

## **Based on the Open Research on the Influence of the Traffic Capacity**

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**Abstract:** Due to the rapid development of the city, the city scale is more and more big, the urban road congestion problem increasingly serious, in order to improve urban traffic conditions, open has become a important way. Based on the analytic hierarchy process (AHP), the calculation method of SPSS (Statistical Product and Service Solutions) and vissim simulation system, and classifying area, collect the real data of the area surrounding traffic, through the analysis of the weighting analysis, mathematical model is established the of the theory in gated community open question for study, and put forward reasonable suggestions.

**Keywords:** Analytic hierarchy process (AHP); Vissim simulation system; Mathematical simulation; Mathematical statistics software SPSS

### **Introduction**

From farming and social development to now, China is still a walled society: the city walls, units in the walls on the fence, all kinds of the neighbourhood, DaTiLiang land transfer, and big projects blustery, the land of the main street of all kinds, big square, community, large cycle, too big yard to separate a city, to form a closed unit, has become a city block of microcirculation of a big MAC.

The world is in the direction of diversification development, and single residential structure in China, mostly residential building closed structure, and the enclosed residential area makes urban spatial structure, the lack of a continuous public space carrying people's activities and communication; In addition, community internal and external isolation results in the decrease of urban road network density and accessibility, and internal travel mainly depend on the city's main roads, cause interference to urban road, the urban traffic congestion problem increasingly prominent, in addition, the closure of large residential suburbs spread disorderly let resources and the environment is destroyed, the urban space of residential differentiation phenomenon more and more obvious.

Block system is usually USES the way of city planning and construction of the western countries and is, in fact, surrounded by the urban main road, small and

medium-sized streets segmentation, road network density is higher, improve the public transport, public service facilities supporting to the nearest open block model. The main difference of gated community with China lies in the scale, the size and diversity. Push block system in a sense, is the gated community with rich become the block system of village, village road public. The main purpose is to intensive use of land, optimizing urban road layout, the final point is to treat and prevent. Jane Jacobs has repeatedly stressed the diversity of the city. Blocks should not only provide housing, and to have a lot of business and leisure packages. The house with the outside world through comprehensively, forming a fenceless open society. Implement internal public roads, solve the problem of traffic road network layout, set up the "narrow road, dense network of urban road layout idea, construction of expressway, primary and secondary distributor roads and branch gradation reasonable road network system. Based on neighborhood comparison before and after the open study, aims to put forward reasonable Suggestions.

### **1. The problem analysis**

With the rapid development of economy, various types of cars in the city gradually popularization, the community building is becoming more and more popular, more and more common, so the network structure is loose and wide, makes the urban traffic congestion problem is increasingly serious. Area open to the influence of road traffic has become the focus of today's society, is a focus topic of widespread public concern, it is closely related to our life. Village open could improve now serious traffic jams, improve road traffic capacity, optimize network structure, but it may also be because of the village and opening up, in and out of the increase in the number of the intersection area, the area surrounding the main speed have influence, so for the effects of community open everyone, however, how to balance transportation and living environment is a big difficulty.

Surface of the phenomenon, this is a very complex social problem. To accurately consider from all aspects, comprehensively accurately collect a large number of community surrounding roads traffic data is difficult. If we are to measure the traffic capacity of road traffic, village open the impact on the surrounding roads, this I'm afraid I can't have higher credibility. Because it has many influence factors, such as plot structure layout type, can achieve reform feasible degree, in the whole of the geographical location, the surrounding traffic conditions, different times surrounding roads of the vehicle speed, etc.

#### **1.1 Model assumptions**

- (1) Assume that all cart can't enter the village road.
- (2) Hypothesis pathways for two-way lane in the community.
- (3) Hypothesis into the community after the vehicle speed is 15 km/h.
- (4) Assumes that the accident, the road vehicle no longer turn.
- (5) Suppose all influence factors on the theoretical value.

## 1.2 Symbolic description.

Symbol	Instructions	Symbol	Instructions
$\mu_{ab}$	The sample correlation coefficient	$Cov(a,b)$	Two groups of data covariance
C	On an average day on the road traffic	$Q$	The starting point of the traffic
$\beta_n$	Delay parameters on the ij sections	$\beta_{ji}$	The first in the region in the ith node j social indicators

Tab.1 Symbols that table

## 1.3 The community open evaluation index system of influence on surrounding roads

We use the analytic hierarchy process (ahp) and comprehensive evaluation of residential traffic impact on the surrounding roads, open the complicated plot surrounding traffic problem as a system, the target is decomposed into three principles: the construction of community, community surrounding traffic levels and comprehensive level to the community. From the rule layer further decomposed into more detailed indicators: the number of the entrances and exits, road, lane of the type, the number of intersections, traffic volume, traffic road network density, the number of the residents, bicycle, the outdoor parking lot number, residents travel mode. On the basis of the evaluation index to construct evaluation system to clear evaluation area open the impact on the surrounding traffic capacity.

