Annexes

Annex A. Inventory on Application of Traffic Management Measures **168**
Annex B. Methods of Traffic Management Planning Process **171**
Annex C. Household Accessibility and Personal Mobility in Hanoi **181**
Annex D. Expert Survey on Weighing of Assessment Criteria **210**
Annex E. Qualitative Assessment of Traffic Management Measures **237**

Annex A. Inventory on Application of Traffic Management Measures

Table A- 1: Application of traffic measures in OECD countries until 1995

Categorisation				Area		Traffic time		Other Conditions			
No.	Type	Strategy class	Measures	U	IU	P	OP	HD	CM	SE	INC
1	Demand-side	Land use and Zoning	Land use and Zoning policy	X	Y	X	Y			X	
2			Site and Amenities and Design	X		X	Y			X	
3		Communication Substitutes	Telecommuting	x	Y	X			Y		
4			Teleconferencing	Y	X	Y	Y				
5			Teleshopping	Y		Y	Y				
6		Traveller Information	Pre-trip Travel Information	X	X	X	Y	X	X	X	X
7			Regional Rideshare Matching	X		X			Y	Y	
8		Economic Measures	Congestion Pricing	X	X	X	Y	X	Y	X	
9			Parking Pricing	X		X	Y			X	
10			Transport Allowances	X		X					
11			Transit and Rideshare Financial Incentives	X		X	Y			Y	
12			Public Transport Pass Programs	X		X					
13			Innovative Financing	X		X	Y			Y	
14		Administrative Measures	Transport Partnerships	X		X					
15			Trip Reduction Ordinances and Regulations	X		X					
16			Alternative Work Schedule	X		X	X			X	
17			Auto Restricted Zones	X		X	X			X	
18			Parking Management	X		X					
19	Supply-side	Traffic Operation Measures	Entrance Ramp Controls	X	Y	X	Y	Y	Y	Y	Y
20			Traveller Information Systems	X	X	X	Y	Y	X	X	X
21			Traffic Signalisation improvement	X		X	X		Y	Y	Y
22			Motorway Traffic management	X	Y	X	Y	Y	Y	Y	Y
23			Incident management	X	X	X	X	Y	X	Y	X
24			Traffic Maintenance During Construction	X	Y	X	X		X	Y	
25		Preferential treatment	Bus lanes	X		X	X		Y	Y	
26			Carpool lanes	X		X	Y		Y		
27			Bicycle and Pedestrian facilities	X		X	Y			Y	
28			Traffic Signal Preemption	X		X	Y			Y	
29		Public Transport Operations	Express Bus Services	X	Y	X	Y		X	Y	
30			Park and Ride facilities	X	Y	X	Y	Y	X	Y	Y
31			Service Improvement	X	Y	X	X		X	X	
32			Public Transport Image	X	Y	X	Y		X	Y	
33			High capacity public transport vehicles	X	Y	X	Y		X	X	
34		Freight Transport Operations	Urban Good Movement	X		X	X				Y
35			Intercity Goods Movements	Y	X	X	X		Y	Y	Y

Note: **X=** Significant Application, **Y** = Some Application, Blank= No Application
U = Urban area, **IU**: Inter Urban , **P**: Peak period, **OP**: Off-Peak Period,
HD: Holiday, **CM**: Construction & Maintenance of Facilities, **IC**: Incident Management

[Source: (Strickland and Berman, 1995)]

Table A- 2: Strategic assessment of traffic management measures

No.	Categorisation		Traffic Shifting			Traffic Avoiding		
	Strategies	Measures	Modal shift	Destination	Time	Linking trips	Travel substitution	Trip Modification
1	Capacity Management	Freeze on New Road Infrastructure	x					
2		Road Capacity Restraint	x	x				
3		Integrated Planning				x		
4	Pricing & Taxation	Road Pricing by location	x					
5		Road Pricing by time	x		x			
6		Fuel Pricing	x					
7		Information pricing	x					
8		Parking charge	x	x	x			
9		Carownership taxation	x					
10		Tax concessions	x					
11		Pollution Pricing	x	x	x			
12		Commuted payment for public transport	x					
13	Land Use Planning	Urban concentration		x	x			
14		Mixed use development		x	x			
15		Development at Public Transport Nodes	x	x				
16		Design of New development for NMT facilities	x	x				
17		Design of new development for PT access facilities	x	x				
18	Communications and Technology	Teleworking/Telecommuting					x	
19		Teleshopping/telebanking					x	
20		Telematics/information remote provision					x	
21		Telematics route planning & guidance						
22		Telematics for Park and Ride facilities	x					x
23		Electronic freight dispatching						x
24		vehicle technology-Intermodality	x					x
25		Demand responsive transport	x				x	
26		Provision of Non-telematics travel information	x					
27	Policy Measures	Public Transport Deregulation	x					
28		Company car policy	x					
29		Lift Sharing/carpooling schemes	x			x		
30		Company working hours policy			x			
31		Company encouragement use of alternative modes	x					
32		Park and ride facilities	x					
33		Encourage opportunities for intermodality	x					
34		Enforcement of traffic regulations	x					
35		Return goods optimisation				x		
36		Use of alternative modes by freight transport	x					
37		Restriction of trucking licences	x					

Note: **X** = impact, Blank= No impact

[Source: adapted form Marshall, Banister et al.(1997)]

Table A- 2: Strategic assessment of traffic management measures (cont.)

