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Study on Classification Method of Open Road in Urban Traffic Planning

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Abstract: Based on the analysis of the typical roads at home and abroad, from the perspectives of road functions, traffic capacity and service level, this paper puts forward the research on the classification method of the roads in urban traffic planning, and constructs a three-level road system. At the same time, in order to meet the throughput with the maximum carrying capacity of different grades of roads, the grade allocation method is designed, which provides a scientific basis for determining the scale and grading of new roads. The simulation results show that this method is feasible and has some reference value for road planning.

Keywords: Road grade; Traffic planning; Passenger throughput; Collecting and sparing roads

1. Introduction

The highway grade is divided according to the use task, function and flow of the highway. Jishu highway in mainland China is divided into five levels: expressway, jishu first-level highway, second-level highway, third-level highway and fourth-level highway. The traditional classification method of concentrated and scattered roads has problems such as low accuracy of classification, which is easy to cause road congestion. Domestic transport industry is developing rapidly in recent years, the status of transportation in comprehensive transportation gradually improve, during the period of "much starker choices-and graver consequences-in" national new and renovated sparse road number will reach 50, collection of sparse road network construction, however, relative lag, several large collection of hydrophobic road traffic saturation, traffic congestion situation, greatly influenced the passenger travel satisfaction, thus to carry out the collection of hydrophobic road level configuration, hydrophobic road construction on the science instruction set, passenger access efficiency is of great significance. In the code for design of urban roads in China, urban roads are divided into four levels, i.e., class A roads, trunk roads, secondary trunk roads and branch roads, with clear provisions on the nature, function and technical indicators of roads at all levels. Set of hydrophobic expressway in megacities or set in the main cities, set is hydrophobic, with median set hydrophobic downward vehicles apart, dredging for car special fast to set hydrophobic downtown main contact in major regions and hydrophobic downtown and faubourgs (mainly, sets contact hydrophobic satellite town, the main way to thin burden city's main guest, sets scanty freight traffic, set traps with high speed and large capacity. Jishu trunk road is the skeleton of urban road network. Jishu connects the major industrial areas, residential areas, ports, stations and other freight centers of the city, and jishu undertakes the main traffic tasks of the city. It is not advisable to build too many pedestrian and vehicle entrances on both sides of jishu main road, otherwise the speed will be reduced. The secondary trunk road is the common traffic trunk road in the urban area. The urban trunk road network is composed of the collection and collection of trunk roads, and the collection and collection of trunk roads can connect all parts and distribute the traffic load of the main road. Jishu sub trunk road has service functions, jishu allows both sides to arrange to attract people of public buildings, jishu and should be set up parking. Branch road is the connection line between secondary trunk road and jiefang road. Public transport lines or bicycle lanes can be set up in the main branch road of jishu, and transit traffic is not suitable on the branch road of jishu. Currently use level of urban road grade configuration methods classification accuracy is not high, thus puts forward the urban traffic planning cimc sparse road hierarchy method study, by building a) road system, hydrophobic road carrying capacity analysis set maximum satisfy the throughput, and the simulation experiment, the experimental results show that the method can effectively divide road level.

2. Study on Classification Methods of Open Roads

2.1. Optimization of the allocation method of sparse roads

Road means an engineering facility for the passage of various vehicles (trackless) and pedestrians. There are many kinds of roads with different properties and functions. Therefore, it is impossible to grade all roads with a single standard. For this reason, the current practice in all countries is generally to divide the road types first, and then to classify the technical standards of all kinds of

