Evaluation of Urban Rail Transit Planning

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Abstract
Urban rail transit is an important urban infrastructure, a city in order to have advanced rail transportation, there must be a reasonable forward-looking overall development and construction planning. Correct and objective evaluation of urban rail transit planning, planning and design departments can provide the basis for improving urban rail transit planning. The fuzzy comprehensive evaluation can evaluate the urban rail transit planning comprehensively, scientifically and objectively.
Key words: *rail transportation; planning, evaluation; weight; membership; fuzzy comprehensive evaluation*

1 Introduction
Urban rail transit is an important component of modern urban public transport. Urban public transport is the infrastructure for the city to live on, and it is the necessary public service for urban economic development and residents' life. The construction of reasonable and economical urban public transport network can optimize the layout of urban land use, provide convenient, fast, safe, efficient, economical, comfortable and low pollution environment for residents, and improve the urban environment Of the inevitable requirement

With the rapid development of China's economy, the scale of many cities has been expanding and the population and vehicles have been increasing rapidly, which makes the urban traffic problems such as traffic congestion, traffic accidents and exhaust pollution become more and more prominent. In order to alleviate the urban traffic problems, many cities have been or are preparing to develop urban rail transit. The development and construction of urban rail transit, there must be a whole of a reasonable forward-looking development and construction planning. Urban rail transit is divided into tram, light rail and subway, urban rail transit development and construction planning, not only to the rational choice of the type of rail transport, but also rational distribution of rail transit lines, sites.

Urban Rail Transit system having a plurality of fuzzy uncertainty, fuzzy comprehensive evaluation to evaluate the urban rail transit planning, not only can effectively solve the ambiguity caused trouble, but also to fully take into account a variety of factors, making the evaluation results more scientific, comprehensive and objective.

2 Evaluation of the principles of urban rail transit planning
Evaluation of Urban Rail Transit Planning should be a reasonable choice of evaluation factors, reasonably determine the weight of each evaluation factor weights, the evaluation of urban rail transit planning must adhere to the following principles:

2.1 The principle of comprehensiveness

Factors affecting urban rail transit a lot, to a comprehensive evaluation of urban rail transit planning, evaluation factors should be chosen to reflect different aspects of planning is reasonable.

2.2 Scientific Principles

Select the evaluation factors and the factors determining the weights, selection and calculation

2.3 The principle of objectivity

To ensure objective and fair evaluation factors selected to ensure the accuracy of the data used.

2.4 Practical principles

Evaluation of Urban Rail Transit Planning aims to identify problems in order to better plan and manage the construction of urban rail transit, so the evaluation and selection factors and evaluation methods should be as convenient and practical.

3 Evaluation Factors Urban Rail Transit Planning

Urban rail transit system should have the safety, convenience, speed, efficiency, economy and comfort. Urban rail transit planning should take into account the overall economic, practical, forward-looking and the impact on the environment. Therefore, the evaluation of urban rail transit planning should consider the following factors:

3.1 Security

Passenger safety concerns including personal safety, property safety and health security. Accidents, equipment failures urban rail transit system, emergency road on the way to start, braking, sharp turn, etc., may cause life injuries to passengers. On and off the crowded, crowded car can cause damage to property of passengers. Health and safety impact of urban rail transit system in the vehicle, the site health, congestion and car ventilation.

3.2 Convenience

Convenience of urban rail transit system means passengers rail transport ease. Evaluation of the main indicators of convenience include wire mesh density and coverage area nets, set up, transfer node set up the site, in addition to the need to consider the grid frequency and punctuality. Good urban rail transit planning should as far as possible when walking distance passenger travel the shortest transfer times at least, the shortest travel time, waiting time to a minimum. The only way to increase the proportion of travel by rail in order to effectively alleviate congestion and exhaust pollution problems of urban transport.

3.3 Quickness

Quick mainly reflected by the passenger travel time and operating speed rail system and other indicators. Passenger travel time includes travel time, walking time, transfer time, and waiting time. Travel time depends not only on the size of the average speed of the traffic system, and depending on the setting line network layout, site, frequency and punctuality rate grid. Of

course, speed and punctuality rate and maintenance of transportation facilities and design standards, facilities, and is closely related to the scheduling system.

3.4 High efficiency

Efficient mass transit system mainly refers to the operational capabilities of high efficiency, high attendance and high efficiency management system, wire mesh land-use efficient, high social benefits, rather than a high economic efficiency. Urban Rail Transit is public welfare undertakings, efficient transportation system can promote the rapid development of the city.

