A Simplified and Rapid Method for Formulating Urban Transport Strategy

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In developing countries, as cities expand in terms of area, population and economic activities, urban transport problems increase their seriousness. Before facing the critical situation, it is important to formulate an urban transport strategy and take necessary actions. In order to formulate an urban transport strategy, it is desirable to conduct a comprehensive and full scale urban transport master plan study. The master plan study, however, requires huge cost and time. In this background, instead of conducting the master plan study, this paper proposes a simplified and rapid method to support for formulating the urban transport strategy based on " the Research on Practical Approach for Unban Transport Planning" conducted by JICA(Japan International Cooperation Agency). In this method, as inputs, data from the check list for diagnosis on transport problems, the urban data sheet and the interview sheet developed by the JICA's research are used. The outputs are diagnosis and prescription of urban transport problems. Then using the proposed flow charts, basic components for urban transport strategy are selected. The components consist of the selected factual traffic mode, such as railway, BRT and measures such as TDM.

Key Words: *urbanization expansion, urban transport problems, urban transport strategy, practical approach, traffic mode selection,*

1. Introduction

(1) Background

Urbanization is rapidly progressing also in the developing countries. Demographia[1)], an urban and city population related data base, listed 398 cities (including urban agglomerations) whose population are one million or more. There are 167 cities in East, Southeast, South and Central Asia. Among 26 cities with over 10 million population, 16 cities are located in the above Asian area. Annual population growth potential in 112 cities is exceeding 2%. The 112 cities exist in the Asian area (68cities) and in Africa (30cities). In addition, 99 cities have population density over 100 people/hectare. The area distribution is 67 in the Asian area and 15 in Middle East.

As urbanization progresses, problems arise especially in the transport sector. They are usually traffic congestion, inconvenience, decline of traffic safety, pollution/nuisance and social injustice/inequity.

Before facing the critical situation, it is necessary to take actions subject to the transport planning. Key actions are considered to facilitate the modal shift from personal traffic mode to public mode and introduction of mass transit system. Traffic demand control system is required depending on cases. For the planning, one of the important things is to formulate urban transport strategy with long/medium term policy goals and visions.

To support urban transport strategy formulation, the best way seems to conduct an urban transport master plan study with comprehensiveness and full scale. It is indispensable for the master plan study to collect a lot of data with heavy load. For example, a large scale of traffic survey to obtain the current traffic pattern and forecasting future traffic demand etc. is usually required. This is time consuming and costly. From this background, JICA conducted a research (the Research on Practical Approach for Unban Transport Planning[2)]) aiming to support urban

transport strategy formulation. One of the achievements, the research developed a method to support the formulation.

This paper proposes the simplified and rapid method based on the JICA's research. In the next chapter, the outline of the research and the proposed method are presented. Chapter 3 introduces input tools of the method. Chapter 4 explains the two process tools of the method. Then in Chapter 5, outputs and sample cases are shown. Next, Chapter 6 shows the implementation result of the selection process for basic components of an urban transport strategy, namely, transport mode and/or measure.

2. Outline of the proposed method

(1) JICA's Research

The JICA's research tried to find important and useful inputs/implications for supporting urban transport strategy formulation. The research undertook the collection and typological analysis of basic data on cities (urban agglomerations). Those data are composed of socio-economic phase and findings on problems, prescription and actual actions/measures taken. The actions/measures include introduction of transport mode and/or TDM (transportation demand management). The actions/measures are extracted from the reviewing results of factually proposed and implemented transportation projects. Then, the relation between socio-economic phase and the action /measure was analyzed.

Although the research yielded a certain set of conclusions, many of the conclusions only suggest probable tendencies. Partly, the obtained result, such as correlation between metro operation start time and GRP (Gross Regional Product), can be usable. The research, however, rather made it clear that the actual urban transport situations have diversity which cannot be neglected. The findings of the analysis at that point could not be generalizes as universally applicable to every city. From this result, the JICA's research tried to find minimum necessary data and to devise procedures to arrive at a basic transport strategy component.

(2) The outline of the proposed method

Referring to the above findings and outcomes, a simplified and rapid method for supporting an urban transport strategy formulation was developed. By the research, first, minimum necessary data were identified again. Then the formats for data collection were devised. Third, two analysis processes (a matrix and flow charts) were developed.

Fig.1 illustrates this method. The method is constituted by three stratums: inputs, processes and output. For obtaining inputs, one check list and two sheets are used. From the check list, diagnosing urban transport problems are directly obtained. The check list also produces prescriptions for urban transport problems through the matrix for diagnosis and prescription. Finally, combining the inputs (data from the check list and two data sheets), the basic component selection procedures (flow charts) outputs components of a basic urban transport strategy. The components consist of alternative measures:

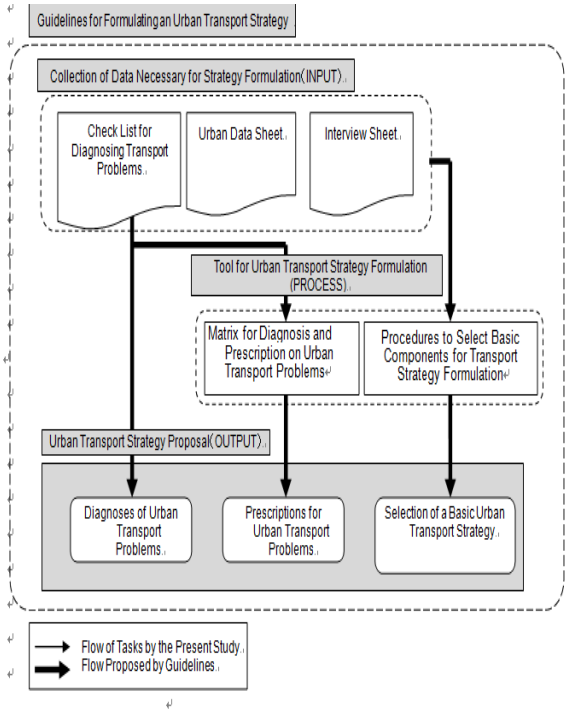


Fig.1 Composition of the method for formulating an urban transport strategy proposal

public transport mode such as rail, BRT, urban highway and/or TDM.

