

<http://ansinet.com/itj>

ITJ

ISSN 1812-5638

INFORMATION TECHNOLOGY JOURNAL

ANSI*net*

Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Urban Transport Mode's "Publicity" Calculation Evaluation

Xiaohong Chen and Xueli Fang

School of Transportation Engineering, Tongji University,
Key Laboratory of Road and Traffic Engineering, Ministry of Education,
4800, Cao'an Road, Shanghai, 201804, People's Republic of China

Abstract: Currently, different countries and regions have their own classification methods and standards defining urban public transport or the modes. These classification standards are adjusted over time as new means of transport and transport technologies arise. What the crucial is that government should judge advantage of the transport or the modes firstly, allow the use of public finances as a subsidy. This study considers the service excludability of urban transport (whether it is open to all residents) and the utilization efficiency of public resources (whether there is intensive land utilization of road space and time resources). The "publicity measurement" index is proposed for urban rail transit, the rapid transit bus, the conventional public bus (tram), the taxi, public bicycle, school bus, private compact car and other common transport modes. The "publicity measurement" index is calculated and analyzed to quantitatively characterize the "publicity" of different modes of transport.

Key words: Excludability, intensive land utilization, publicity measurement index

INTRODUCTION

After years of development, urban public transportation in China has made the progress but it also faces many problems (Wang, 2007a). These problems can directly affect residents' understanding of the development and functionality of urban public transportation (Wang, 2007b). Subsequently, they have a practical effect on the prioritized development of urban public transportation to reduce transport congestion and promote urban development.

Currently, different countries and regions have their own classification methods and standards of defining urban public transport or the modes and select its urban public transport methods (MOC, 2004). These classification standards are adjusted over the time as new means of transport and transport technologies arise. Nevertheless, there is some consistency among the different definitions (MOC, 2006). For example, public transport should be more efficient than individual transport and its primary function is to provide intensive land utilization services for the public, rather than concern on the means of transport or transportation method (Chen *et al.*, 2006). In addition, this public service should be led by a government or public institution to unify management (Liu *et al.*, 2011). Government departments

should clearly state the public transport market entry rules, operational service requirements, price verification and planning permission (Li *et al.*, 2005). They should also freely provide some or all of the municipal public facilities, as well as allow (but not require) the use of public finances as a subsidy or allowance (Chen, 2008).

The important is that government should judge advantage of the transport or the modes firstly, allow the use of public finances as a subsidy (Xiong and Chen, 2009). It is not proper that the government give the public subsidy to all the urban public transport or the modes (Adler, 1980). Because it will lead to the problems on management, such as operational service requirements, price verification and so on (McGee, 2003).

This study considers the service excludability of urban transport (whether it is open to all residents) and the utilization efficiency of public resources (whether there is intensive land utilization of road space and time resources). The "publicity measurement" index is introduced for urban rail transit, the rapid transit bus, the conventional public bus (tram), the taxi, public bicycle, school bus, private compact car and other common transport modes. A "publicity measurement" index is calculated and analyzed to quantitatively characterize the "publicity" of different modes of transport.

“PUBLICITY” MEASUREMENT AND CALCULATION

Measurement system based on “publicity”: The following is a brief introduction to the indicators used in the measurement index system for the “publicity” of urban transport.

Excludability index: The Excludability Index (EI) measures the degree of openness of a transport mode in providing public services to the community. The greater the value of the index is, the lower the level of excludability and vice versa will be. When $EI = 1$, the mode of transport is completely open to the public, when $EI = 0$, the public is fully excluded and when $EI = 0.5$, the mode of transport is partially open to the public. For example, public buses and trams have an EI value of 1, private cars have an EI value of 0 and school buses have an EI value of 0.5.

Level of intensive land utilization: The level of Intensive Land Utilization (ILU) indicates the passenger transportation efficiency of the transport mode per unit road (or track) area. The greater the value of the index, the higher level of intensive land utilization and vice versa. Assuming the ILU value of public buses and trams is 1, the ILU values of other modes of transport will be multiples of 1.

“Publicity” measurement index: The “publicity” measurement index for a transport mode is established using the excludability index and the ILU. The formula is shown in Eq. 1:

$$MPR = EI * W1 + ILU * W2 \quad (1)$$

where, MPR is the measuring publicity ruler which indicates the “publicity” index of the transport mode; EI is the excludability index of the transport mode; ILU is the level of intensive land utilization of the transport mode, W1 is the weight of the excludability index and W2 is the weight of the ILU.