roads. Highways can be divided into five levels according to the traffic volume of using task, function and adaptation: expressway, first-level highway, second-level highway, third-level highway and fourth-level highway. Highways. A highway with full access control and specially designed for cars to drive at high speed on separate lanes. It is mainly used to connect politically, economically and culturally important cities and regions, and is the backbone of the national highway trunk line network. The average number of cars passing through each day and night is more than 25,000. First class highway. The highway, which is mainly connected with important political and economic centers and leads to key industrial and mining areas, is the main highway of the state. Generally, it can adapt to the perspective design of all kinds of cars converted into small passenger cars. Second class. A main highway connecting political and economic centers or large mining areas, or a suburban highway with heavy traffic. Generally can adapt to a variety of vehicles driving, secondary roads can generally adapt to the various vehicles converted into a medium truck vision design years of annual average day and night traffic volume of 3000 ~ 7500 vehicles. Level 3 highway. General arterial highways connecting counties and towns above the county level. Usually can adapt to a variety of vehicles driving, three-level highway can generally adapt to the various vehicles converted into a medium truck vision design years of the average day and night traffic volume of 1000 ~ 4000 vehicles. Level 4 highway. Feeder roads connecting counties, townships and villages. Usually can adapt to a variety of vehicles, four-class highway can generally adapt to a variety of vehicles converted into a medium truck vision design years, the annual average day and night traffic volume is: two-lane 1500 or less; Single lane under 200 vehicles. The classification of road classification is shown in the figure below.

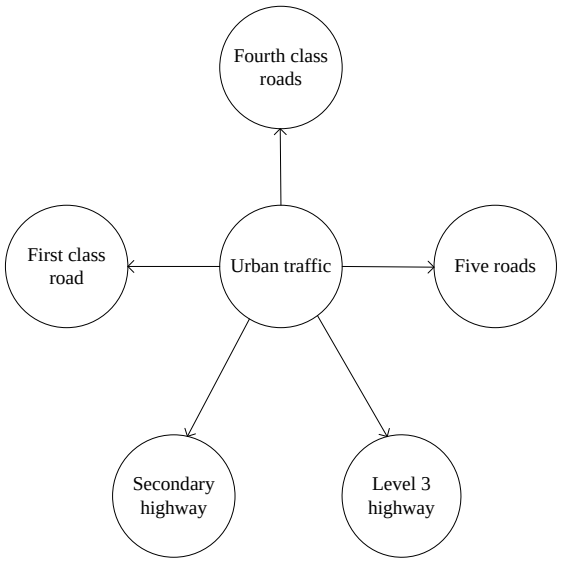

Figure 1. Is a classification map of sparse roads

The selection of highway grade should be based on the planning of highway network, from the overall situation, in accordance with the use of highway tasks, functions and perspective traffic volume comprehensive determination. A highway can be divided into different vehicle fatigue Numbers or different highway grades according to traffic volume and other conditions. Design duration of highway at all levels: 20 years for expressway and first-class highway; The second class highway is 15 years; Class iii highway for 10 years; Level 4 highways are generally 10 years old and can be adjusted appropriately according to the actual situation. The passing amount of the above two, three and four levels of roads is the mixed driving on the road bicycles, rickshaws, rickshaws, cars, tractors, car trailers or semi-trailers, etc., are converted into the number of cargo vehicles according to a certain coefficient. The volume of highway traffic in China and most developing countries exceeds the original capacity, so corresponding technical measures must be taken to re-grade the highway to meet the demand of vehicle capacity.

2.2. Sparse road grade parameter evaluation

Based on the theory of supply and demand balance, aiming at the capacity of roads at all levels to meet the passenger turnover, the grading methods of roads A, B and C3 for distribution and transportation are determined as follows. First, the unit length of roads at all levels is calculated, and the unit length of roads at all levels is set as Ni, then:

$$N_i = 2N_{0i}k_{1i}k_{2i}k_{3i}k_{4i}n_i / k_{5i} \quad (1)$$

In formula, Ni is the theoretical capacity of class I roads, which is divided according to the road level above and combined with the national urban road standard. The theoretical capacity values of class A, B and C3 roads are shown in table 2.

Table 1. Single-lane theoretical capacity of roads at all levels

Road type	Class A road	Class B road	Class C road
Theoretical capacity /(pcu ħ-1)	1600	1200	1000

K_{1i} is the average occupation rate of class I roads, which is 0.6. K_{2i} is the lane width influence correction coefficient of class I road, with an average of 0.9. K3i is the correction coefficient of class I road intersection. As the grade of A road is relatively high, non-motorized lanes are not set on both sides of the road. If there is A road intersection or interchange, it is usually an overpass. Therefore, the reduction coefficient of the intersection of this type of road is taken as A high value. B level road, C level cross roads for more planes, reduction coefficient is

small, the ways of class B and C grade road intersection, has certain priorities, so B road level slightly higher than the reduction coefficient of C road, k4i route is average use frequency coefficient, which refer to the driver in the process of moving the degree of understanding of the route, driving direction, by the factors such as area, this article 0.75. Ni is the correction coefficient of the average number of lanes of class I roads.