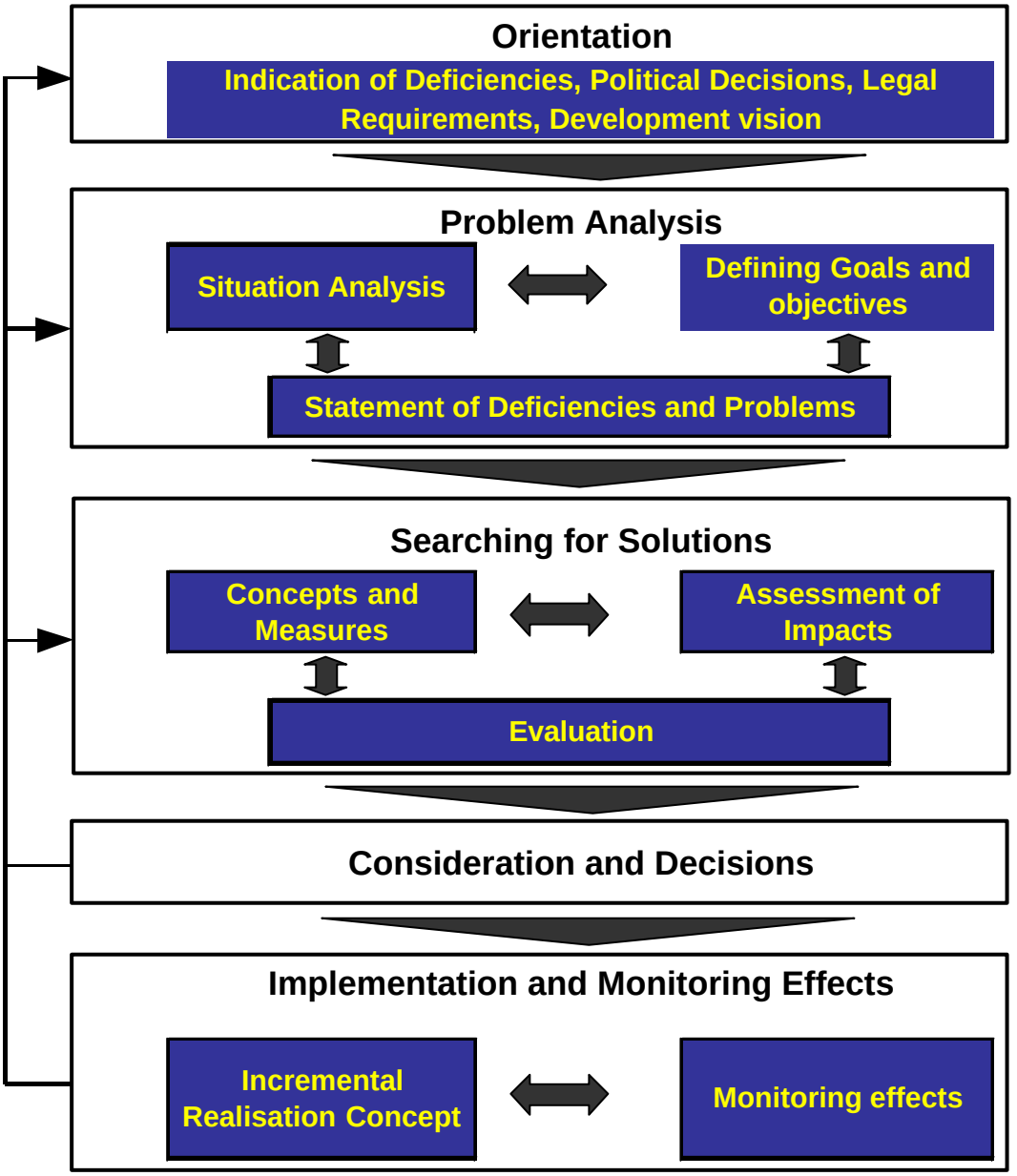
No.	Categorisation		Traffic Shifting			Traffic Avoiding		
	Strategies	Measures	Modal shift	Destination	Time	Linking trips	Travel substitution	Trip Modification
38	Physical Measures	Public Transport Priority	x					
39		Public Transport Road Space	x					
40		Cycle priority	x					
41		Cycle road space	x					
42		Pedestrian Priority						
43		Pedestrian Road Space	x					
44		Car pooling priority				x		
45		Car pooling road space				x		
46		Traffic Calming - discouraging private car use	x					
47	Subsidies and Spending Measures	Car pooling subsidies				x		
48		Cycle Subsidy /investment in cycle networks	x					
49		Walk subsidy/investment in walkways	x					
50		Public transport subsidy - operators	x					
51		Public transport subsidy - users	x					
52		Public Transport Capacity Investment	x					
53	Location/Time/User Restrictions	Area access controls by user	x					
54		Area access controls by time		x				
55		Restrictions on city centre parking	x	x				
56		Restriction on company parking	x		x			
57		Time and user restriction on public parking	x		x			
58	Public Awareness	Media campaign to promote alternative modes	x					
59		Increase awareness of public transport	x					
60	Other	Home delivery of goods / services						x
61		Car sharing/subscription car rental						x
62		Improving access to public transport	x					
63		Urban freight distribution				x		x
64		Freight logistics schemes coordination				x		x

Note: **X** = impact, Blank= No impact

[Source: adapted form Marshall, Banister et al.(1997)]

Annex B. Methods of Traffic Management Planning Process

The following sections will present the methods to elaborate the Traffic Management Planning process for a city. This process can also applied for the other scale of Traffic Management Plan in principle with some minor adjustment.



[Source: FGSV (2001)]

Figure B- 1: Transport planning process (FGSV, 2001)

Phase 1: Orientation

- **Initial Demand Identification**

The need for a Traffic Management Plan normally comes from three main sources: (i) the complexity of transport problems that requires complex solutions; (ii) the reactions of the civil society (citizens, interest groups, experts) to the undesired traffic performances and

incidents; and (iii) new obligations, especially the national and international legislation and regulation. In some cases, traffic management can also initiate by the research institutions or the industries.