3. Input

The necessary data are categorized into objective data and subjective data. The objective data such as socio-economic indicators and traffic demand characteristics are collected by the urban data sheet. The subjective data are organized as informed judgment about the problem intensity and causes. Effective alternatives available for solving the problems are included in the subjective data. Those subjective data are obtained by the the check list and interview sheet

(1) Urban Data Sheet

The format and data items to be collected are shown in Appendix A. In addition to the official data base,

usually transport consultants who have access to available sources of transport statistics are important and efficient source.

(2) Diagnosing Transport Problem Check List

In the Appendix B, the format and data items are presented. Because the list is simplified, data should be collected not only from experts and governmental officials but also from ordinary citizens. In addition, to avoid the biased opinion effect on the statistical significance of collected data, data gathering should be conducted from as many sources as possible.

(3)Interview Sheet

Appendix 3 introduces the format and data items of the interview sheet. Interviews are conducted with at least 10 to 15 knowledgeable experts in urban transport problems and policy measures. It is desirable to carry out pre-interview to finalize the question for interviews.

4. Process

(1) Diagnosis and Prescription Matrix

Fig.2 depicts the concept of the matrix. The vertical axis shows rows of itemized urban transports. On the other hand, horizontal axis lists columns of prescribed measures to solve the problems. The matrix components (cells) are rated by assigning 1 to 3 points in light of three levels of the prescription's effectiveness (the columns) against the designated problems (row). This three point rating method is adopted as a trial.

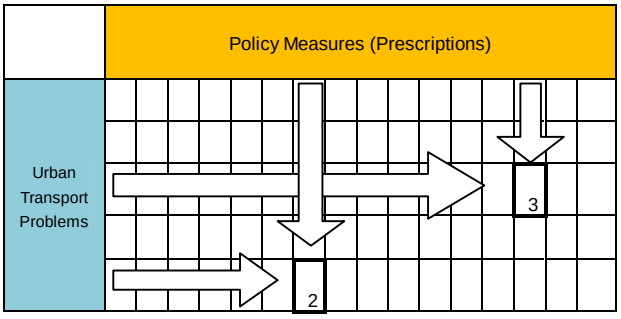


Fig.2. Diagnosis and prescription matrix

Appendix B shows the classified urban transport problems and Table 1 tabulates the prescribed measures for transport problems. Both have three categories from primary level to tertiary level as presented. Based on the 4 problems summed up[2)] as primary classification (the first column of the table on Appendix B), the problems are further typologically classified by the JICA's research reviewing the reports of conducted master plan studies by JICA. The prescriptions are also complied based on the proposed projects and measures by the JICA's conducted studies. Using this matrix, the relationship of the prescription and problems is calculated by multiplying. This is expressed as:

Importance of a prescribed measure =
(scale of the effect from the measures: an assigned point in the cell) x (seriousness of the problem: a point which is evaluated according to a problem item).

Table 1 Typology for prescribed measures for transport problems

Development Strategy (Prescribed Measures for Transport Problems)		
Primary Classification	Secondary Classification	Tertiary Classification
Land Use / Urban Structure		· Compact multi-core urban structure
Infrastructure	Road Infrastructure	· Construction of urban highways and arterial roads
		· Construction of missing links in the network
		· Establishment of grade-separated network
		· Development of feeder roads and local roads
		· Strengthening of road maintenance system (improvement of pavement)
		· Grade separation at major intersections
		· Improved designs for intersections at grade with traffic
		· Removal of roundabouts
		· Construction and widening of bridges
	Transit Infrastructure	· Construction and improvement of urban railways
		· Restructuring of bus network
		· Construction and improvement of bus stops
		· Construction and improvement of bus terminals
		· Diversification and replacement of vehicles
		· Modernization of bus services
		· Integrated separation of bus, minibus and para-transit services
Traffic Management	Road Traffic Management	· Installation of traffic signals
		· Improvement of signal control (green phases for left- and right-turn traffic)
		· Introduction of zone traffic control
		· Efficiency improvement of traffic control
		· Development of roadside and off-road parking space
		· Strict policing on illegal parking
	Traffic Demand Management	· Suppression on ownership and use of private automobiles
		· Facilitation of modal shift
		· Transit-oriented development policy
		· Demand dispersing measures
	Traffic Safety	· Public education on traffic safety
		· Construction and improvement of traffic safety facilities
		· Strengthening of policing on traffic rule violations
Organization / Institution	Transport Planning and Administration	· Clear definitions of administrative jurisdiction between related agencies or departments
		· Establishment of an administrative coordinating body for urban transport development and management
		· Capacity development of personnel
	Management and Operation of Transit Systems	· Efficiency improvement of management systems (licensing and permits, enforcement of regulations, etc.)
		· Establishment of fiscal independence and abolition of subsidies
		· Modernization of operating systems
	Institutions for Project and Program Implementation	· Improvement of the procedure for land acquisition or appropriation
		· Development of PPP schemes
		· Capacity development of personnel
	Shortage of Finance	· Increase of revenue sources
		· Creation of transport-specific revenue sources

