of community open on the road before and after the impact are presented. And the established mathematical models on traffic are used to study the effect of the open area on the surrounding traffic.

2 Assumptions

(1) Suppose that after the community opened, the parking spaces in the district have decreased since the parking prohibited on the roads.
(2) Suppose that after the plot opened, the traffic network loads even better.
(3) Suppose that after the community opened, per capita road space more.

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(4) Suppose that after the plot intersections opened, factors such as the rate of road accidents have increased.

3 Model symbols

This article will deal with an open space modeling model of the impact on traffic in the vicinity. The fluid dynamics model of the circulation organization at the periphery of microcirculation in the network optimization model traffic, analyze the impact of the open community on the surrounding road traffic and the area around the relationship between road vehicles as well as the internal structure of the community. Then choose three types of community in reality, using genetic algorithms to analyze the data, open the community before and after the relationship between the saturation of the surrounding roads, which used specific symbols as shown in Table 1.

Table 1: Symbol description of the model

Symbol	Meaning	Work Unit
k	Traffic density	$cars / km$
q	Traffic flow	$cars / hour$
x	Space	
t	Time	s
u	Space mean speed	$km / hour$
T	Relaxation time of car-following theory	s
u_e	Balancing speed	$km / hour$
v	Expectations index	
S	Access to community traffic	$cars / hour$
δ	An empirical coefficient $\delta \in [0,1]$	
ϕ	Rate of change of traffic on the main road	
V	Node set	
A	Set of road sections	
B	Branch road set	
$l(a)$	Road length	km
$(q_{rs})_{m \times n}$	Traffic demand	
q_{rs}	The flow of node r to node s	
$y(a), a \in B$	Section one-line decision variables set	
$B(y)$	Set of feeder road	
$C_0(a)$	Traffic capacity	
$x(a, y)$	The flow of sections of $a \in A \cup B(y)$	
$S(a, y)$	Saturation	
$\overline{S}(a, y)$	Maximum saturation	
$L(r, s)$	Path number of(r ,s)	
f_k^{rs}	The traffic of no.k path between(r,s)	
$t_a(x(a))$	Impedance function	
t_{a0}	The drive time of the free flow section of path a	min
α , β	Calibration of parameters	
$y(a), a \in B$	Branch section of the line the decision variables	
$Z_{\max}$	Upper limit of objective function $Z(y)$	

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4 The Model

4.1 On the mathematical model of traffic

Due to the effect of the community open and which can be associated with the cell structure and the surrounding road structure and traffic flow. So we built a model of fluid dynamics to analyze the impact of community open to the surrounding road traffic[1,2]. However, this model does not analyze the impact of community structure on the surrounding roads. So our second model, one-way traffic organization in traffic network optimization model of microcirculation to analyze the internal structure of the area around the road and community relations[3,4].

4.1.1 Establishment of Model 1

4.1.1.1 Fluid kinematics model

According to M.J. Lighthill and G.B. Whitham, a famous fluid dynamics model using the first order continuum model first proved the shocks, the traffic characteristics and their application in road traffic analysis in order to establish the theory of traffic. And traffic should satisfy the continuity formula:

$$\frac{\partial k}{\partial t}+\frac{\partial q}{\partial x}=s(x,t) \qquad (1)$$

For the volume of traffic, where k is treated as traffic density, q is the traffic flow, x and t are space and time, respectively, and u is set to be the space average speed. The following expression can be achieved:

$$q=ku \qquad (2)$$

Assuming that the equilibrium relation between the average speed and the traffic density is as follows:

$$u=u_e(k) \qquad (3)$$

By characteristic method of solving simultaneous formulas (1) and (2) and (3), where the characteristic lines intersect, namely the shock waves generated by the traffic.

Due to the first order continuum model, it does not consider the effects of acceleration, inertia and assumes that the traffic is in equilibrium. Therefore, in real life, there can be no traffic response characteristics in unbalanced conditions. And the following dynamic models are launched.