## 1.4 Establishment of the model

Using ahp fuzzy comprehensive evaluation area open to the influence of surrounding roads impassable, from different index to evaluate district open more accurate and well organized, making the problem easy.

1) AHP (Analytic Hierarchy Process AHP for short) is the United States house of operational research, university of Pittsburgh; professor L.Saaty put forward in the early 1970 s, the AHP is a problem of qualitative quantitative analysis of a simple, flexible and practical method of multi-criteria decision making. Its characteristic is through the various factors of complex problems into interconnected orderly level, streamline, according to the structure of a certain objective reality of subjective judgment (mainly is the comparison of the two) the expert opinion and analysis of the objective judgment result directly and effectively combined with the importance of a two level elements compared to quantitative description. Then, using the mathematical method to calculate reflect elements at each level the value of the relative importance of the order through all levels between the total sorts of calculate the relative weight of all the elements and sorting <sup>[1]</sup>.

## 2) Establishment of the model

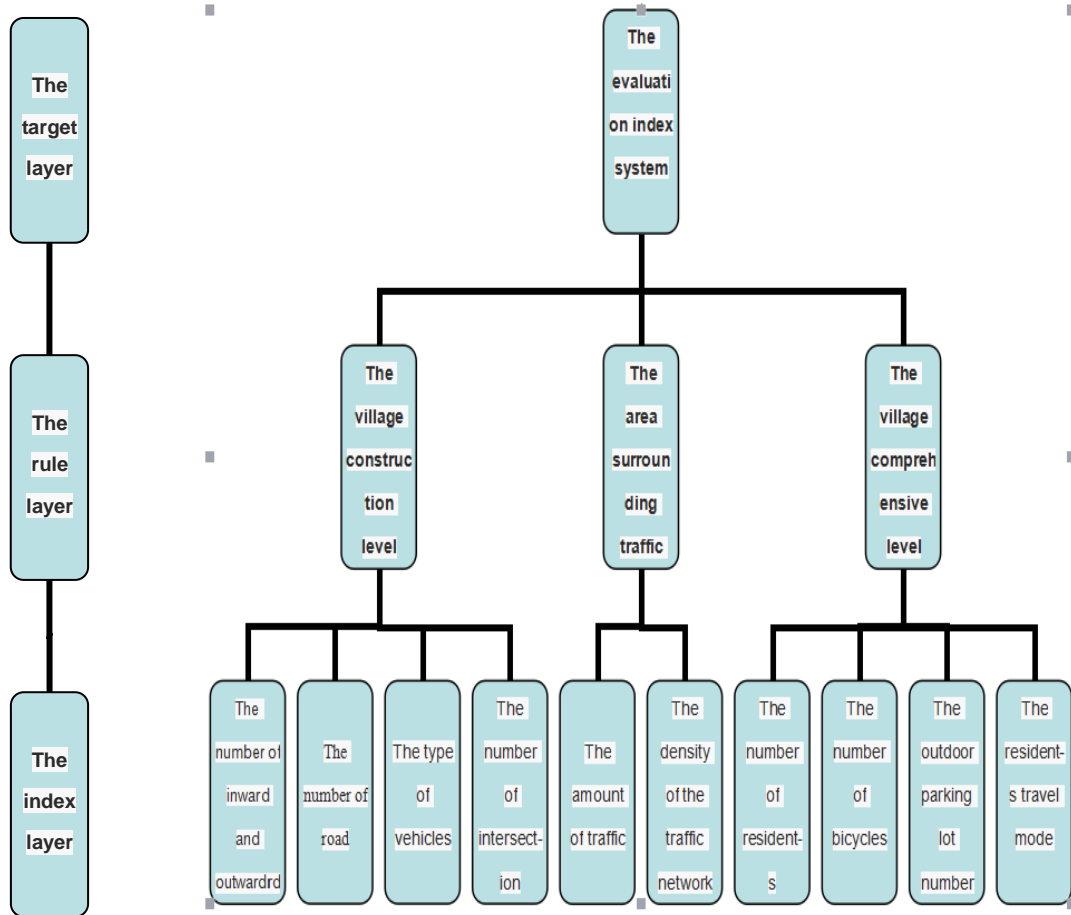


Fig. 1 The evaluation index system

Based on the mathematical model of traffic, in order to study the effect of area open to the surrounding roads traffic.