(2)Procedures to Selected Basic Components for Transport Strategy Formulation (Flow Chart)

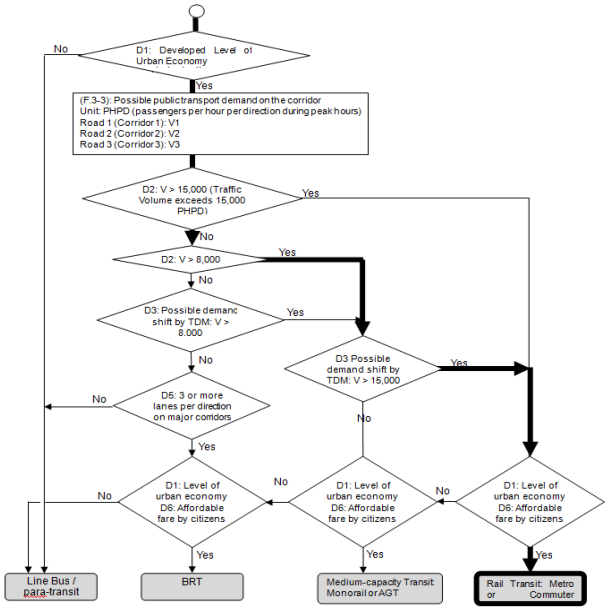
In formulating an urban transport strategy for a given city, it is most important to decide the components of the strategy. Those are the type of public transport mode suited the city including to check

whether the city is ready to introduce the mode type. At the same time, it is necessary to select and put into effect a set of traffic management measures. By the JICA's research, flow charts are prepared to show the procedures for selecting a transport alternative and applicable TDM measures.

The following five flow charts are proposed to prepare and show the stragegic precedure judgment for the component selection. Those procedures to judge are:

a) the selection of a basic public transport mode,
b) the introduction of a railway transit system,
c) the introduction of a BRT system,
d) a selective set of TDM measures and
e) the introduction of urban highways.

Fig.3 demonstrates the flow chart of a), Fig.4 and Fig.5 illustrates the flow charts of the above c) and e) respectively. The flow charts b) and d) are shown in Appendix D and E as factual application cases of the six cities as explained in Chapter 6.



. **Fig.3** Procedure (Selection of basic pulic transport mode)

In each procedure(flow chart), to select YES or NO, data from Urban data sheet(F) and interview sheet(I) are used. Table 2 shows a sample of steps for judge (criteria) relevant to Fig.3. Regarding judging criteria, partly the result of the JICA' research is used. For example, in Fig 3, D1 (criteria to judge the urban economic level) in the first diamond, whether the city's GRDP (Gross regional domestic product) reaches US 3.0 million, refers to the research result.

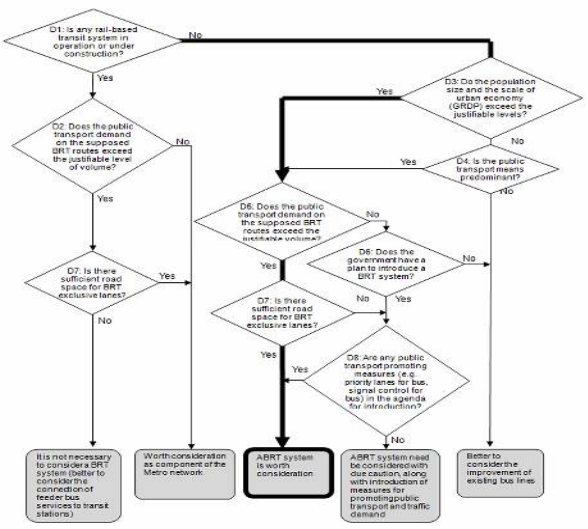


Fig.4 Procedure(Jugdging a BRT system introducion)

Table 2 Steps to Judge a suitable public transport system

Item No. For Judgment	Strategic Question	Information Necessary for Judgment	Yes No
D1	Do the current social and economic conditions of the city exceed the justifiable level of development to sustain the operation of a BRT or metro system?	(F.2-1) Judge affirmative, when per capita GDP exceeds US$700, or GRDP of the city (= the city's population multiplied by per capita GDP) reaches US$3.0 million.[1)]	Y/N
D2	Is the current passenger traffic on major corridors sufficiently large?	(F.3-3) Judge affirmative, when passenger traffic during peak hours on one of three major corridors exceeds 8,000PPHPD (for a BRT system), or 15,000PPHPD (for a metro system).	Y/N
D3	Are some TDM measures now in force to promote the modal shift to public transportation? Or, Is it feasible to expect the suppression of demand by TDM measures?	(I.3-3) What Is the current level of public awareness about the need of modal shift? (I.3-4) If 10% of the passengers on private automobiles should shift to public transport, can the existing system absorb the shift? (I.3-5) What are the measures necessary to back up the absorptive capacity of public transport? (I.3-6) Is there any measure in force to suppress the private use of passenger cars? (I.3-7)On-going measures to promote the use of public transport (I.3-8) What types of TDM measures are feasible to restrict the private ownership and use of automobiles in the city?	Y/N