4.1.1.2 Dynamic model

According to the concept of car-following theory, H.J. Payne introduced the momentum formulas of fluid dynamics to traffic flow analysis. The average velocity u and the density k take the relation as follows:

$$u(x,t+T)=u_e(k(x+\Delta x,t)) \qquad (4)$$

where $\Delta x=0.5/k$, the relaxation time of the car and the chi theory is Taylor in both side of formula (4) with T and Δx, the following formula can be achieved：

$$\frac{du}{dt}=\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}=-\frac{1}{T}(u-u_e(k))-\frac{v}{kT}\frac{\partial k}{\partial x}$$

（5）where u is the traffic flow speed, u_e is balancing speed, $v=-0.5\frac{\partial u}{\partial k}>0$ is the expectations index, $-\frac{1}{T}(u-u_e(k))$ is relaxation items. Rule that the driver adjusts the speed of the car to the speed of the car. And $\frac{v}{kT}\frac{\partial k}{\partial x}$ is the expectations index. Adjust the driver to respond to future traffic. Due to traffic in the open community area is affected by traffic from the main road, then, add an element in formula (5), the following formula can be achieved :

$$\frac{du}{dt}=\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}=-\frac{1}{T}(u-u_e(k))-\frac{v}{kT}\frac{\partial k}{\partial x}-\frac{\delta us}{k} \qquad (6)$$

where s is the traffic in and out of the neighborhood, δ is the empirical coefficient whose value is changing between [0,1].

This model is the basic method to consider the community open on the main street in front of traffic and the rate of change between traffic flow after the opening of the plot. According to the quantitative analysis, the community open does not influence the opening of the traffic flow on the main roads. However, there exists one problem that need to be noticed about this model is that the community is only considered as a branch. Then the spread of the main road, ignoring the surrounding roads, the effects of the community structure and therefore we model two, used to analyze the internal space of the community and the surrounding roads.

4.1.2 Establishment of Model 2

4.1.2.1 One way traffic organization problem

Assuming that the microcirculation of the urban traffic network consists of several sections of roads and within the community network. The width of the road because the community is still very limited, if the two-way vehicles, although you can provide convenience for travelers, but bidirectional traffic conflicts often decrease in two-way traffic capacity, unidirectional traffic capacity less organized. In order to ensure that the transport network in circulation throughout the transport network plays an important role, the best possible efficiency of the vehicle, traffic on the network is necessary according to the actual structure of traffic demand and the structure of the transport network, organizational optimization of one-way traffic.

The microcirculation of the organization of unidirectional urban traffic in the traffic networks are sections of each extension on the network of microcirculation in urban traffic. That determines whether the traffic of the line of the organization and determines its direction, consists of sections (such as width of the road, etc.) as well as the traffic demand and other factors. Thanks to the organization of a one-way traffic flow, the reduction of the saturation of the road sections on the one hand balance that regional road traffic is proper response.

(1) One-way traffic organization analysis

The microcirculation of the organization of unidirectional traffic in the optimization of the road network can be analyzed from the following aspects:

1) To minimize the average road saturation, a ‘traffic system’ is developed as one of the main objectives. Average road saturation reflects mean saturation levels for the main road network (does not reflect a specific section of the saturation level).

2) Saturation Ultra-limited edition of road sections, called ultra-limited saturation, is the highest expected saturation in relation to the road, reflecting a single saturation of a maximum degree of maximum section saturation, which is complementary To minimize the mean of saturation.

3) Minimizing the average community saturation means ensuring open measures of the ‘transport system in circulation’, reflecting the average levels of saturation in the road network in the community as a whole (do not reflect the specific saturation level of the community, The internal network community).

In addition, when you consider the level of saturation within a particular community because you can restrict access to the community, maximize the expected saturation method of traffic restrictions, so that each community in the sense of expected maximum saturation may be constrained.

4.1.2.2 One-way traffic organization in traffic network optimization model of the microcirculation

For a given microcirculation network $N = (V, A \cup B)$,

where $V = \{v_1, v_2, \Lambda, v_n\}$ is set of note, A is the trunk road sections set (there are two phases in A between adjacent nodes, which correspond to the direction of the two), B is the village road set (there is only one undirected edge between adjacent nodes in B ,whether one-way and driving direction). Section length is $I(a), a \in A \cup B$. Traffic demand is $(q_m)_{m \times n}$, where q_m is the traffic of node r to node s.

Assuming that $y(a), a \in B$ is the single line decision variable set, for $a = (Vi - Vj), i < j$, $y(a) = 0$ adjust that a is a two-way road, $y(a) = 1$ adjust that this is a one-way road between v_i and v_j, $y(a) = -1$ adjust that this is a one-way road between v_j and v_i.

After the confirmation of $y(a), a \in B$, the driving direction of section $a \in B$ will be confirmed with it. Thus, $B(y)$ can be called as the internal route set within the community under the condition of causing no confusion as well.