Based on community open on surrounding traffic impact evaluation index system, first of all we should get the real data of the area surrounding traffic. Then we use vissim simulation system to establish the theory of traffic model, and use the covariance model after the opening area are calculated in theory of road traffic volume comparing with actual data, finally it is concluded that open the impact on the surrounding traffic. According to a district intersection traffic flow, the use of the mathematical simulation of mathematical model, design related weight, through theory calculation into open access district 823 cars a day on average, 12.8% of traffic to ease the traffic pressure.

The model establishment and solving

1) City roads all kinds of main technical indicators (level) road<sup>[2]</sup>

The project category	Level	The design speed	The two-way traffic lane number (a)	Each traffic lane width (m)	The separation zone Settings	The cross-sectional adoption patterns
The expressway		80, 60	$\geq 4$	3.75	Must be set	Double, four
The main	I	60, 50	$\geq 4$	3.75	Should be set up	Single, double, three, four
	II	50, 40	$\geq 4$	3.75~3.5	Should be set up	Single, double, three,
	III	40, 30	2~4	3.75	Can be set	Single, double, three,
Time Road	I	50, 40	2~4	3.75~3.5	Can be set	Single, double, three,
	II	40, 30	2~4	3.5	Do not set	Single
	III	30, 20	2	3.5	Do not set	Single
Branch	I	40, 30	2	3.5	Do not set	Single
	II	30, 20	2	3.5	Do not set	Single
	III	20	2	3.5	Do not set	Single

Tab.2 Urban road main technical indicators

Using the VISSIM simulation system, will be open, set to a district traffic area. (residential flat cloth buy figure and surrounding roads. DWG and pictures in the attachment)

2) A district intersection traffic flow

Moment	North to south	On Monday South to north	Combined	On Tuesday, Three, Four		
				Combined	South to north	Combined
7-8	1390	1559	2949	1269	1429	2698
8-9	1255	1414	2669	1134	1335	2469
13-14	1059	900	1959	957	791	1784
14-15	1418	1118	2536	1253	925	2178
17-18	1277	1223	2500	1151	1075	2226
18-19	1505	1574	3079	1419	1313	2736
Combined	7904	7788	15692	7183	6868	14051

Tab. 3 A district intersection traffic flow

Moment	Moment	On Friday Moment	Moment	On Saturday Moment	Sunday Moment	Moment
7-8	1236	1526	2762	774	861	1635
8-9	1171	1238	2409	808	1070	1878
13-14	1018	900	1918	924	1008	1932
14-15	1339	1142	2481	1142	1253	2396
17-18	1238	1408	2646	792	740	1532
18-19	1467	1553	3020	1129	1011	2140
Combined	7469	7767	15236	5569	5943	11513

Tab. 4 A district intersection traffic

3) Calculate daily through the intersection traffic model is set up

$\mu_{ab}$  : The sample correlation coefficient.

$Cov(a, b)$  : Two groups of data covariance.

$\bar{k}_1$  : Average traffic in a week.

K: Non-uniform coefficient of every day in a week.

z: Day long.

$\hat{z}$  : Day length radian.

y: Nights are long.

$\hat{y}$  : Nights are long arc.

B: Traffic in daylight hours.

W: Traffic in long nights.

$\partial$  : Every day the road traffic.

V: Through the intersection traffic this week.

C: On an average day on the road traffic.

$$\left\{ \begin{array}{l} \mu_{ab} = \frac{Cov(a,b)}{\sqrt{D(a)}\sqrt{D(b)}} \\ Cov(a,b) = \sum_{i=1}^n (a_i - \bar{a})(b_i - \bar{b}) \end{array} \right. \quad (1)$$

$$\left\{ \begin{array}{l} \bar{k}_1 = \frac{\sum_{d=1}^n X_d}{7} \\ k = \frac{random}{\bar{k}_1} \end{array} \right. \quad (2)$$

$$\left\{ \begin{array}{l} z = \frac{\hat{z}}{360^\circ} \times 24 \\ y = \frac{\hat{y}}{360^\circ} \times 24 \\ z + y = 0 \\ \partial = \frac{zB}{yW} \end{array} \right. \quad (3)$$