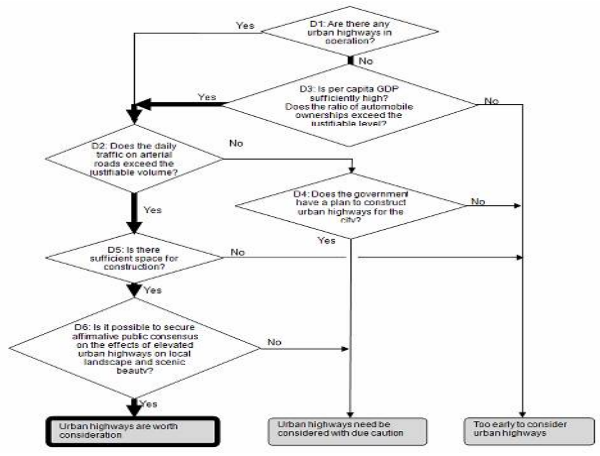


Fig.5 Procedure(Jugdging an urban highway introduction

5. Output

(1)Diagnosis of Urban Traffic Problems

The diagnosis of an urban traffic problem involves observing the problem, the number of times it occurs, and its seriousness extent. The problems are rated according to the following scale of seriousness and urgency:

A=very serious/immediate action needed
B=serious/actions needed
C=not serious

For rating, 3 points is given to A, 2 points to B and 0 point to C(Other rating is possible.)

For each primary classification level, the share of the points to the maximum rate is calculated and shown in radar charts per city. If all tertiary items are considered as "very serious" the rate would be 100%, and if not serious (0 points), the rate would be 0%. In Table 3 and Fig.6, the cases of Jakarta and Hanoi are introduced.

Table 3 Diagnosis of urban transport problems

Transport Problems	No. of Tertiary Items	Maximum Points	Jakarta		Ha Noi	
			Points	Ratio to Maximum	Points	Ratio to Maximum
Congestions (Capacity Shortage of Infrastructure)	5	15	13	87%	11	73%
Congestions (Other Causes)	17	51	40	78%	28	55%
Inconvenience	10	30	23	77%	9	30%
Declined Traffic Safety	8	24	18	75%	20	83%
Transport-origin Pollution and Nuisance	6	18	10	56%	3	17%
Social Injustice	10	30	22	73%	5	17%
Total	56	168	126	75%	76	45%

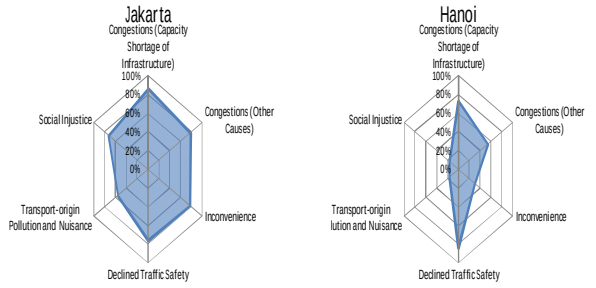


Fig. 6 Diagnosis of urban transport problems

(2) Prescriptions for Urban Transport Problems

The importance of a prescribed measure is determined by the seriousness of the problem (awareness degree of seriousness) aiming to solve and its potential to help solve that problem. The actual calculation is explained in Chapter 4. (1). The results should be able to indicate the relative importance of measures prescribed for each subsector. As a sample the case of Jakarta and Hanoi are shown in Table 4 and Fig. 6.

Table 4 Relative importance of prescribed measures

Development Strategy (Prescribed Measures for Transport Problems)		Judged Points				Relative Importance			
		Jakarta		HaNoi		Jakarta		Ha Noi	
Primary Classification	Secondary Classification	Primary	2nd-ary	Primary	2nd-ary	Primary	2nd-ary	Primacy	2nd-ary
Land Use / Urban Structure		23	23	14	14	96%	96 %	58%	58 %
Infrastructure	Road Infrastructure	264	136	142	97	85%	89 %	46%	63 %
	Public Transport infrastructure		128		45		82 %		29 %
Traffic Management	Road Traffic Management	227	72	178	58	80%	75 %	62%	60 %
	Traffic Demand Management		87		58		94 %		62 %
	Traffic Safety		68		62		71 %		65 %
Organization / Institution	Transport Planning and Administration	111	36	81	30	76%	75 %	55%	63 %
	Transit Management and Operation		17		9		63 %		33 %
	Institutions for project and program Implementation		23		13		77 %		43 %
	Finance		35		29		83 %		69 %
Total		625	521	415	287	82%	68 %	54%	38 %

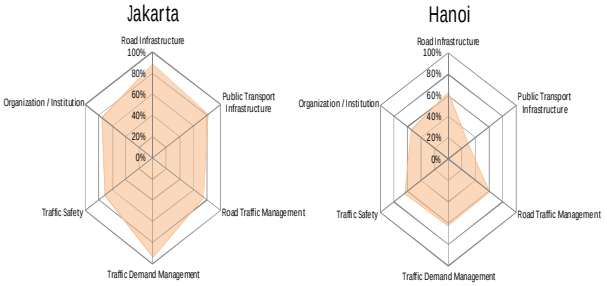


Fig.7 Relative importance of prescribed measures

(3)Urban Transport Strategy Basic Components

Using the five procedures (selection flow charts), judgment results of a basic public transport mode is selected from Line Bus/parat-transit to rail transit (metro/commuter rail). Then, further justification, viability and timing of actual measures (railway, BRT, TDM and urban highway) are judged by the other flow charts. Appendix D and E show the 6 cities' cases as the result of the method application. As sample, the Appendixes highlight railway transit and TDM introduction of the 6 cities.

6. Implementatio result of the method (Section Flow Chart)

A case study on six cities in Asian area was conducted to check the practical validity of the proposed method focusing on the selection flow charts. Two cities each were selected from India, Vietnam and Indonesia. The necessary data, those cities' current

transport conditions, policies and programs, are collected by the tools (the cheek list, data sheet and interview sheet) of the proposed method. Then using the collected data as inputs to the selection flow charts, judgment on a basic public transport mode and other four measures obtained by the flow charts were compared to the proposals by the actual master plan of the six cities.