Analysis based on the “publicity” measurement Index Excludability index analysis: Everybody can use the following modes as public bus, rail transit, bus rapid transit, public bicycle and taxi which are completely open to the public, so the value of the index is 1. The school bus is partially open to the public, so the value of the index is 0.5. The compact car is fully excluded to the public, so the value of the index is 0.

Table 1 shows the excludability indices for the various transport modes.

Table 1: Excludability index of transport modes

Transport mode	Excludability index
Public bus (tram)	1.0
Rail transit	1.0
Bus rapid transit	1.0
Public bicycle	1.0
Taxi	1.0
School bus	0.5
Compact car	0.0

Table 2: Level of intensive land utilization of transport modes

Transport mode	Level of intensive land utilization
Rail transit	15.00
Bus rapid transit	2.50
Public bus (tram)	1.00
School bus	0.80
Public bicycle	0.16
Taxi	0.05
Compact car	0.05

Table 3: Combination of index weights

Index	Weights combination		
	1	2	3
Excludability index, W1	0.7	0.6	0.8
Level of intensive land utilization,	0.3	0.4	0.2

Level of intensive land utilization analysis T: The level of Intensive Land Utilization (ILU) indicates the passenger transportation efficiency of the transport mode per unit road (or track) area. Assuming the ILU value of public buses and trams is 1, the ILU values of other modes of transport will be multiples of 1.

Table 2 shows the ILU values for the various transport modes.

Index weights analysis: Three sets of index weights are used in this study to calculate and analyze the “publicity” of the different transport modes, as shown in Table 3.

DEFINITION OF PUBLIC TRANSPORT MODE BASED ON “PUBLICITY” MEASUREMENT

“Publicity” calculation results: Table 4 shows the “publicity” calculation results for three sets of transport modes based on Eq. 1 and Tables 1, 2, 3.

A comparison of the “publicity” values for the different transport modes, using the three sets of weight combinations, show uniform calculation results. The sequence of transport mode in terms of “publicity” is as follows: Rail transit, bus rapid transit, public bus (tram), public bicycle, taxi, school bus and compact car as shown in the Fig. 1-5.

The analysis of “publicity measurement” index calculation showed that, if conventional public

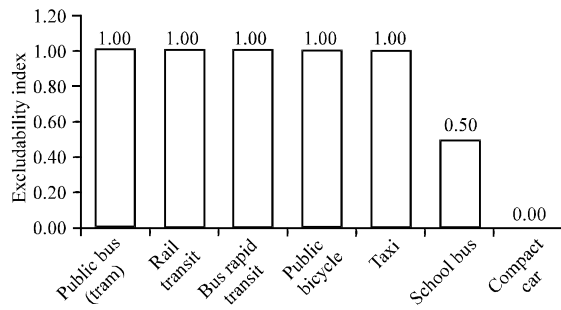


Fig. 1: Excludability index

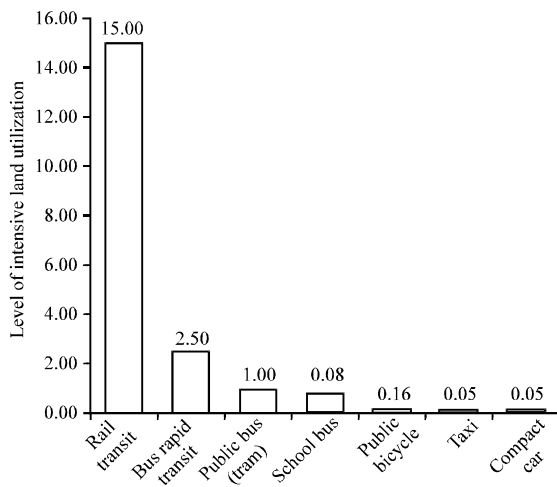


Fig. 2: Level of intensive land utilization

Table 4: "Publicity" calculation results

Transport mode	"Publicity" calculation results		
	1	2	3
Rail transit	5.200	6.600	3.800
Bus rapid transit	1.450	1.600	1.300
Public bus (tram)	1.000	1.000	1.000
Public bicycle	0.748	0.664	0.832
Taxi	0.715	0.620	0.810
School bus	0.590	0.620	0.560
Compact car	0.015	0.020	0.010

buses (tram) are used as a standard, then rail transport, rapid transit buses and public buses (trams) are undoubtedly public transport modes. The "publicity" value of the private compact car is close to zero which indicates it has a good identifiability. Worthy of discussion are the public bicycle, school bus and taxi. The "publicity" indices of these three transport modes are lower than public buses (tram) but significantly higher than private compact cars. These three modes play an important role in satisfying the travel needs of specific groups. They can also help to facilitate a smooth change of transportation travel behavior and promote the sustainable development of transportation. Therefore,