By (1) (2) (3) available

$$C = V \times \mu_{ab} \times K \times \partial$$

#### 4) The analysis of the paradox phenomenon

Paradox Braess by mathematicians Diertrich Braess made in 1968, in an article, is a paradox. Paradox refers to the personal independent path of choice, for a certain network additional capacity (such as road, etc.), but can reduce the overall level of the entire road network. Sometimes add a section on a transport network, or improve the local traffic capacity of a road, on the contrary make all traveler's travel time increases, this in order to improve the capacity of investment not only failed to reduce traffic delays, it reduces the service level of the whole traffic network. People have done a lot of research on the problem, in the middle of the city construction and avoid the occurrence of this phenomenon. But in a complex urban road, paradox still appear from time to time, cause the efficiency of the actual traffic declined significantly if the Nash equilibrium of a certain road system is not the optimal state, it may produce paradox phenomenon<sup>[3]</sup>.

Paradox is not in two situations: One low traffic demand requirements:

$$Q > \frac{2(\alpha_n - \alpha_x)}{3\beta_n + \beta_x}$$

The second requirement for high traffic demand:

$$Q < \frac{2(\alpha_n - \alpha_x)}{3\beta_n + \beta_x}$$

$Q$  as the starting point of traffic;

$\alpha_n$  for the free time on the ij roads s;

$\alpha_x$  for the ij adjacent or intersecting roads free time s;

$$\beta_n \text{ for delays in the } ij \text{ road section parameters;} \quad \left\{ \begin{array}{l} \beta_n = \delta \left( \frac{v_{ij}}{c_{ij}} \right)^r \alpha_n \\ \delta = 0.15 \\ r = 0.4 \end{array} \right.$$

$\beta_x$  is in the first  $ij$  contiguous or intersection delay parameters on the road.

When  $Q$  is located in between the two, there will be no paradox phenomenon, see below:

$$\frac{2(\alpha_n - \alpha_x)}{3\beta_n + \beta_x} < Q < \frac{2(\alpha_n - \alpha_x)}{3\beta_n + \beta_x}$$

5) The village of inward and outward opening and vehicle flow of Significant relationships:

		Sum of squares	df	The mean square	F	Significant
	Between groups (combination)	1926516.050	4	481629.012	2.098	.089
Linear term	Comparison	488189.025	1	488189.025	2.126	.149
	Deviation	1438327.025	3	479442.342	2.088	.109
Within	Groups	1.722E7	75	229587.913		
	Sum	1.915E7	79			

Tab.5 The actual flow of vehicle before opening

		Sum of squares	df	The mean square	F	significant
	Between groups (combination)	1405525.321	7	200789.332	.815	.578
Linear Term	Unweighted	368031.183	1	368031.183	1.494	.226
	Weighted	235984.188	1	235984.188	.958	.331
	Deviation	1169541.132	6	194923.522	.791	.580
Within	Groups	1.774E7	72	246390.059		
	Sum	1.915E7	79			

Tab.6 The actual flow of vehicle after opening

From the table above, you can see that whether the village entrance open, is has a significant correlation to the actual traffic. But, through quantitative analysis and comparison, the open mouth of the community is not with the number of cars is



closely relative to actual flow.

### 3 Quantitative comparison before and after each type of community open to traffic.

The effect of open area is associated with surrounding environment. With our community structure classifying residential area, the quantitative comparison of the axis type layout type and block type layout. Finally, it will be digital, using our curve fitting the established mathematical model, and carries on the quantitative analysis of correlation coefficient.

3.1 The village of inward and outward open relationship with vehicle traffic actual flow coefficient:

		The actual flow of the vehicle	The inward and outward open before
The actual flow of the vehicle	Pearson correlation	1	-.160
	Significant (unilateral)		.079
	N	80	80
The inward and outward open before	Pearson correlation	-.160	1
	Significant (unilateral)	.079	
	N	80	80

Tab.7 Correlation Analysis before opening

		The actual flow of the vehicle	After the village entrance
The actual flow of the vehicle	Pearson correlation	1	-.111
	Significant (unilateral)		.163
	N	80	80
After the village entrance	Pearson correlation	-.111	1
	Significant (unilateral)	.163	
	N	80	80