Table 5 shows the comparison the strategic judgment (selection) by the method and the result of the transport master plans of the six cities. In the judgment(procedure) of (I),(II),(III) and (V), the case study result agree with the proposals from the master plan of the six cities. Although the judgment (IV) does not produce strong agreement, the proposed method (procedure) is judged practical to identify feasible prospects for urban transport development as a whole.

Table 5 Comparison of flow chart judgment and master plan proposal

Country / City	Vietnam		India		Indonesia	
	Ha Noi	Ho Chi Minh	Hyderabad	Pune	Jakarta	Sura-baya
(I) Judgment on a basic public transport mode	transport corridor is different	A	A	A	A	A
(II) Judgment on a railway transit	A	A	A	A	A	A
(III) Judgment on a BRT system	A	A	A	A	×	A
(IV) Judgment on feasible TDM measures	B	B	NA	B	B	NA
(V) Judgment on urban highways	C	A	NA	NA	A	C

Note: A =not much different from the master plan proposal
B=different in part C=no congruity with master plan proposal
NA means not applicable.

7. Conclusion

The JICA's research has developed a simplified and rapid method for supporting an urban transport strategy formulation. The model has three tools to deal with urban transport development: the tool to diagnose problems and subsectoral priorities, the tool to prescribe appropriate measures to solve or alleviate the problems, and the third one is the tool to select a most strategically suitable alternative for transport development. The tools are simple and compact in design to provide quickly whatever answers they are meant to provide.

The employed logic in the devising process of the tools, however, is still too crude to stand up to well-intentioned scrutiny. First, individual urban transport problems are rated to three ranks of "very serious", "serious" and "not serious." However, the JICA's research does not provide a clear definition of what constitutes the seriousness or the lack thereof. The individual transport problems themselves are heavily dependent on the subjective judgment on what is "problematic." Second, the elements (cells in the matrix) of prescriptions as per problems are rated for their respective effectiveness considering the possible size of investment requirements and the possible size of passengers who are either affected by or benefit from a given prescription. But the large part of the rating is philosophical. Third the flow charts of the selection are fairly simple. Paths in the flow charts for judgment will have to be increased to ensure more general applicability.

It will be necessary to improve their designs and raise their practicability. The tools devised by the JICA's research must be continuously modified. For the modification, the important action is to feed back the inadequacies found during the repeated application trials to the proposed method.

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Appendix A

1) Urban Data Sheet and Interview Sheet

(1) Urban Data Sheet

1. Basic Information

F.1-1 Please attach maps which show the city boundary and specify the urban area on it. (Note: "Urban Area" is defined as urbanized area with a continuously built up land mass of urban development, which is different from a "City" defined with an administrative boundary. "Urban area" can be larger or smaller than "city". Please note which one is used in the following questions, "City" or "Urban Area")

(i)

(ii)

F.1-2 Please fill the table below;

	(A)City	(B)Urban area
(iii) Area (km2)		
(iv) Longer width of the city (km)		
(v) Shorter width of the city (km)		

F.1-3 Please describe the geographical conditions of the city.

	Flat (%)	Hilly area (%)	Mountainous area (%)
(vi) City center			
(vii) City			
(viii) Urban area			

F.1-4 What kinds of function does the city have? Please select all applicable to the city.

(i) Capital
(ii) Provincial Capital
(iii) Administrative, financial, and business center
(iv) Distribution center
(v) Industrial city
(vi) Tourism city
(vii) Academic city
(viii) Others (please specify, _____)

F.1-5 In the city center, is residential area or small-scale industrial sector mixed with business and commercial area?

(a) All of them are mixed.
(b) City center is specialized into business and commercial sector.

F.1-6 Is there any CBD (Central Business District) in the urban area?

(a) Yes.

Name of CBD	
Name of CBD	
Name of CBD	

(b) No.

2. Urban Structure

F.2-1 Please describe demographic and economic condition of the city and the urban area.

(A) City

		Latest		about 5 years ago		about 10 years ago	
		value	year	value	year	value	year
Population							
Pop. growth rate (%/yr)			from		from		from
			to		to		to
GRDP (currency unit) _____(at current price)							
GRDP per capita (ditto)							
Share of GRDP (%)	Primary						
	Secondary						
	Tertiary						

(ix)

(B) Urban area

		Latest		about 5 years ago		about 10 years ago	
		value	year	value	year	value	year
Population							
Pop. growth rate (%/yr)			from		from		from
			to		to		to
GRDP (currency unit) _____(at current price)							
GRDP per capita (ditto)							
Share of GRDP (%)	Primary						
	Secondary						
	Tertiary						

APPENDIX B

(1) Check List for Diagnosis on Urban Transport

1. The seriousness of urban traffic problems

Please rate each item on a 3-point scale. (A: Very serious, B: Serious, C: Not serious)