- **Organisational Formulation**

As the first action after the identification of initial demand, a Traffic Management Planning team should be developed under the responsible agency (Cambridge Systematic Inc., 2000). The team is the body to initiate and manage the planning process through to its conclusions and some time they will be re-employed to do the post-evaluation. The leader of the team (or the planning project manager) is the most important person, who will select the project planner and other members and delegate the works. Cambridge Systematic Inc. (2000) recommended that the best candidate for the position of team leader is the highest-level non-appointed staff member that the agency can afford to devote for the planning project. In the case of an outsourced planning project, the planning team from the agency will work at a steering body to the employed planners (e.g. consultants). The Term of Reference (Government of National Capital Territory of Delhi) of the TMP study and the stakeholders will be defined by the TMP team.

- **Developing the Term of Reference**

The Term of Reference is the first technical outcome of the planning team. Contents of the TOR should include the followings:

  - Reasons of the TMP study
  - Goals and objectives of the study
  - Spatial and administrative study areas
  - Time frame of the study (study time and time horizon),
  - Boundary conditions (legal, technical, financial, institutional conditions),
  - Procedure and specifications of the study (approach, preparation, decision-making, and implementation),

The TOR can provide also the budget of the study. Recently, a free bid based on the technical TOR is preferred by many cities for having a least cost TMP study. Normally, the planning team is responsible for developing the TOR. In a large-scale study, the technical consultants are frequently employed to develop the TOR.

- **Defining the Stakeholders**

The stakeholders in the transport planning of a city are: the political bodies, administration, functional authorities (Transport, City Planning, Traffic Police…), lower level political leader, administration and authorities (District and Community), public transport and logistic services providers, business groups (vehicle manufacturers, informatics, telecom…), citizen representatives, interest groups (environmental protectors), and technical consultants, public media (FGSV, 2001). The plans that involved more than an autonomous administrative area (province/state/special city) will required the national political bodies and administration to participate in the orientation and decision making phase.

Phase 2: Problem analysis

- **Situation Analysis**

The situation analysis is the step of providing images of existing situation and forecasting the future situation of the transport and urban development activities within the time horizon of a Traffic Management Plan. The tasks will be carried out in this step are data collection, defining transport situation, identifying causes and consequences.

Data Collection

The data collection is a critical and continuous task to provide objective data for all phases and steps within the TMP process. In the phase situation analysis, data is required for formulating an actual image of transport system and its interactions with other sectors in the targeted study area.

- Urban development data will be collected in five major categories: socio-economic conditions, political and legal conditions, land use structure conditions, technological conditions, and natural environment conditions.
- Transport system data will be collected by every transport mode in four major categories: transport demand (intensity, time, location, direction), transport supply service (infrastructure, vehicle, operation systems); transport performance (traffic flow quality and costs); and transport institutions (organizational structure, function, and performance).

The data collection will be conducted into two parts. The first part of data collection is to access the available secondary data and databases (censuses, statistical reports, development plans…). The second part is to conduct essential surveys to collect the unavailable data (household surveys, aerial photos, roadside surveys…). Bohlinger (2005) addressed three categories of organisations (authorities, enterprises and special groups) that supposed to be the main sources of data for a TMP.

Development Scenarios Analysis

The trend scenario is defined as the continuation of current development trend and it is normally provided in the enactive development plans. A picture of relationships between demand and supply of transport system and the interactions between transport and urban development activities at certain time slide will be formulated. This analysis will help to discover the gaps between long-term forecasting and the short-term projection.

The planned scenario comprises the realisation of development projects and activities of the Urban Master Plans (UMP), Transport Development Plans (TDP), and Public Transport Development Plans (PTDP) during the time horizon of the TMP. Therefore, the planned scenario will represent the existence and impacts of the new urban or transport infrastructures or services, during the implementation and operation phases.

Defining Situation

This step is to identify the performance levels of transport system in different modes (at specific time point, location, duration and scale). The situation needs to be defined for the existing time as the base line situation, the situation of trend scenario, and the situation of

planned scenario. In transport planning process, transport system performance is normally addressed in four categories of indicators: (1) mobility of people and goods; (2) safety level of urban traffic; (3) energy consumption and environmental pollutions; and (4) economic impacts. The performance levels will be compared quantitatively and qualitatively with the thresholds (standards, or expected levels) in order to address the traffic problems that are commonly used to present the undesired traffic situations (as presenting the needs of solutions).

Identifying Causes and Consequences

It will discover the roots and the consequences of the problems. This step also studies inter-dependences between urban development conditions and transport performances. There are two major categories of causes and consequences.

Internal Causes are defined as the malfunctions of the components of the transport mode (users, infrastructure, vehicles, and operation systems) that caused transport problems. The **Consequences** of a problem are defined here as the increase of the intensity of the problem itself, the raising of the other problems, or the malfunction of the transport system components.

External Causes are defined as the undesired impacts from the urban conditions (socio-economics, politics, land use, technology, and environment) and development planning process to the transport system. The **Consequences** of a transport problem in this case would be the undesired performance levels or changes in the other urban sectors.

- **Defining Goals and Objectives of the traffic management**

Reviewing Strategic Vision and Development Goals

This step should include the ultimate vision of the urban area, the urban development goals and the goals of the urban transport system, including the development goals of different transport modes. The vision goals are the basis for formulating traffic management goals and objectives. Normally, the vision, goals are addressed by laws, regulations, standards, enactive long-term development plans (UMPs, TDPs, PTDPs) and special documents (FGSV, 2001). The vision and goals can also be addressed in the statements of the political leaders or bodies, wills of public, results of scientific works...