Tab.8 Correlation Analysis after opening

model	Unstandardized coefficients		The standard coefficient		
	B	Standard error of	trial version	t	Sig.
constant	6384.138	128.237		49.784	.000
The inward and outward open before	-55.238	38.665	-.160	-1.429	.157

Tab.9 A Dependent variable: the actual flow of the vehicle before opening

Model	Unstandardized coefficients		The standard coefficient		
	B	Standard error of	Trial version	t	Sig.
Constant	6384.123	176.738		36.122	.000
After the village entrance	-30.127	30.536	-.111	-.987	.327

Tab.10 a. Dependent variable: the actual flow of the vehicle after opening

3.2 Each type of area before and after the opening of the influence of the road. The main different types of cases.

Main choosing different plot types of cases, the quantitative comparison of different community types before and after the open to the village .The influence of surrounding roads. A Canadian Pacific union community and Beijing MOMA respectively.

1) Canadian Pacific union community <sup>[4]</sup> (axis layout)

Background: Canadian Pacific union community in the central city of Vancouver waterfront zone, adjacent to Wenger China's central business district. Community is located to the railway station site, union company in China in 1988 the land from the government. Covers an area of 830000 square meters, a total construction area of 1.1 million square meters. Road system in the community as a community connection and split each group and communication with external hub.

Analysis:

① Canada is North America's most north of the country, west Pacific, east to effect the Atlantic ocean. North to the arctic ocean, the north and east of the Danish territory of Greenland, the east and French Saint Pierre and Miquelon, The southern border with the United States, to the northwest and Alaska. Territory covers an area of 9.98 million square kilometers, the second largest in the world, the most located within the Arctic Circle, population is concentrated in the southern coast of the great lakes. Famous city with Toronto, Vancouver, etc.

②The population of Canada is 35.54 million (2014), the per capita covers an area of about 280.81 square meters. The 2011 census, Vancouver has a population of 600000, the population of greater Vancouver is 2.3 million, is Canada's third metropolis, the first big city in western Canada. Located in Vancouver is too flat to the coast, and it is across the western end of the nation's roads and railways, make the city become one of the domestic industrial town. So union community in Vancouver, for the sake of between Canada and the Pacific Ocean, ditch Canada east and west, promote foreign trade links, Concorde community may not be completely closed type area.

③ Union community located in the center of the city of Vancouver; Vancouver marina hose, covers an area of 83 hectares, including land.

An area of 67 hectares, water area of 16 hectares. Residential construction area of 900000 square meters; Residential total 9000 households; Public area of 200000 square meters; Resident population of 16000 people; The park green space and other 20 hectares of public open space<sup>[5]</sup>. Union community residential groups scattered layout, by parks and other public space, open space and community road to define them. In the community have six community road is used to communicate social area and other parts of the city, and urban organic combination. Around the Pacific union community and urban community have a closed between pedestrian and bicycle transportation system, can guarantee that people convenient to enter the waterfront,

even residents are not impeded. On 3 km long coastline, there is a broad waterfront boulevard, specifically for the use of pedestrians and cyclists. In addition, the union Pacific community planning have consciousness to high-rise tower layout in urban road on both sides, to ensure that the water at the end of the road landscape effect Fruit. Concorde companies use 17 hectares of land to build the five big park, accounting for 25% of the total land area, the index of green area of one thousand more than a hectare, not including 3 hectares of waterfront road and other public open space.

④ Chart is a map of Vancouver Concorde community.

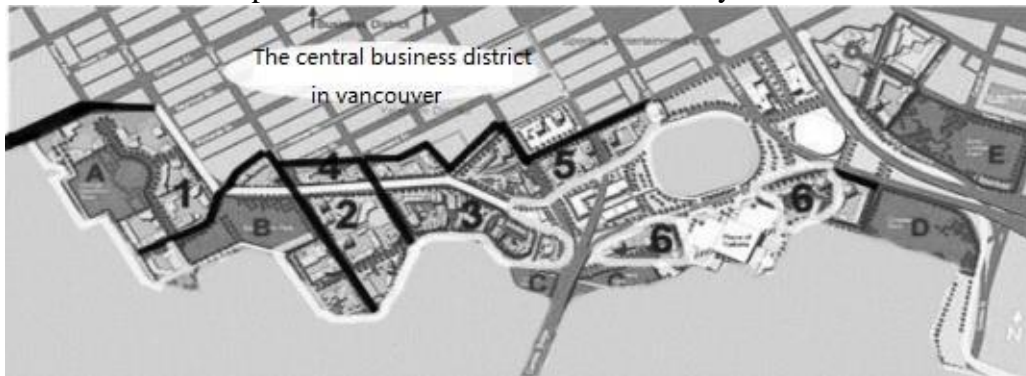
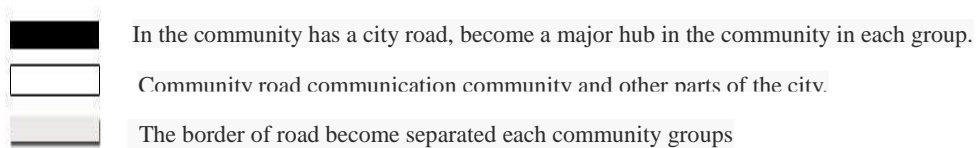