Urban Traffic Issue			Degree
Large classification	Middle classification	Small classification	
(A) Traffic Congestion	1) Congestion on express-ways	Traffic demand beyond road capacity	A･B･C
	2) Congestion on arterial roads	Traffic demand beyond road capacity	A･B･C
		Mixed inter-city and inner-city traffic	A･B･C
		Deterioration of road pavement	A･B･C
		Frequent traffic accidents	A･B･C
		Bad driving manner	A･B･C
		Insufficient traffic safety education	A･B･C
		On-street / road-side parking or street people or vendor	A･B･C
	3) Congestion on roads in city centre	Traffic demand beyond road capacity	A･B･C
		Increase in individual trips	A･B･C
		On-street / road-side parking	A･B･C
		Incomplete crackdown on illegal parking	A･B･C
		Mixed traffic of 4-wheeler and 2-wheeler / non-motorized traffic	A･B･C
		Insufficient public transport services	A･B･C
		Ineffective bus route network	A･B･C
		Bad driving manner	A･B･C
	4) Congestion on intersections	Traffic demand beyond intersection capacity	A･B･C
		Ineffective traffic control on intersections	A･B･C
		Bad driving manner	A･B･C
	5) Traffic jam of buses around bus-stops	Excessive bus service	A･B･C
		Interruption of traffic flow at bus-stops	A･B･C
		Bad driving manner	A･B･C
(B) Inconvenient Transport Service	(x) 1) Poor public transport services	No public transport services available	A･B･C
		Poor accessibility to public transport	A･B･C
		Low reliable operation of public transport	A･B･C
	2) Low comfort and safety	Overcrowding at public transport vehicles	A･B･C
		Insufficient bus network	A･B･C
	3) Poor inter-connection of public transport	Inconvenient transfer in terminal	A･B･C
		Too much transferring for a trip	A･B･C
	4) Inconvenient taxi services	Rejection of boarding of taxis	A･B･C
		Unclear fare structure	A･B･C
	5) Inconvenient para-transit services	Low-quality service	A･B･C
(C) Lowering of Traffic Safety	1) Lowering of pedestrian safety on crossing	Bad driving manner	A･B･C
		Shortage of pedestrian facilities	A･B･C
	2) Lowering of pedestrian safety on sidewalk	Narrow width of sidewalk	A･B･C
	3) Traffic accidents on roads	Mixed traffic of cars and NMT / buses and para-transits	A･B･C
		Deterioration of road pavement	A･B･C
		Bad driving manner such as ignoring traffic signals	A･B･C
		Black spot for traffic accidents	A･B･C
	4) Lowering of public transport security	Overcrowding at public transport vehicles	A･B･C
(D) Environment Deterioration	1) Air pollution from automobile fumes	Inflow of large trucks	A･B･C
		Incensement of private vehicles	A･B･C
	2) Noise / Vibration problems	Increased volume of traffic at night	A･B･C
		Increased number of inappropriate vehicles (such as high gas emissions or decrepit cars)	A･B･C
		Deterioration of road pavement	A･B･C
	3) Landscape / insolation problems	Worsening by road construction or elevated structure for traffic	A･B･C
(E) Social Injustice	1) Vulnerable road users	Existence of no public transport service area	A･B･C
		Existence of disaster-prone area	A･B･C
		Low mobility of pedestrians or NMT users	A･B･C
		Shortage of barrier-free facilities for the elderly and the disabled	A･B･C
		The mobility disparity between men and women	A･B･C
	2) Bad influence on residents near the site of ongoing projects		A･B･C
	3) Undeveloped accident compensation system		A･B･C
	4) Incomplete crackdown on traffic violation		A･B･C
	5) Fare setup	Biased subsidy	A･B･C
		Improper pricing	A･B･C

Appendix C

(1) Interview Sheet

2. The kind of urban traffic problems

Please select all applicable choices and put a in the appropriate box without having received instructions.

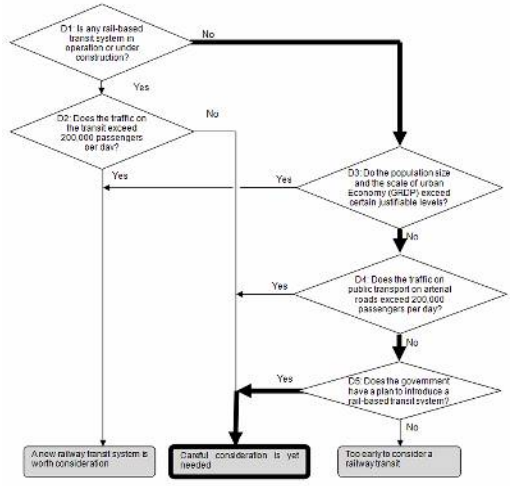
Note:
BRT: a term applied to a variety of public transportation systems using buses to provide faster, more efficient service than an ordinary bus line. Often this is achieved by making improvements to existing infrastructure, vehicles and scheduling. The goal of these systems is to approach the service quality of rail transit while still enjoying the cost savings and flexibility of bus transit.

METRO：metro system is defined as an urban, electric passenger transportation system with high capacity and high frequency of service, which is totally independent from other traffic, road or pedestrians. The terms heavy rail (mainly in North America) and heavy urban rail often have similar definitions.