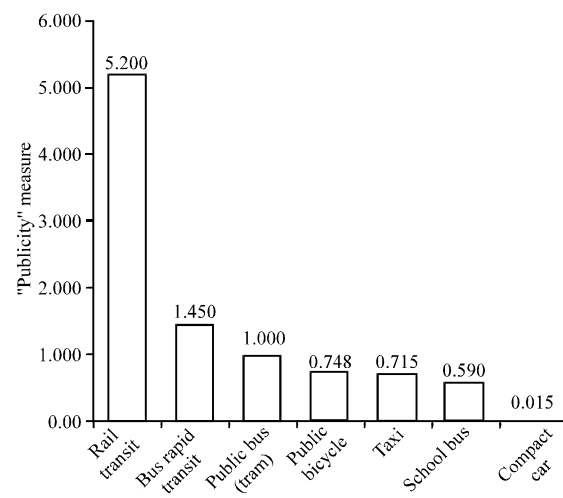


Fig. 3: "Publicity" calculation results

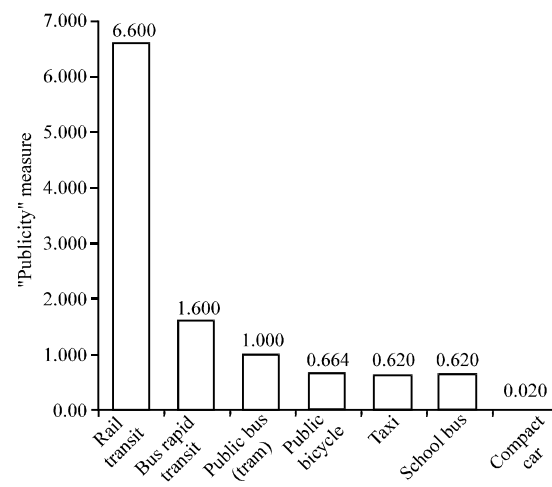


Fig. 4: "Publicity" calculation results

these transport modes should be considered as characteristic (or special) forms of public services and be adopted into the public transportation system to facilitate integrated management by the city government.

Where to position taxis is particularly important and is discussed here in more detail. Based on the above publicity measurement evaluation and the analysis of the priority of buses, it proposes the following macro development orientation to taxi transport:

- Taxi transport is a public transport service that can meet a specific time and space in travel demand, compensate for inadequate service of regular public transport services and have a positive effect in reducing and slowing the purchase of compact car

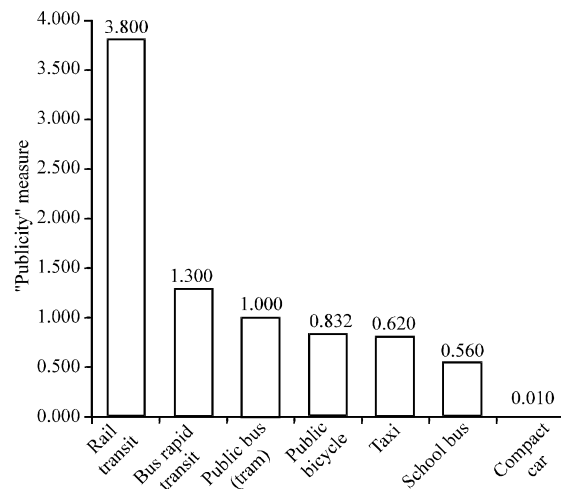


Fig. 5: "Publicity" calculation results

by families. Thus, it should be included in the government's public transportation management field and its overall scale, growth rate, business model, pricing and so on, should be unified and managed by the government