Defining Traffic Management Goals and Objectives

The task here is defining goals and specific objectives for the consequent traffic management strategies. The requirements of the goals and objectives are specific, measurable, resource-based, and time bound. The following activities are desirable to carrying in order to defining goals and objectives of a Traffic Management Plan:

- Integrating urban development goals and transport development goals,
- Defining goals of the Traffic Management Plan,
- Formulating a list of traffic management objectives,
- Structuring a goals and objectives hierarchy of the TMP,
- Identifying the conflicts and supports between objectives,

- Prioritising and selecting of objectives for the TMP,
- Selecting indicators (criteria, measure units) of the objectives,
- Defining quantitative and qualitative levels of the objectives.

Expected Situation

The visions, goals, and objectives define the expected situation of the urban transport system in general and of different transport modes in particular and the interactions between urban transport and the urban development conditions.

- **Statement of Deficiencies and Problems**

Deficiencies (or chances) are the differences between the actual and expected situation (FGSV, 2001). The analyses are conducted in three steps:

Inventory of Manifested Deficiencies

The manifested deficiencies and chances normally come from continuous monitoring of the transport performance, its causes and impacts of the citizens, interest groups, organisations or political bodies, via information from professional planning or other planning level or from implementing levels. These deficiencies will be informed, by different channels, to the planner (and responsible authorities) to asking for actions. The planner must collect additional information from the sources and by himself. All information must be verified that they are useful for planning process.

Examination the Planning Relevance of the Manifested Deficiencies

The manifested deficiencies are initially identified under the subjective viewpoints of the persons or groups, which provide information to initiate the demand for a Traffic Management Plan. These primary identifications is necessarily examined and rearranged based on the defined goals and objectives of the Traffic Management Plan in order to prove its relevance.

Statement of the Deficiencies and Problems

Finally, it is the statement of deficiencies. In this statement, a catalogue of deficiencies should be defined in term of art, causes, and impacts. The problems are defined according to the statement of deficiencies as the basic questions that need to be answered by the solutions in the next planning phase.

Phase 3: Searching for Solutions

The most critical phase in transport planning process is to find the appropriate solution for solving the defined problems. According to FGSV (2003), this phase is carried out by two consequent steps: (1) Selection of measures (2) strategy formulation, and (3) assessment of strategy.

- **Selection of Measures**

Measures Inventory

The inventory of measures is collected according to the goals and objectives of the Traffic Management Plan. The first source includes the mature measures, which are already applied and well functioned in the targeted urban areas or in the other cities. The second source

contents developing measures that are just in the phase of research and development or implement in some trial projects. Finally, some total new measures are specifically needed for the unique situation of the targeted urban area. The collected measures should also be grouped in different categories. As the approach adopted by FGSV (2003), traffic management measures can be categorised by modes: public transport measures, intermodal measures, multimodal measures, and motorised individual vehicle measures.

Measure Development

This step is to describe the technical and organisational features the traffic management measures in corresponding with the traffic problems and objectives at specific location, land use condition, time (point and duration), related systems, and institutions. The technology, operation process, draft estimation of cost (capital and operational cost) of the measures should be prepared in this step.

Assessment of Measures

The assessment of measures aims to answer the root question “What are the most suitable measures for solving the problems of the targeted study area?”

FGSV (2001) synthesised the assessment processes into three categories: informal process, formal process, and combined process. The informal process is suitable for evaluating the qualitative criteria, while the formal process is applied when all assessment criteria are quantitative. A combined process is applied when the criteria are combined both qualitative and quantitative ones. Therefore, the most important task in assessing the measures is to select the right criteria that will be able to indicate the contents of suitability.

Remak and Rosenbloom (1976) recommended an assessment model that is going to assess the measures by two major groups of criteria, Benefit and Feasibility. In term of benefit, four lower level criteria were adopted as (i) effectiveness; (ii) cost of implementation, (iii) indirect benefits and dis-benefits, and (iv) time factors. The feasibility were assessed by five major criteria, (i) obtaining of essential institutional support, (ii) public acceptance, (iii) acceptance by private organisations, (iv) compatibility with the existing laws and regulations, and (v) state of the art (technological readiness for implementation).

Recently, Bohlinger (2004) adopted a four steps measure assessment model that includes six groups of criteria (i) goal and objective suitability, (ii) applicability, (iii) compatibility, (iv) flexibility, (v) complexity, and (vi) adaptability.

The use of terminologies of these two authors may different and they may have different way in modelling the assessment process, but their models and all other models are aiming to answer the questions as presented in Table C- 1.

In responding to the questions, the assessment model for measures and further for traffic management measures strategy in this study can be formulated based on two groups of criteria: (i) effectiveness; and (ii) applicability.

Table C- 1: Questions in assessment process

No	Assessment Question	Level of assessment	Expected answer
1	**What are the goals and objectives that expected to be achieved by the measure ?**	**Description**	Decriptive answer (Objective A, B, C.. Or Non)
2	**What is the main impact areas of measure according to the traffic management definition?**		Descriptive answer (Avoiding, Shifting, Controlling or Non)
3	**What is the maturity of the measure?**		Descriptive answer (R&D, Some Test project, Many application)
4	**How is the effectiveness of the measure?**	**Measurement**	Indicative answer (Qualitative or Quantitative measurement by assessment criteria)
5	**How is the feasibility of the measure?**		
6	**Is measure X more effective than measure Z?**	**Comparison**	Decisive answer (Yes or No, based on the comparison between the qualitative or quantitative values of the criteria)
7	**Is measure X more feasible than measure Y?**		
8	**Is the measure recommended for implementation?**	**Prioritisation**	Decisive answer (Yes or No based on prioritisation outcomes)

Effectiveness Analysis

This analysis tries to predict the desired and undesired impacts that would be created by implementing the proposed traffic management measures. Normally, the effectiveness of traffic management measure would be analysed according to the predefined goals and objectives. For example, the effectiveness traffic management measures can be examined in four main goals of urban transport system as (i) urban mobility; (ii) traffic safety; (iii) environment and resource and (iv) city and region economy (Albert Speer and Partner 1993). The lower level criteria for effectiveness assessment will be selected according to the objectives and detail criteria and standards of specific measures in the specific conditions of the case study.