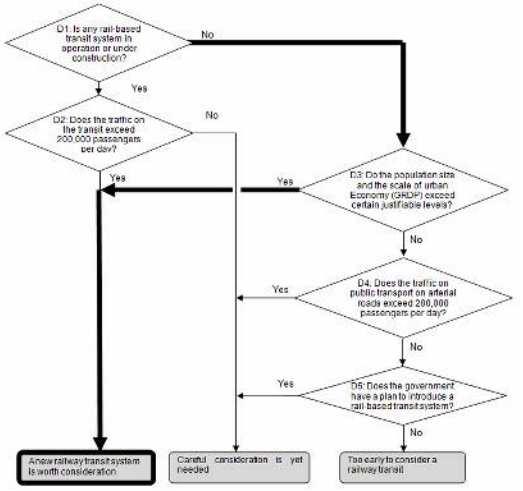
Group	No.	Question	Item	check
1. The traffic status of the city				
Traffic congestion	I.1-1	How do you feel about traffic congestions in urban areas of the city?	Serious across the city	
			Serious only at major bottlenecks	
			Not so serious	
			Not serious	
	I.1-2	What do you think are the major causes for urban road traffic congestion?	Traffic demand beyond road capacity	
			Roundabout	
			Bottleneck at bridge or at-grade rail crossing	
			Traffic demand beyond intersection capacity	
			Deterioration of road pavement	
			Bad driving manner	
			Reckless crossing of pedestrian without traffic signal	
			Unconsolidated and insufficient road traffic sign	
			Ineffective traffic signals and those failure Roundabout	
			Manual traffic management at intersections	
			Mixed traffic of 2-wheeler and 4-wheeler	
			Mixed traffic of cars and non-motorized traffic	
			Inflow of large trucks	
			Mixed inter-city and inner-city traffic	
			Frequent traffic accidents	
			On-street / road-side parking	
			Street people and vendor	
	I.1-3	What kinds of problems are caused by bus services?	Traffic congestion due to the excessive bus service	
			Traffic congestion due to the loading and unloading of bus fleets	
			Traffic congestion due to the bus stop parking of bus fleets	
			Traffic congestion due to the bus fleet parking except the bus stop	
	I.1-4	What kinds of problems are caused by para-transit services? (e.g. rickshaw,ojek, bajaj, tuktuk)	Traffic congestion due to the roadside parking of para-transit vehicles	
			Traffic congestion due to the mixed traffic of para-transit vehicles and normal traffic	
			Traffic congestion due to the loading and unloading of para-transit vehicles	
			Traffic congestion or accidents due to the bad driving manner of para-transit vehicles	
			Traffic accidents against pedestrians	
			Traffic accidents against cars	
			Trouble on fare negotiation	

Appendix D Six Cities: Judgments about Railway Transit

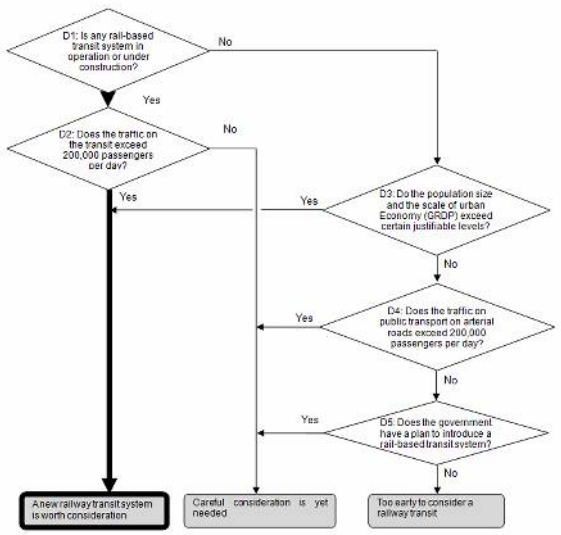
Hanoi



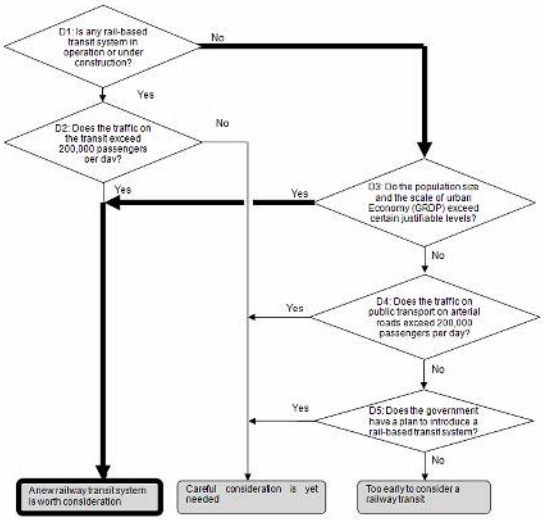
HCMC(Ho Chi Minh)



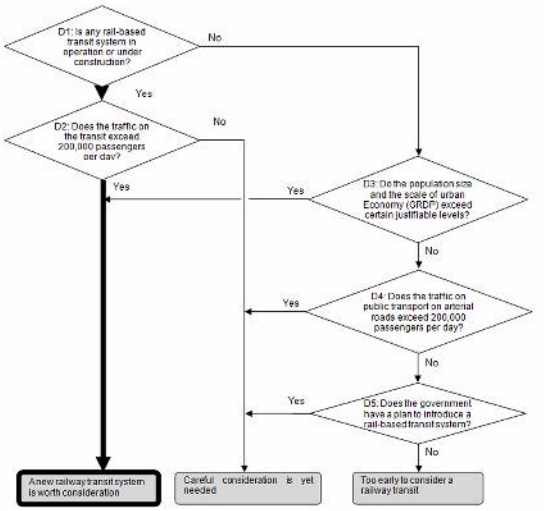
Hyderabad(India)



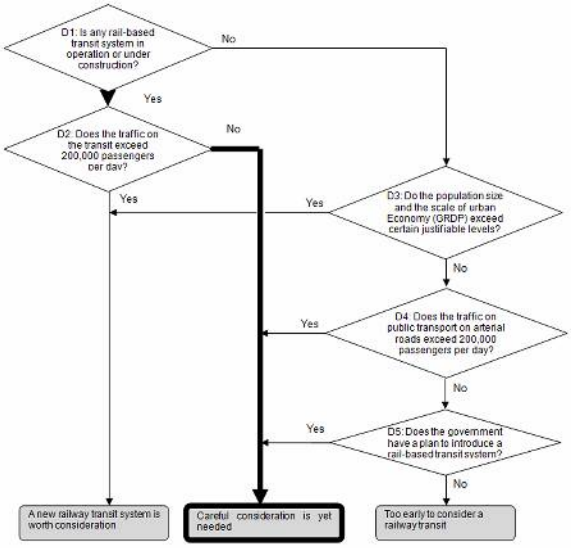
Pune(India)