The road section capacity $C_0(a), a \in A \cup B(y)$ can be calculated correspondingly according to the one-way scheme $y(a), a \in B$. It is noteworthy that $C_0(a), a \in A \cup B(y)$ is related to the variable $y(a), a \in B$ and has no certainty seemingly. In fact, for any $y(a), a \in B$, there are two possibilities of one-way driving and both way driving, while it is assumed that the capacity of both directions are the same. Therefore, $C_0(a), a \in A \cup B(y)$ can be acquired immediately, no matter how $y(a), a \in B$ changes, provided that the corresponding capacity value is calculated in advance based on the two circumstances of one-way and both-way driving. For simplicity’s sake, the road section capacity before the transformation is expressed as $C_0(a), a \in A \cup B(y)$ in the article and it is deemed as known.

The flow of section $a \in A \cup B(y)$ is $x(a, y)$ and the saturation is $S(a, y) = x(a, y) / C_0(a)$. The maximum main road average saturation is shown as

$$\min_{y} \sum_{a\in A} l(a)S(a,y) / \sum_{a\in A} l(a) \qquad (7)$$

The maximum saturation $\overline{S}(a), a\in A$ shows that the expectation meets

$$S(a,y) \le \overline{S}(a), a\in A \qquad (8)$$

However, $a \in A$ of the main road cannot be restricted with the above formula strictly. Therefore, the maximum main road saturation ultra-limited can be expressed as

$$\min_{y} \sum_{a\in A} \max\{S(a,y) - \overline{S}(a,0)\} \qquad (9)$$

The maximum internal road average saturation within the community can be expressed as

$$\min_{y} \sum_{a\in B(y)} l(a)S(a,y) / \sum_{a\in B(y)} l(a) \qquad (10)$$

The reason why the average saturation of the main road and roads in the community are divided into two objective functions is that the focus is different during the optimization process.

In view that the maximum saturation can be realized through restricting the flow entering into the community for roads within the community, formula (8) can be expressed as

$$S(a,y) = \frac{x(a,y)}{C_0(a)} \le \overline{S}(a), a\in B(y)$$

The constraint condition of road flow within the community can be acquired as,

$$x(a,y) \le \overline{S}(a) C_0(a), a\in B(y) \qquad (11)$$

The capacity of the link, in the community section of the maximum expected saturation limit, traffic flow can be achieved through an allocation of user balance. Above, the traffic network of the microcirculation in the problem of the optimization of the organization of the circulation of the line can. Through the structure, double planning of the target, plan the decision variable higher for the internal sections of the community one-way organization programs, optimization goal for minimum cross sections average saturated degrees and minimum road sections super-saturated degrees; through the sections all sense of flow in the capacity of the sections of the road, and the capacity of the internal sections of the community and the Xia saturated limits meet the rules of user balance, all flows are in the direction of the lower sections of the planning of the decision variables. The microcirculation of the organization of unidirectional traffic in the two-level programming of the optimization of the traffic network can be described as follows:

Upper-level planning for:

$$s.t.\begin{cases} \min_{y} \sum_{a\in A} l(a)S(a,y) / \sum_{a\in A} l(a) \\ \min_{y} \sum_{a\in A} \max\left\{S(a,y) - \overline{S}(a), 0\right\} \\ \min_{y} \sum_{a\in B(y)} l(a)S(a,y) / \sum_{a\in B(y)} l(a) \\ S(a,y) = x(a,y)/C_0(a), a\in A \\ S(a,y) = x(a,y)/C(a), a\in B(y) \\ y(a) = -1,0,1, a\in B \end{cases}$$

There into, $x(a,y), a\in A$ meets the lower-level planning:

$$s.t.\begin{cases} \min_{x} \sum_{a\in A\cup B(y)} \int_0^{x(a,y)} t_a(w)dw \\ \sum_{k=1}^{L(r,s)} f_k^{rs} = q_{rs}, r,s = 1,2,\Lambda,n \\ x(a,y) = \sum_{r=1}^{n}\sum_{s=1}^{n}\sum_{k=1}^{L(r,s)} f_k^{rs}\delta_{ak}^{rs}, a\in A\cup B(y) \\ f_k^{rs} \ge 0, r,s = 1,2,\Lambda,n, k = 1,2,\Lambda,L(r,s) \end{cases}$$

In the above planning, $L(r,s)$ is the path number of OD to (r,s) and f_k^{rs} is the traffic flow of Path k of OD to (r,s). If Section a is on Path k of the dot pair (r,s), δ_{ak}^{rs} is 1; otherwise, it is 0. $t_a(x(a))$ is the road impedance function. Here, it adopts the function developed by bureau of public road, namely, BPR function.

$$t_a\left(x(a,y)\right) = \begin{cases} t_{a0}\left(1+\alpha\left(x(a,y)/C_0(a)\right)^{\beta}\right), a\in A \\ t_{a0}\left(1+\alpha\left(x(a,y)/\left(\overline{S}(a)C_0(a)\right)\right)^{\beta}\right), a\in B(y) \end{cases}$$

There into, t_{a0} is the driving term (min) of the free flow Section a, a and β are parameters to be calibrated and the BPR function suggests: $\alpha = 0.15, \beta = 4$.