Applicability Analysis

Applicability of measures will be examined by three criteria: (i) cost of measure; (ii) technical systems; (iii) institutional participation, and (iv) public acceptance. The lower level criteria for applicability assessment are selected according to the phase of assessment.

- **Strategy Formulation**

Scenarios

According to FGSV (2003), the traffic management strategy and the corresponding scenario of urban and transport situation are two sides of a coin “traffic management scenario”. In most of the urban area, there are usually some projects planned to implement or operate within the time horizon of the Traffic Management Plan. However, at the study time of Traffic Management Planning, these projects are not yet taken place. Hence, two scenarios of the urban and transport situation are normally defined for formulating planning options as (i) Trend development situation (ii) Planned development situation.

Combining Measures

A traffic management strategy is finally formulated as a single mean that combines the mutually Supportive Measures. Therefore, the approaches in combining different traffic management measures in a strategic package are very important.

In Traffic Management Planning, the measures will be combined in four major types of strategy: (i) traffic control; (ii) traffic shifting; (iii) traffic avoiding and (iv) integrated traffic management.

- A traffic controlling strategy includes the Basic Measures that focus on controlling traffic other than other two impacts (avoiding and shifting), and the supplementary measures that will help to achieve the success of the major ones. The traffic shifting and avoiding measures can be included in this strategy as the supplementary measures.
- A traffic shifting strategy includes the Basic Measures that focus on shifting traffic other than other two impacts (avoiding and controlling), and the supplementary measures that will help to achieve the success of the major ones. The traffic controlling and avoiding measures can be included in this strategy as the supplementary measures.
- A traffic avoiding strategy includes the Basic Measures that focus on avoiding traffic other than other two impacts (avoiding and controlling), and the supplementary measures that will help to achieve the success of the major ones. The traffic controlling and shifting measures can be included in this strategy as the supplementary measures.
- Finally, the integrated traffic management Strategy includes the basic and supplementary measures that have all three types of impact (controlling, shifting and avoiding).

- **Assessment of Strategy**

Assessment of strategy facilitates decision making by appraising the merits and demerits of alternative options in term of either single or multiple decision criteria. The outcomes of this step are a priority list of traffic management strategies that will be submitted to the decision-making bodies to select and decide for further implementation. The assessment model for strategy also comprises of two groups of criteria: (i) Effectiveness and (ii) Applicability. In many cases, a sensitivity analysis is included in order to examine the possibility of the realisation of (trend development and planned development) (Gerçek, Karpak et al., 2004).

Phase 4: Consideration and Decision

The outcome of assessment process is main source of information supporting the decision. In the case of city, the final decision for an integrated city Traffic Management Plan would be made mostly by the elected political leader or the authorised persons of the city. In some cases, the assemble bodies will take over the responsibility to make decision. In the case the plans impacts to than one city, the regional or national decision making mechanism are needed.

Phase 5: Implementation and Monitoring Effects

- **Implementation of the Traffic Management Strategy**

The implementation phase is the sum total of activities and choices for the execution of selected strategies. In fact, many traffic management strategies faced difficulties in implementation, especially the human behaviours related strategies. Therefore, an effective implementation plan is necessary for the success of the traffic management strategy (Institute of Transportation Engineers, Georgia Institute of Technology et al., 1993). Normally, the strategic implementers will propose an implementation program, the budget, and procedures to get the approval of the decision makers, after that the implementers will execute the works.

Program

A program is a series of day-to-day activities that will be performed in order to achieve the goals and objectives of the traffic management measures a. The implementation program comprises firstly the work-breakdown structure that defined clearly different groups of actions that would be responsible by specific implementers and beneficiaries (organisations, groups of users). The related systems should also be defined in the program. After that, a general schedule is necessary in order to have the major milestones for accomplishments of each activity.

Resources Plan

It is the estimation of financial and human resources for handling the traffic management activities. The plan should also present the mobilisation and procurement of finance and human resources. The budget approval will be the most realistic condition for starting any activities and further achieving the strategic goal. On the other hand, the availability of qualified personnel is also essential.

Procedure

After the programs and budget are approved, a series of operating procedures and the corresponding specifications must be developed. The procedures ensure that day-to-day operations will be consistent over times and locations until the achievements of objectives and goal. The procedures must be updateable to reflect any change in technology and strategy.

Execution Plan

The programs will be executed according to the procedures and by the implementers that can be public transport authorities and operators, traffic management centres, road's construction and management authorities or enterprises. Therefore, each implementer should develop an execution plan that reflects its specific conditions.

- **Monitoring of Effects**

The implementation of traffic management strategy will make changes in the urban transport system (users, vehicle, infrastructure, and operation) and the urban conditions (politic, economic, socio-culture, technology, and natural environment). The monitoring and control will answer the four basic questions: what changes were made to the transport system?

What were the impacts of these changes? Why did these effects occur? How successful were the strategies taken to improve the transport system? In addition, the monitoring and control also provide guidance to the decision makers on the effectiveness of implementation measures (Mayer and Miller, 2001).