Fig.2 The central business district in Vancouver



Vancouver public transportation in the urban traffic in the region plays a very important role. The north side of mountains, the region bordering the south and the United States, a large number of agricultural land in the planning is not considered within the scope of urban development. The special geographic conditions, combined with relatively low density of highway network and the regional transportation planning strategies dominated by bus, make a high population density and the benign development of public transport. Translink as regional transportation planning and finance department, is responsible for managing the bus and main city road.

Regional bus system including many kinds of way to travel - ground bus and tram, commuter trains "Express" in the West bank (West group Express) connecting downtown Vancouver and ferry in north Vancouver S SeaBus. The region's skeleton line transit train air SkyTrain light rail system for unmanned, carrying 240000 passengers a day, about a quarter of the total passenger bus system. Two SkyTrain lines of 50 km, including 33 site. Train when you rush hour effective start from 108 seconds. The SkyTrain peak passenger flow is close to its capacity. In one of the sites, travel to the center of the city passenger 3 train in the morning rush up to have to wait to get on the bus.

Bus transport network system includes 15 streetcar line (228 standard car), more than 200 diesel lines consist of more than 1200 bus, the bus capacity is large, some can carry 120 people, a small community bus passenger only 24 people. At the

beginning of 2008, Columbia provincial government announced a bold provincial bus plan, plans to greatly increase the public traffic network scale in 2020 and further improve the quality of public transport services. Provincial bus plan is designed to transport sharing rate increased from 12% in 2007 to 17% in 2020, and 22% in 2030. The development plan for the implementation of the need a accurate and reasonable model as a strong support, and puts forward high demands on model and the analysis work. Face under the structure of the model in detail.

⑤The departure time distribution of the number of guests from the site and first time distribution curve of the preliminary, and assumes that the passengers during the rush hour (especially morning rush) trip distance, the longer the time of departure is the earlier. Travel time distribution curve according to the main rail site 24 hours and the bus stops and traffic distribution of calibration.

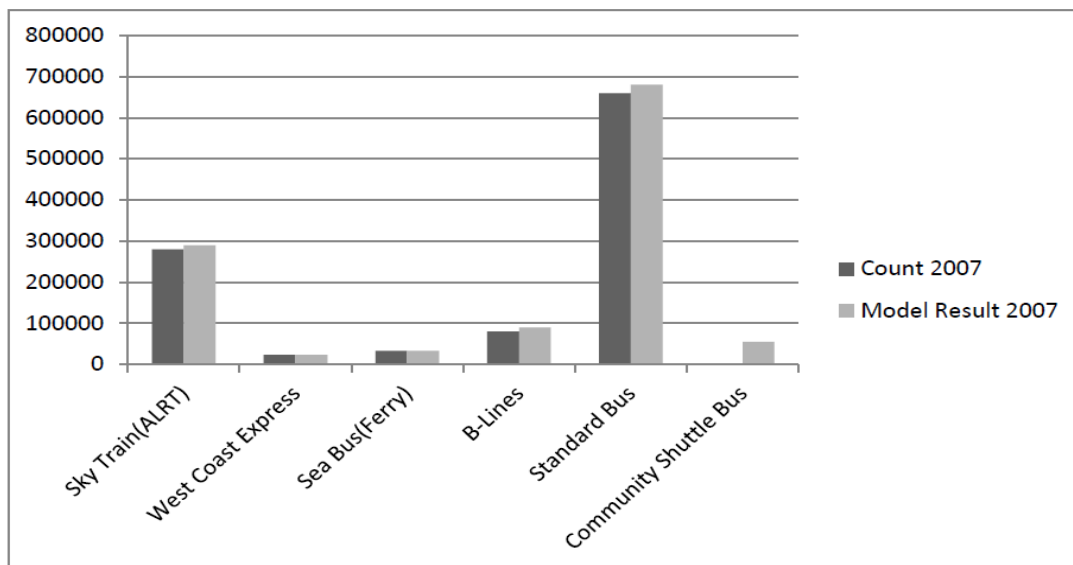


Fig. 3 Each big bus system is traffic throughout the day (model and the observed value)