After determining the turnover volume, the travel distance density function is calculated. The travel distance density function of passengers is mainly affected by the throughput and the mode of transportation. The passenger access modes are mainly private car and public transport. The ratio of public transport to private car is used as the influencing factor. By fitting shuangliu, baiyun, jiangbei, xiaoshan, lukou and other large data, the passenger travel distance density function can be obtained as follows:

$$f(r)=\lambda r e^{(-\lambda r^2/2)} \quad (2)$$

In formula (2), r is the travel distance, km; Lambda is the parameter of the Rayleigh model.

$$\lambda=-0.0000145x_1-0.02439x_2+0.12464 \quad (3)$$

In formula (3), x1 is the passenger throughput of the airport (ten thousand people/year), x2 is the ratio of public transportation and private cars to the airport. According to the experience, the travel proportion of public transportation is about 40% ~ 50%, and that of private cars is 15% ~ 20%.

In the process of travel, due to different travel distances, passengers choose different levels of roads differently. With the reduction of road grades, the superior travel distances are continuously reduced. Suppose that the traveling individuals follow the principle of switching step by step on different levels of roads. Suppose that the distance between A, B and C levels of roads is d3, d2 and d1 respectively, which satisfies the requirement that d1 < d2 < d3. The distribution of road network decreases step by step from high to low according to the road level, and the distribution is surrounded. Meet the set of road classification.

2.3. Realization of the classification of sparse roads

Expressways are arterial roads specially designed for cars to drive in different directions and lanes and to control all access and exit. The four-lane expressway can adapt to the long-term design period of small passenger cars converted from various cars, and the annual average day and night traffic volume is 2500 ~ 55000 vehicles. The six-lane expressway can generally adapt to the long-term design life of all kinds of cars converted into small passenger cars. The eight-lane expressway can generally adapt to the long-term design life of 60,000 ~ 100,000 adult passenger cars according to various types of cars. A highway with full access control for motor vehicles on separate lanes. It is mainly used to connect politically, economically and culturally important cities and regions, and is the backbone of the national highway trunk line network. The average number of cars passing through each day and night is more than 25,000.

Based on the above experience of road construction for collection and distribution, and from the perspectives of road functions, traffic capacity and service level, the influencing factors affecting the classification of roads for collection and distribution are comprehensively considered. The grade of roads for collection and distribution is divided into class A, class B and class C, and the road attribute characteristics of each level are shown in the following table.

Table 2. Road classification table

Highway grade	Road function	One-way ability/ (pcu ·h - 1)	Service level	Design speed /(km/h - 1) -	Number of two-way lanes
Class A road	Rapid access	3200～3800	Class B above	100-120	More than 6
Class B road	Contact town, groups and fast lanes	2500～3200	B - C level	80-100	4-6
Class B road	Contact city residential areas, functional areas and connecting roads	2000～2500	Clevel	60-80	4

As can be seen from the above table, class A roads are direct and accessible fast lanes, mainly expressways and expressways, with one-way traffic capacity of 3,200-3800pcu /h, design speed of 100-120km /h, and two-way traffic of more than 6 lanes. Type B road: it is the connecting road between the surrounding towns, clusters or new areas and the fast lane, mainly national and provincial roads, with one-way traffic capacity of 2500 ~ 3200pcu/h, design speed of 80 ~ 100km/h, two-way 4-6 lanes. Type C road: it is a collection and distribution road connecting the inner functional areas and residential areas of each city with the connecting roads, mainly urban trunk roads, with one-way traffic capacity of 2000-2500pcu /h, design speed of 60-80km /h, and two-way four-lane road. The classification process of road rank is shown in the figure 2 below.