The most important concern of in monitoring is having correct processes and suitable methods to collect information needed to determine the causes of changes. The changes of transport and urban conditions can be measured by different methods in order to compare the “before” and “after” situations. There are three approaches that are frequently used: comparison at different time points, comparison of different communities or population groups, and comparison between real and hypothetical systems.

Annex C. Household Accessibility and Personal Mobility in Hanoi

Introduction

As a part of the data collection for the dissertation "Traffic Management in the Motorcycle Dependent City (MDC)", a household accessibility and personal mobility survey was conducted in Hanoi in order to define a clear image of accessibility and mobility of people in a typical motorcycle dependent city.

As the case study of this dissertation, Hanoi, the capital of Vietnam, has a total area of 963 square kilometres and a population about 2.97 millions (at the end of 2003). The urban traffic in this city is appeared as highly depend on the motorcycle by the rate of motorcycle ownership is about 400 motorcycles/1000 persons and about 65% of urban personal traffic demand served by this two-wheel transport mode.

Hanoi and other four special cities in Vietnam, Hanoi has three official administrative layers: City, District, Phuong, and two lower unofficial management layers (division and group). The city divided into 14 Districts or 225 Wards. There are 8-12 divisions in each ward and 5-10 groups within a division. According to the constraints of time and finance, the survey was conducted in a sample of nine wards in seven different districts that represented the differences in urban characteristics.

Conducting under the title of University of Transport and Communication (UTC), this survey gained a full support of the ward administrations that provided household lists and facilitated the households' cooperation with the surveyors. The questionnaire was designed as critical, understandable, and time saving and was divided into 4 parts: control information, household information, accessibility of household, and personal mobility that was answered by the volunteered members of he interviewed households.

The 4th-year-students in the Transport Planning and Management section in UTC were employed to distribute the questionnaires and collect the answered sheets. The surveyors were trained to understand the questionnaires and they conducted a trial survey during the third week of October 2004. The questionnaires were distributed to 435 households and there were 371 of them returned with answers. Six hundred twenty six persons voluntarily provided their daily mobility.

The answers were collected and processed independently except question 18 that regarded to personal trip patterns. The trip data will be fully eliminated if the purpose or mode is absent. The raw data was firstly inputted in the Microsoft Excel sheets. The SPSS 12.0 version was employed to analyze the data and provide information for the report.

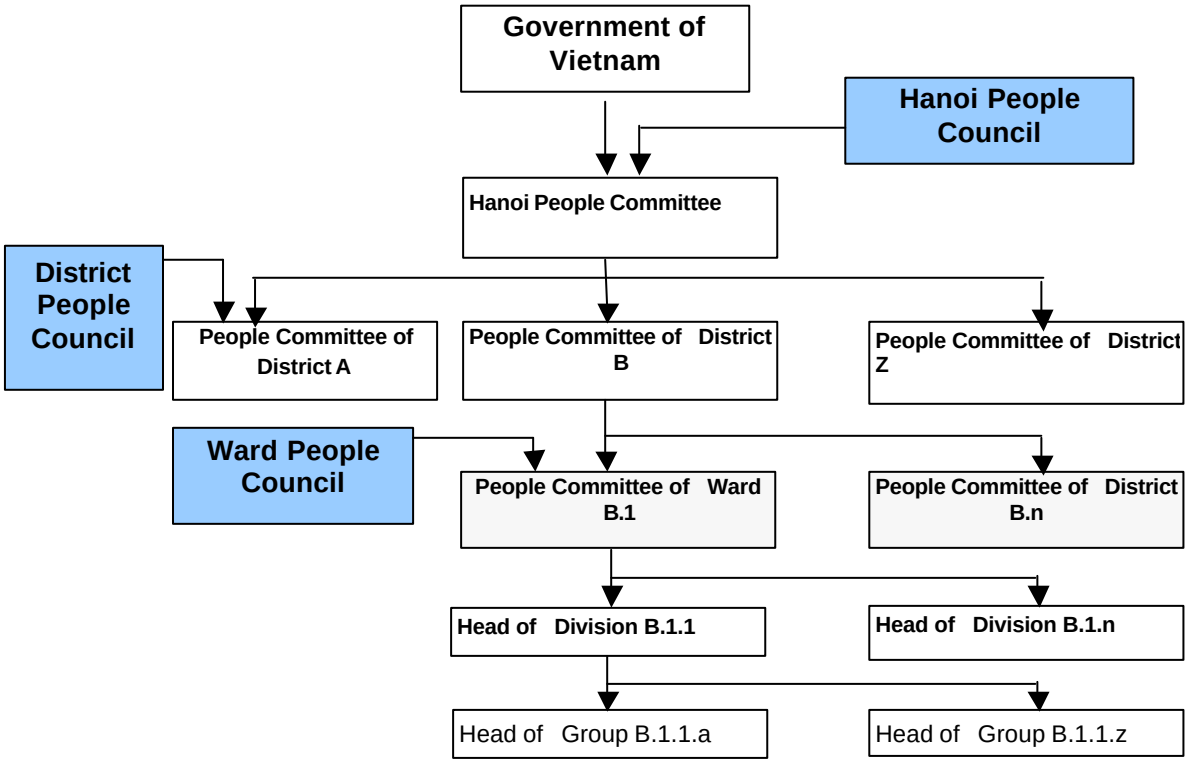
The report is divided into 5 chapters, the first chapter is introduction, the second chapter presents methodology of this survey, chapter 3 expresses the household mobility conditions, chapter four focuses on the personal mobility and the last chapter is some conclusions of this survey.