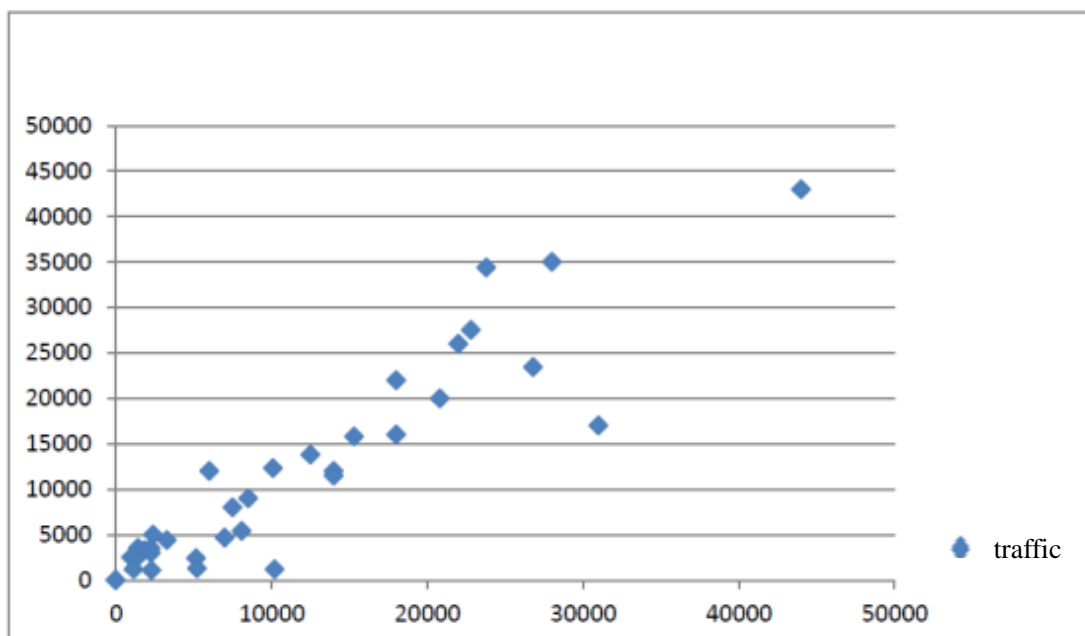


Fig. 4 The ground bus routes throughout the traffic (model and the observed value comparison)

Fig. 3, fig. 4 are from Vancouver, the bus cable and operational planning model and enlightenment" [6]

## 2) Beijing contemporary MOMA [7]

Contemporary MOMA: Is located in Dongcheng district of Beijing Xianghe garden street no. 1, Beijing is one of the few open community model. Project planning construction area of 220000 m<sup>2</sup>, house of 135000 m<sup>2</sup>, supporting the business area of 85000 m<sup>2</sup>, including many art cinema hall, art gallery, library and cultural exhibition facilities, including boutique hotels, international kindergarten, top restaurants, top club, gym, swimming pool, tennis court and other living facilities and sports leisure facilities.