The constraint (11) of the road section capacity and the expected maximum community saturation are not directly displayed in the above model, which is displayed by the BPR function. If necessary, the capacity constraint (11) can be added to the lower level to restrict by-pass strictly. Some roads in the community can also be regulated as one-way roads, even by positioning one-way roads with specific

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directions depending on the experience of traffic organization or travel habits.

4.1.2.3 One-way traffic organization optimization genetic algorithm in the microcirculation traffic network

It is a multiple-target planning to introduce non-negative equivalent factors: ξ_1, ξ_2, ξ_3, and unifying the three objective functions planned in the upper-level as a single objective function.

$$\min Z(y) = \xi 1 \sum l(a) S(a,y))/(\sum l(a) + \xi 2 \sum \max\{S(a,y) - S(a), 0\} + \xi 3 \sum l(a) S(a,y))/(\sum l(a)$$

Given the complexity of two-tier planning, the algorithm for the design solution of the genetic algorithm is adopted.

The one-way decision variable $y(a), a \in B$ of the by-pass is coded to acquire $(y(a), a \in B)$ and estimate the upper bound of the objective function $Z(y)$, marked as $Z_{\max}$. The construction of fitness function is $F(y) = Z_{\max} - Z(y)$. The genetic algorithm to design one-way traffic organization optimization is as follows:

Algorithm Genetic algorithm of one-way traffic organization optimization.

Input the traffic demand $(q_{rs})_{m \times n}$, the traffic capacity $C_0(a)$, the road length $l(a)$, the maximum expected saturation $\overline{S}(a)$ and the free flow driving time $t_{a0}, a \in A \cup B$.

Output one-way traffic organization decision $y(a), a \in B$, the flow of each section $x(a,y), a \in A \cup B(y)$, the saturation of each section $S(a,y), a \in A \cup B(y)$, the average saturation of the main road and the average saturation of roads within the community.

Procedure:

Step 1 Initial group generated randomly.

Step 2 Implement the following steps

in circulation.

(1) For each individual $y(a), a \in B$, the assignment to the user's equilibrium will be made in the direction search mode, which should correspond to the section flow $x(a,y), a \in A \cup B(y)$ of each individual $y(a), a \in B$.

(2) For each individual y(a), a ∈ B it will use the objective function and adaptability of $x(a,y), a \in A \cup B(y)$.

(3) The next generation of the group is built by selection, exchange, variation and copy, etc.

(4) The completion of the algorithm will be confirmed according to the genetic algebra of the update frequency and the objective function, etc.

The purpose of this model lies in the structure of the community and under the influence of the environment, considers whether to open the community and open the community impact of good or evil. Quantitative analysis of the situation of the community, urban planning and traffic management provides the theoretical basis of decision-making.

5 Solutions

5.1 Quantitative comparison of various types of community before and after the opening impact on road

5.1.1 Taking into account the community model of traffic

According to an established fluid dynamics model, consider only the traffic cases, communities may be reduced to a branch on the main road[5], as shown in Figure 1.

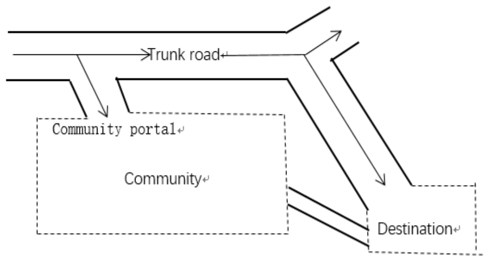

Figure 1. Flow diagram

Using the model of a formula (1), (2), (3) and (5), the following formulas can be achieved:

$$\frac{\partial u}{\partial t} + (\frac{0.5}{kT} + u)\frac{\partial u}{\partial x} = 0 \qquad (12)$$

The characteristic formula is:

$$\frac{dt}{1} = \frac{dx}{\frac{0.5}{kT} + u} \qquad (13)$$

The characteristic line is:

$x - (\frac{0.5}{kT} + u)t = C$ (C is an arbitrary

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constant) （14）

Let $\varepsilon = x - (\frac{0.5}{kT} + u)t$,then

$\frac{\partial \varepsilon}{\partial x} = 1 + \frac{\partial u}{\partial x} t$, $\frac{\partial \varepsilon}{\partial t} = -(\frac{0.5}{kT} + \frac{\partial u}{\partial t} t + u)$;

substitute $\frac{\partial \varepsilon}{\partial x}, \frac{\partial \varepsilon}{\partial t}$ into (11) and acquire：

$$u = 1 - \frac{0.5}{kT} \quad (15)$$

The formula (2) in the simultaneous model acquires:

$$q = k - \frac{0.5}{T}$$

Given the influence of community bypass on the main road after community opening, the following result is obtained in formula (1), (2), (3) and (6) in Model I of Question 2):

$$\frac{\partial u}{\partial t} + (\frac{0.5}{kT} + u)\frac{\partial u}{\partial x} = -\frac{\delta us}{k} \quad (16)$$

In a similar way: $u_1 = \frac{k}{\delta s}$, $q_1 = \frac{k^2}{\delta s}$

From the above we can know that the traffic flow rate of change of the main road is:

$$\phi = \frac{q_1 - q}{q} = \frac{Tk^2}{\delta s(kT - 0.5)} - 1 < 0$$

Given the community's effect on trafficking, only a context can be considered as an open area on the surrounding road capacity and has, to a certain extent, reduced the pressure on the main roads and reduced road congestion.

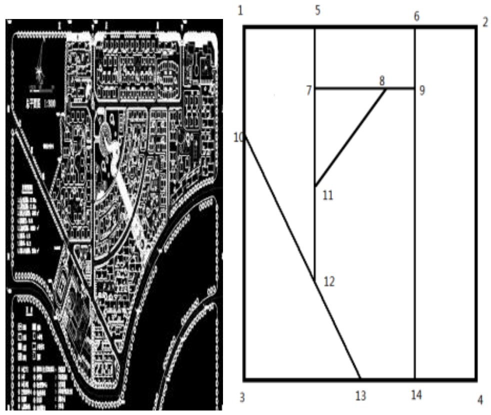
From the rate of change ϕ <0, we know that in considering the effect of community open to traffic only context can be thought of open area on the surrounding road capacity has helped. And to a certain extent, reduce the pressure of main roads and reduce traffic congestion.

5.1.2 Consider the internal structure of the community model

We selected three types of community and established a schematic diagram to analyze the influence of internal structure on the surrounding roads. The original figure is shown in Figure 1; and the schematic diagram traffic network is shown in Figure 2. Numbers in these figures show the model scheme. The thick line shows the main road set A of both-way road; and the thin line shows the by-pass road set B.

To simplify operation, we simplify each route as a path to the same length.

Aiming at community A : for each road, $a \in A \cup B$ the road lenth is $l(a) = 0.3km$; the free flow driving term is $t_{a0} = 0.3\min$. The maximum expected saturation is $\overline{S}(a) = 1$. For $a \in A$, the direction capacity of both-way driving is 2000 vehicles / hour. If , $a \in B$ the capacity of each direction of both-way driving is 500 vehicles / hour, and the one-way driving capacity is 1400 vehicles / h. The traffic demand are $q_{1,4} = q_{4,1} = 1200$ vehicles / h and $q_{2,3} = q_{3,2} = 1000$ vehicles / h.



(1) Original figure of community A (left)
(2) Schematic diagram of community A(right)
Figure 2. Original figure and schematic diagram of community A

It is based on the above data and uses the genetic algorithm solution. First, reasonable values of ξ_1 , ξ_2 and ξ_3 , item 2 weight in formula (6) will be larger through evaluation namely, trying to make the road flow be lower than the maximum traffic capacity.

The both-level model is acquired through the genetic algorithm. The optimization parameter is y and the variable number (chromosome length) is 5 (namely, the number of microcirculation roads). The genetic algorithm program (refer to Attachment 2 for the program) is prepared with $MATLAB\ 7.0$. The iterations are 30, the number of population is 300, the crossing-over rate is 0.7 and the aberration rate is 0.1. The optimization result is as follows:

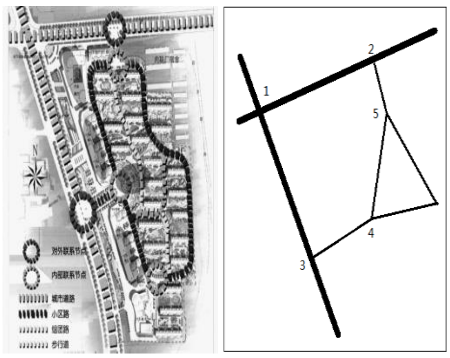
The average total saturation is 0. 7368, where the mean saturation of the main road is 0.6590 and the average saturation of the average circulation of the microcirculation is 0.5374.