Methodology

- **Sampling Process**

Model of Hanoi administrative structure

Hanoi is one of five special cities in Vietnam together with Hochiminh (Sai Gon), Hai Phong, Da Nang, Can Tho. The model of administrative structure in the special Vietnamese cities is much more complicated than any other cities in Germany or in Europe. There are three official layers from the top administration up to the lowest one: City (Thanh pho), District (Quan/Huyen), Ward (Phuong/Xa). However, there are still two unofficial lower levels, called Division (Cum/Thon), Group (To dan pho).



[Source: Hanoi People Committee (2004)]

Figure C- 1: Hanoi administrative structure

In Vietnam, the Local People Councils (City, District and Ward) are elected by public voting. The Council will elect the Chairman of People Committee, as the top local administrator, who is one of the People Council members and must be introduced by the Communist Party. With the advisory of Communist Party, the Chairman will select the candidates for directorates of the city authorities (e.g. Director of Finance Department) and request the Council to approve by vote. The Heads of Group and Division are selected by public vote among household's representative meeting in the Group or Division administrative area and will be approved by the People Council. Chairman of the Hanoi People Committee is the chief of city administration, as similar to the minister president of a state in Germany.

Hanoi has an area of 963 square kilometres and a population of 2.95 millions (in 2003). The city is subdivided into 14 districts, including nine urban and five sub-urban districts. The

district is subdivided into lower level, called Ward (Phuong). Hanoi has 225 Ward as the lowest level of official administrative.

Table C- 2: Demographic information of Hanoi

No.	District	Characteristics	Number of Wards	Population (2003)	Area	Density
				(person)	*(hectare)*	*(perons /ha)*
1	Hoan Kiem	Ancicent & French quarter	18	173,000	529	327
2	Ba Dinh	French quarter& After 1954	12	211,600	925	229
3	Dong Da	French quarter& After 1955	21	352,000	1,009	349
4	Hai Ba Trung	French quarter& After 1956	20	350,000	1,465	239
5	Cau Giay	Urban (1985-2000)	7	160,053	1,210	132
6	Thanh Xuan	Urban (1985-2000)	11	180,000	913	197
7	Tay Ho	Urban (1985-2000)	8	92,700	6,038	15
8	Hoang Mai	Urban (1985-2000)	14	214,760	4,101	52
9	Long Bien	Left-bank urban area	14	170,000	6,038	28
10	Tu Liem	Suburban area	20	150,000	7,515	20
11	Thanh Tri	Suburban area	16	158,413	6,327	25
12	Dong Anh	Suburban area	24	276,750	18,230	15
13	Gia Lam	Suburban area	22	205,275	11,400	18
14	Soc Son	Suburban area	18	252,600	30,600	8
Total			**225**	**2,947,151**	**96,301**	**31**