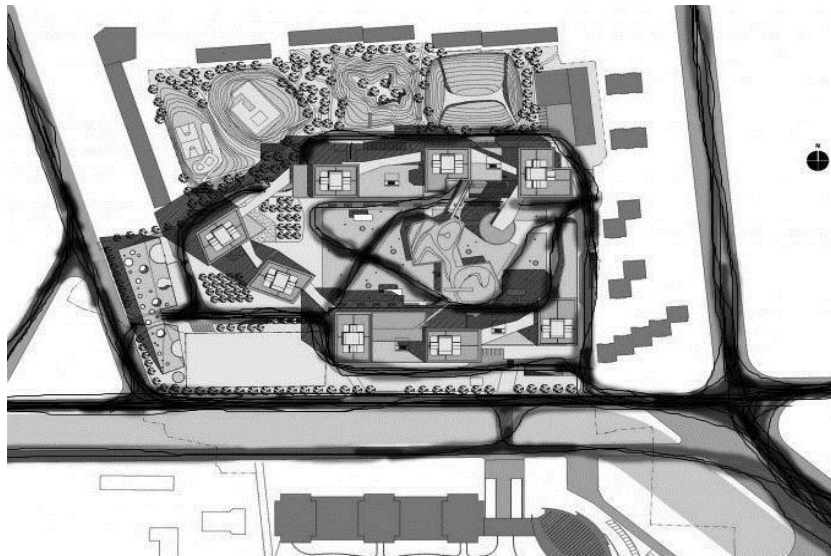


Fig. 5 Beijing contemporary MOMA planning drawings

① In the planning and design, the project more consideration to the life of the future urban pattern, introducing the concept of compound can work, realizing the function of open urban community;

② In the aspect of architectural art more fully excavate the value of urban space, urban space from further contact plane, vertical for the three-dimensional urban space;

③ From the viewpoint of sustainable, contemporary MOMA is truly "energy-saving and ground-saving type" project, not only the products itself on a large scale adopted energy-saving green technology, and through effective model of community service become community operation, promote the sustainable development of the project and the city.

Using forecasting principal component analysis (PCD) [8]

By free OD survey of highway traffic volume forecast method research:

$$F_i = \sum_{i=1}^n \alpha_i \frac{\beta_{i,j}}{\beta_j}$$

$F_i$  : Regional node important degree,  $i = 1, 2, 3 \dots m$  ;

$\alpha_i$  : By principal component analysis (pca) to get the first item i social economic index weight;

$\beta_{ij}$  : The regional node first i j measures of social economy;

$\beta_j$  : The average regional node first j a social economic indicators.

On the basis of network traffic and a function of regional land use of traffic demand:

$$G_N = F(D_f)$$

Through the future regional traffic demand forecast analysis  $D_{NF}$  , The future can be calculated according to road traffic  $G_{NF} = F(D_{NF})$  . According to the network flow formula, too:

$$G_N = \sum_{a=1}^n g_a \varpi_a$$

$$G_{NF} = \sum_{a=1}^n g_a F \varpi_a F$$

$G_N, G_{NF}$  :The road network status quo, planning network traffic;

$g_a, g_{af}$  :The present status of road network in section a, planning and communication;

$\varpi_a, \varpi_{af}$  :The present status of road network in section a, planning the mileage.

$$\varpi_a = \sum_{i=1}^n \frac{L_a}{L_i}$$

$$\varpi_{af} = \sum_{i=1}^n \frac{L_a}{L_{if}}$$

For  $G_N, G_{NF}$  have to

$$\frac{G_N}{G_{NF}} = \varphi = \frac{\sum_{i=1}^n g_{af} \varpi_{af}}{\sum_{i=1}^n g_a \varpi_a}$$

Because network conformation, are  $\varpi_a F = \varpi_a$ , too:  $g_a F = \varphi g_a$

This is the traffic volume forecasting formulas. If road conformation, so  $G_{NF}$  and designed, the  $G_N$  growth  $\varphi$ , then the  $g_{af}$  will be 2 times of  $g_a$ .

#### 4. Suggestions put forward according to the area open

1) Open area will cause Braess paradox, traffic tourist traffic will decline. The number of the open area to reach the Nash equilibrium.

2) Through the analysis and calculation, in a busy road neighborhood, could alleviate the road car pass number. In accordance with the existing rules, car accidents and vehicle is closely relative to the total number. Once had a car accident, will lead to the road traffic, causing more traffic jams. So you need to set up distinct signs in the intersection, especially in enter the intersection set up signs of speed limit, in order to reduce hair gave birth to ensure the traffic capacity of the car accident.

3) To improve traffic management level. Enhance the level of law enforcement, such as to establish the complete emergency handling, the road traffic jam should be equipped with the traffic police command vehicle traffic. Improve traffic management laws and regulations. Provide traffic police personnel more advanced technology and equipment.

4) To determine the overall traffic development strategy.

#### 5. Model of comprehensive evaluation

5.1 Model: the advantages of simple, can more accurately reflect the influence of area open to notice ability.

5.2 Model of faults:

- 1) The establishment of the model is not enough perfect, mature;
- 2) Is not able to fully consider the various factors;
- 3) Access to data will change, for a long time data analysis. Continuous optimization and innovation in the follow-up studies, makes every effort to solve the above problems.

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