Jakarta

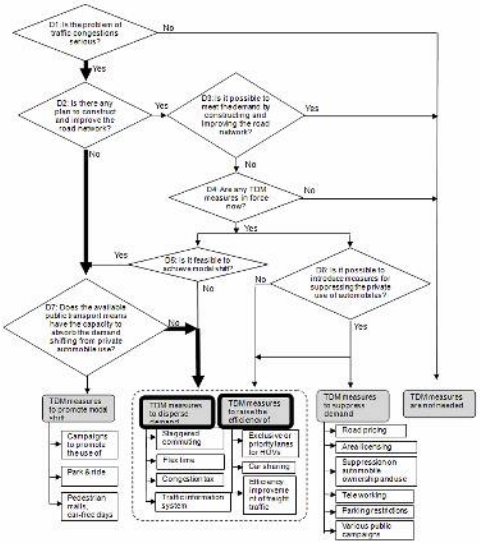


Surabaya

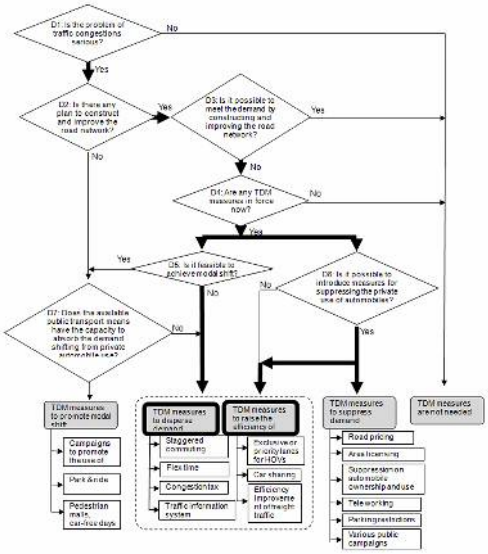


Appendix E Six Cities: Judgments about TDM Measures

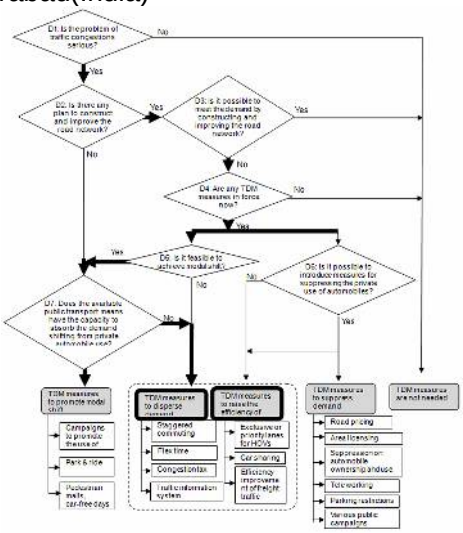
Hanoi



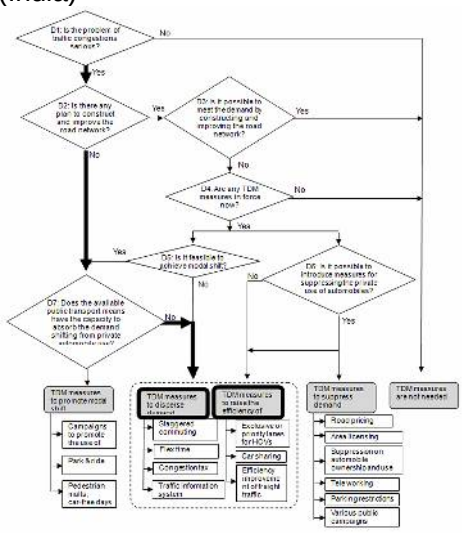
HCMC(Ho Chi Minh)



Hyderabad(India)



Pune(India)



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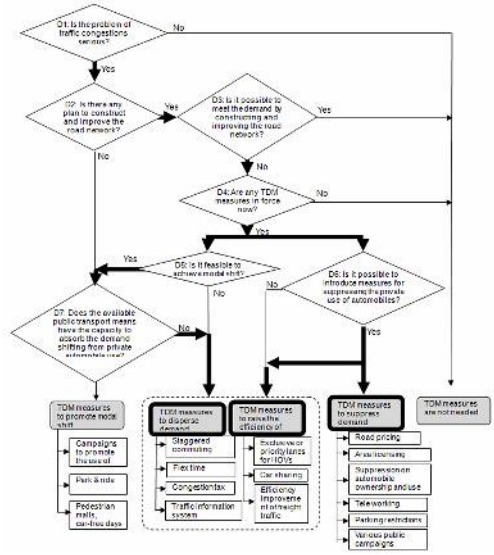

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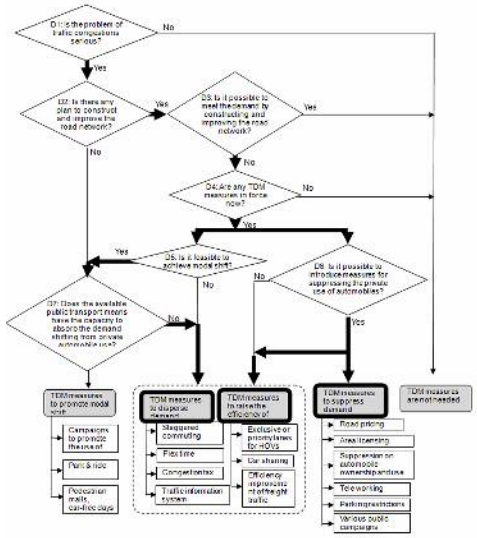

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