It can be seen from the above distance that this method can effectively grade the road reasonably by judging the one-way passing ability, and it has a good feasibility. Combined with the above steps, the classification of road grade in urban traffic planning is effectively realized.

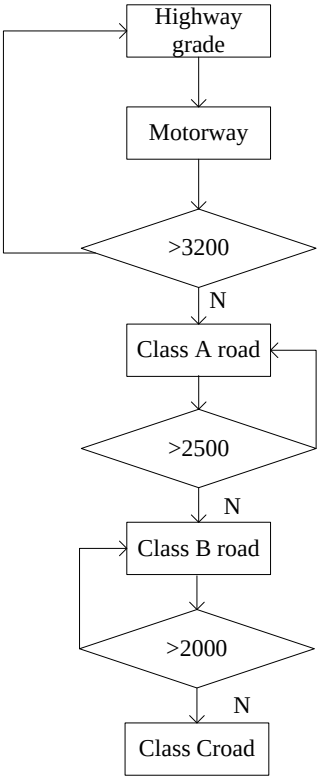

Figure 2. The classification process of road rank

3. Experimental Analysis

In order to verify that this method is superior to the traditional road classification method, the two methods are set as the control group and the experimental group respectively. A certain central section, 11km to the northeast, west of dagu river, east of east outer ring, between jiaoji railway and jiaoji passenger dedicated line, about 39km away from the city center, is selected for the experiment. In order to ensure the reliability of the experiment, the designed annual throughput of road in 2020 is set to be 40 million, then x1=4000, and substituted into equation (3) to get lambda =0.05389, then the function of vehicle travel distance can be determined as: f(r)=0.05389re(-0.02695r2) to get the travel distance of traffic road. The results are shown in the following table.

Table 3. Travel distance of traffic roads

Road type	Class A road	Class B road	Class C road
Average travel distance /km	7.8	3.8	1.6

According to table 3, the dominant travel distance of all levels of roads can be obtained. Since the dominant travel distance of class A roads and class B roads overlaps, the overlapped parts are evenly distributed into these two levels of roads. Then the experiment was started to calculate the carrying amount of the two groups of methods in the same time, and the results were shown in the figure below.

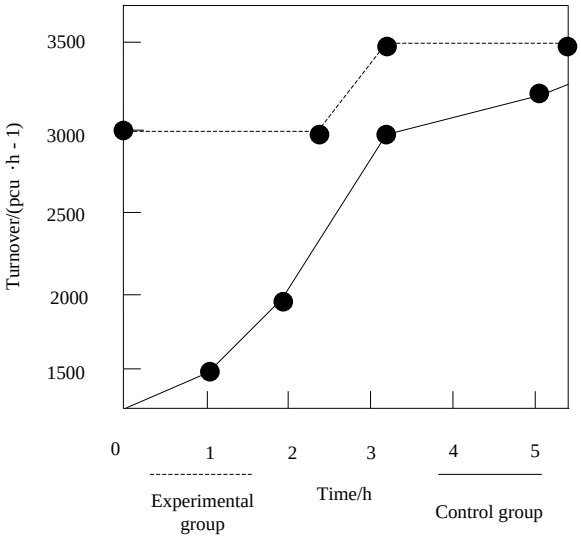

Figure 3. Experimental results of turnover

As can be seen from the above results, compared with the control group, the carrying amount of the experimental group in the same time is significantly higher than that of the control group, which shows that the experimental group has a more accurate division of the grade of gathering and transportation road in urban traffic with better effect.

4. Conclusion

Urban road refers to the road with certain technical conditions and facilities in the city, for all kinds of vehicles (trackless) and pedestrian access engineering facilities. There are many kinds of roads with different properties and functions. Therefore, it is impossible to grade all roads with a single standard. For this reason, the current practice in all countries is generally to divide the road types first, and then to classify the technical standards of all kinds of roads. The traditional road classification method has some problems, such as large division error, which is likely to lead to traffic accidents. Therefore, the classification method of gathering and transportation road in urban traffic is proposed. The simulation experiment is carried out on this method with the goal of road carrying capacity and throughput.

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