- The service quality provided by taxi transportation is the highest of the existing urban transport modes. It is faster and more comfortable than walking, cycling and regular public transport, it eliminates fatigue for individuals who would otherwise be driving and eliminates the trouble of finding parking spaces. The cost of using the taxi service should reflect the quality of its services. Low cost taxi usage would stimulate unreasonable travel demand and would have a negative impact on both the shaping of healthy travel behavior and the cumulative effect of implementing public transportation prioritizing policies
- Taxi transport has a low efficiency in term of the usage of public resources. The reality of the constraint of "many people, fewer resources" has determined that taxi transport can not be included in the priority development target in China. The national authority should state clearly the orientation of the taxi development policy and strategy, control the development scale of taxis appropriately and plan and construct taxi stands and a unified management platform for the public to use free of charge. However, the wisdom of spending a huge amount of public finances to subsidize the cost of taxi operations (e.g., petrol) is debatable

CONCLUSION AND FUTURE RESEARCH

Different countries and regions have their own classification methods and standards defining urban

public transport or the modes to which urban public transport belong. These classification standards are adjusted over the time as new means of transport and transport technologies arise. What the crucial is that government should judge advantage of the transport or the modes firstly, allow the use of public finances as a subsidy. It cannot guarantee that the government gives the public subsidy to all the urban public transport or the modes. Because it will lead to the problems on management, such as operational service requirements, price verification and so on.

A "publicity measurement" index is calculated and analyzed to quantitatively characterize the "publicity" of different modes of transport in this study. It considers the service excludability of urban transport and the utilization efficiency of public resources. A comparison of the "publicity" values for the different transport modes, using the three sets of weight combinations, show uniform calculation results. The sequence of transport mode in terms of "publicity" is as follows: rail transit, bus rapid transit, public bus (tram), public bicycle, taxi, school bus and private compact car.

Especially, the public bicycle, school bus and taxi were controversial in the admin area. These transport modes should be considered as characteristic (or special) forms of public services and be adopted into the public transportation system to facilitate integrated management by the city government. Based on the above publicity measurement evaluation and the analysis of the priority of buses, it proposes some macro development orientation to taxi transport.

A "publicity measurement" index is proposed in this study. However, there is still room for improvement for future studies. Future studies should pay more attention to the following issues about the problem of management: public transport market entry rules, operational service requirements, price verification, planning permission and the subsidy mechanism.

ACKNOWLEDGEMENTS

This research is supported by National Natural Science Foundation Key Program of China named "The Demand Research about the Priority Status of the Development of Urban Public Transportation in China (712401008)". And of course, the authors answer for all viewpoints, conclusions and errors.

REFERENCES

- Adler, S.M., 1980. The political economy of transit in the San Francisco Bay area 1945-1963. Ph.D. Thesis, University of California, Berkeley, USA.

- Chen, L., W.W. Fan and W. Wang, 2006. Connotation, denotation and development strategy of public transport priority. *Urban Public Transp.*, 6: 19-21.
- Chen, X.H., 2008. *Urban Passenger Traffic System*. Tongji University Publishing, Shanghai, China.
- Li, Y.Y., W. Zhou and Y.Q. Wang, 2005. An optional method of urban public transport development mode. *J. Transp. Syst. Eng. Inform. Technol.*, 5: 41-44.
- Liu, J., W. Deng and B. Zhang, 2011. Conjoint analysis based transit service quality research. *J. Transp. Syst. Eng. Inform. Technol.*, 11: 97-102.
- MOC, 2004. Ministry of construction's opinions on the priority of the development of urban public transport. Ministry of Construction, China.
- MOC, 2006. Opinion regarding several policies on the priority of the development of urban public transport. Ministry of Construction, China.
- McGee, M.P., 2003. An examination of the impact of the Americans with disabilities act on Monterey-Salinas transit: Implementation of an unfunded public policy. Ph.D. Thesis, Golden Gate University, Monterey-Salinas, USA.
- Wang, F., 2007a. Continuing priority on public transportation development and advancing construction of harmonious transportation systems. *Urban Transp. China*, 5: 7-13.
- Wang, G., 2007b. Promoting advances in urban science and harmony in society through transit priority strategies. *Urban Transp. China*, 5: 6-10.
- Xiong, W. and X.H. Chen, 2009. Comparison of urban traffic patterns between domestic and overseas cities. *City Planning Rev.*, 33: 56-66.