Figure 2 shows the community due to dangerous areas, and the area around the road less, although the open area for the ability of the surrounding road to relieve pressure, but increases travel time. The opening of such a community, as the case may be.

Community B the parameters shown in the following table:

Table 2: Parameters of community B

Road length l(a)	0.3km
Free flow driving time t_{a0}	0.3min
Maximum expected saturation $\bar{S}(a)$	1
Direction capacity of both-way driving	1500 vehicles/h
Each direction capacity of both-way driving	800 vehicles/h
Capacity of one-way driving	1200 vehicles/h
Traffic demand $q_{1,4} = q_{4,1}$	1200 vehicles/h
Traffic demand $q_{2,3} = q_{3,2}$	1000 vehicles/h



(1) Original figure of community B (left)
(2) Schematic diagram of community B(right)
Figure 3. Original figure and schematic diagram of community B

By orienting Community B in the figure, the two-level model is acquired in the genetic algorithm. The optimization parameter is y, and the variable number (chromosomal length) is 12 (that is, the number of microcirculation routes). In the same way, the iterations are 30; The population is 300; The rate of passage is 0. 65, and the aberration rate is 0. 08.

The average total saturation is 0.864, the average saturation of the main road is 0. 5988 and the mean saturation of the road of the microcirculation is 0.5928.

Figure 3 shows the community is located in an area that is not very prosperous, and the area around the road is less important. Although the community opening reduces the pressure of the traffic capacity of surrounding roads, it has increased the travel time. Therefore, if these communities are open or not, they must be based on real conditions.

Parameters of community C are shown as follows:

Table 3: Parameters of community C

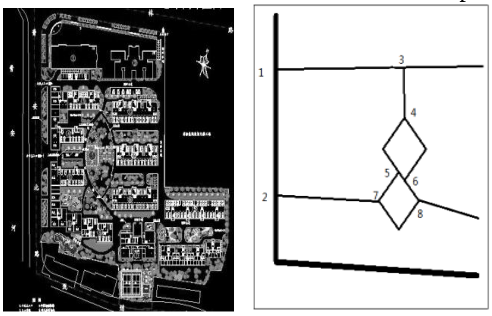
Road length l(a)	0.3km
Free flow driving time t_{a0}	0.3min
Maximum expected saturation $\bar{S}(a)$	1
Direction capacity of both-way driving	1500 vehicles/h
Each direction capacity of both-way driving	800 vehicles/h
Capacity of one-way driving	1200 vehicles/h
Traffic demand $q_{1,4} = q_{4,1}$	1200 vehicles/h
Traffic demand $q_{2,3} = q_{3,2}$	1000 vehicles/h

For the three communities of the figure, the two-level model is acquired by the genetic algorithm. The optimization parameter is y, and the variable number (chromosome length) is 5 (namely, the number of microcirculation roads). In the same way, the iterations are 30, the number of population is 400, the crossing-over rate is 0.8 and the aberration rate is 0.05. The optimization result is as follows:

The total average saturation is 1.5372, the average saturation of the main road is 0.698 and the mean saturation of the road of the microcirculation is 0.6029.

Figure 4 shows that, the road pressure around community types rather than increase, have had a negative impact. Therefore, this type of community is not suitable for openness.

After analyzing the three different types of community, the community interface with the roads and surrounding roads is clear in the community, not the busy phase, opening the main road, the small community around. Import and export of the community on the same main street, as well as in the community, there is no structured entry too weak, for the internal channels of the community mainly for community service, they should may depend on the current situation to decide open.



(1) Original figure of community C(left)
(2) Schematic diagram of community C(right)
Figure 4. Original figure and schematic diagram of community C

6 Conclusions

By calculating the results, community is open or not associated with the internal structure of the community if the community internal structures are too complex. This will affect the journey time. The surrounding road traffic capacity can have a negative impact because the internal roads of the community are divided into clear. There is a hierarchy, structure and other surrounding roads, although the community interface may be open and could dramatically improve traffic congestion surrounding issues.

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