3.5 Economical efficiency

Economy in two aspects: on the one hand is the line network construction and the economy of equipment required, including the line to the difficulty of the network construction, the length of the wire net, land utilization, line network equipment running whether economy applicable, etc.; Is for passengers on the other hand, reasonable cheap price is the main factor to attract passengers, the ticket price formulation to ensure the benefit of the transport enterprise, and to consider the economy of the region, more attention should be paid to the public welfare of urban rail transit.

3.6 Impact on the urban environment

The impact of urban rail transit system for the urban environment is mainly reflected in: the destruction rail transit network of natural landscape and cultural landscape of the occupied land, greenhouse gas emissions, noise and vibration generated by the operation and so on.

3.7 Prospective

Urban Transit Planning should be forward-looking, most cities are expanding, the existing line network planning should be extended and encryption.

4 Fuzzy Comprehensive Assessment of Urban Rail Transit Planning

Fuzzy comprehensive evaluation is influenced by many factors kind of things that make a comprehensive evaluation of the very effective multifactor decision making method. Evaluation can be divided into five steps:

4.1 Establishment of evaluation factors set

Before a comprehensive analysis of the Evaluation City rail transit planning seven main factors, safety, convenience, speed, efficiency, economy and environmental impact on urban and forward-looking. $u_i(i=1,2,\cdots,7)$ respectively represent these factors, the evaluation factor set to $U=\{u_1,u_2,\cdots,u_7\}$.

4.2 The establishment of evaluation set

The quality of urban rail transit planning can be divided into several levels, for example, from best to worst is divided into six levels from 1-6. The evaluation set $V=\{1,2,\cdots,6\}$.

4.3 Establish the weight vector

Due to various factors that affect urban rail transit planning for big and small, and therefore the right to re-evaluate not the same. In the evaluation of the weight of the factor u_i with $c_i(i=1,2,\cdots,7)$, then there is a weight vector $C=\{c_1,c_2,\cdots,c_7\}$, which is $c_i>0(i=1,2,\cdots,7)$, and $\sum_{i=1}^{7} c_i=1$.

Determining weight of factors in many ways, such as fuzzy relation equations, fuzzy coordinated decision method, AHP and a variety of statistical methods. Here the use of simple operation and the results are more objective arithmetic average statistics, please m a broadly representative of experts representing different regions and passengers of all ages, so that they consider reasonable given their weight vector $C_k=\{c_{k1},c_{k2},\cdots,c_{k7}\}(k=1,2,\cdots,m)$. So that $c_i=\frac{1}{m}\sum_{k=1}^{m} c_{ki}(i=1,2,\cdots,7).$

4.4 Establishment of single factor evaluation matrix

Each of these factors to the factors set $u_i(i=1,2,\cdots,7)$ single factor evaluation, passengers can also make a broadly representative of experts and scholars of different ages and in different regions of a number of people on each factor was evaluated. If r_{ij}% human factors evaluation level u_i to $j(j=1,2,\cdots,6)$, then u_i belongs to the membership level j is r_{ij},Whereby u_i single factor evaluation results$(r_{i1},r_{i2},\cdots,r_{i6})$. So the single factor evaluation matrix

$$\begin{pmatrix} r_{11} & r_{12} & \cdots & r_{16} \\ r_{21} & r_{22} & \cdots & r_{26} \\ \cdots & \cdots & \cdots & \cdots \\ r_{71} & r_{72} & \cdots & r_{76} \end{pmatrix}$$

4.5 Fuzzy Comprehensive Assessment of Urban Rail Transit Planning

Univariate judge can only reflect the impact of a factor of urban rail transit planning, and we evaluate the impact of all factors to consider urban rail transit planning. For this purpose, the weight vector and matrix synthesis of single factor evaluation operation is obtained fuzzy comprehensive evaluation $B=C*R=(b_1,b_2,\cdots,b_6)$.

Since the evaluation of urban rail transit planning needs to consider the impact of each factor, the weighted average model synthesis process, that $b_j=\sum_{i=1}^{7} c_i r_{ij}(j=1,2,\cdots,6)$, b_j urban rail transit planning level j belonging to the membership. Finally, according to the principle of maximum degree of membership to give urban rail transportation planning for the Rank $\max(b_1,b_2,\cdots,b_6)$.

5 Conclusion

Fuzzy comprehensive evaluation is a scientific and reasonable evaluation method, the evaluation model can make use of a comprehensive, objective and scientific evaluation of urban rail transit planning. However, when establishing the weight vector and evaluation using univariate research, statistical methods, in order to make the results more objective and impartial evaluation, the survey should be inclusive and representative, respondents should have an objective and fair attitude.

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