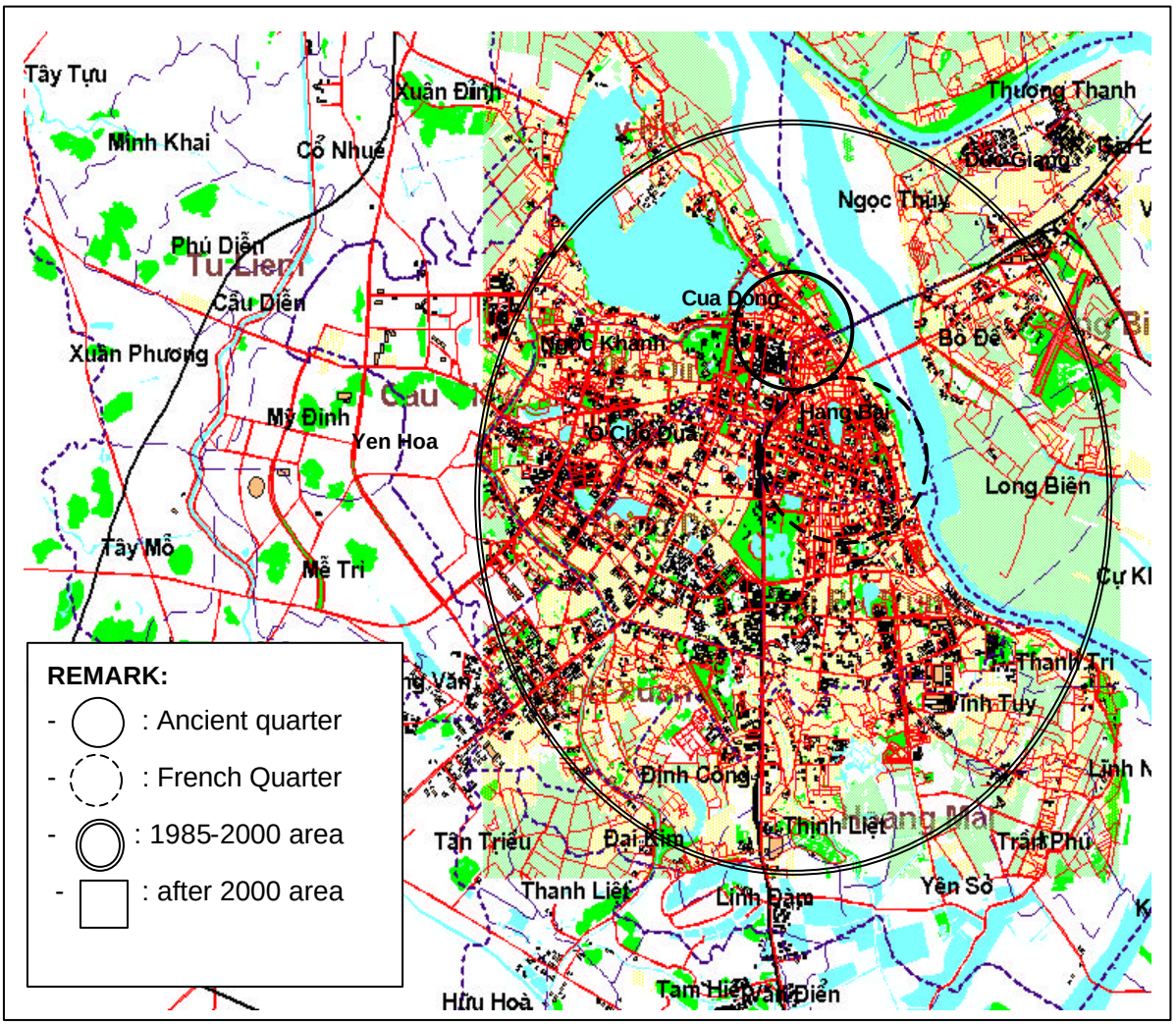
Sample

Table C- 3: Household mobility survey profile

No.	Ward	District	Area	Number of planned Households	Number of answered households	Percentage	Time
1	Cua Dong	Hoan Kiem	Ancient quarter	64	62	97%	25.10-28.10.04
2	Hang Bai	Hoan Kiem	French quarter	50	40	80%	02.11-05.11.04
3	Minh Khai	Tu Liem	Suburban area	35	34	97%	05.11 to 08.11
4	Xuan Dinh	Tu Liem	Developing area (after 2000)	35	32	91%	05.11 to 08.11
5	Ngoc Khanh	Ba Dinh	Urban area (1954 1985)	50	32	64%	08.11-12.11
6	O Cho Dua	Dong Da	Urban area (1954 1985)	33	32	97%	08.11-12.11
7	Yen Hoa	Cau Giay	Urban area (1985 2000)	40	32	80%	12.11-19.11
8	Duc Giang	Gia Lam	Left bank area	60	50	83%	12.11-19.11
9	Dinh Cong	Thanh Xuan	Urban area (1985 2000)	68	57	84%	19.11-22.11
	Total	**-**	**-**	**435**	**371**	**85%**	**-**

According to the constraints of time and resources, a model survey on household mobility was conducted. The sample was formulated from nine Wards (equivalent to Gemeinde in Germany) in seven Districts that represented different urban areas in Hanoi (see Table C- 3). Among the list of household, about 1.5% of total number households in the Ward were

calculated. Five divisions in each Ward were randomly selected among eight to12 divisions of a Ward. In each Division, 2 to 6 groups were randomly selected among 5 to 10 groups per Division. Based on the household lists of the Groups, 1 to 3 households were randomly selected per Group.



[Source: Hanoi Urban Transportation Operation and Management Center]

Figure C- 2: Locations of the wards and traffic counting cross sections in the administrative base map of Hanoi

Survey Approval Procedure

Normally, this type of survey has to get an approval of the Hanoi People Committee Office and the survey team has to contact to people committee of Districts and Wards for seeking their documents in order to have contact to households. However, with the introduction letters of the Rector of the University of Transport and Communication (UTC), this survey can go directly to the People Committee of Wards (PCWs) to seeking their approvals. The chairmen of PCWs provided their letter of recommendations that recommend the households to cooperate with the surveyors.

The Survey Team had contacted 11 Wards but it was refused to conduct the survey in two Wards (Dien Bien and Bach Khoa) where the PCWs would approve only if the interview

household lists could be selected by themselves. The other nine PCWs provided their full supports according to the request of Survey Team through the letters of the UTC's rector.

- **Questionnaire**

The questionnaire was designed as critical, understandable, and time saving. It was divided into 4 parts. Part 1 is the control information that includes name of surveyors, supervisors, date of survey and the household code. Part 2 is household information that contains name of household head, address, telephone number, household's composition, income, and housing condition. Part 3 is accessibility of household, which asks for the physical access condition to road and public transport, vehicle, parking and media access condition. The fourth part is personal mobility that asked for age, sex, occupation, income, education of the interviewee and the most important part is daily trip patterns of this person in a typical weekday. The interviewees of part 4 are members of the interviewed household and voluntarily answered the questions. The detailed questionnaire is presented in the appendix.

- **Survey's Execution**

Ten surveyors, who are the 4th-year-students in the Transport Planning and Management field study, were employed to distribute the questionnaires and collect the answered sheets. The surveyors were trained to understand the questionnaires and they conducted a trial survey during the third week of October 2004. The questionnaires were distributed to 435 households and there were 371 of them returned with answers. 633 persons voluntarily answered to the personal mobility questions.

- **Data Processing**

As the independence of questions, the answers were collected and processed independently except question 18 (part 4), the most complicated one. The personal trip patterns are indicating by purpose, mode, origin and destination, distance, time and parking condition. The trip data will be fully eliminated if the purpose or mode is absent. The raw data was firstly inputted in the Microsoft Excel sheets. The SPSS 12.0 version is employed to analyze the data and provide information for the report.

Household accessibility in Hanoi

- **Backgrounds of the Households**

An Overview of Urbanisation of the Study Area

It is too long for discussion about 1500 years history of Hanoi, this survey studied about the initiation of households among the sample in order to have an overview of development of the city during the last 50 years. There are five milestones during this period: the end of Vietnam's national liberation war in 1954, the end of Vietnam's unification war in1975, the beginning of market economy (Doi moi) in 1986, and the end of economic embargo of Western economies to Vietnam in 1995. Among 261 households those beginning year of living at the address were know, only 7% of them began to live in their address before 1954 and nearly 40% households started their Hanoi's life since 1986.

Table C- 4: An overview of city development

	Before 1954	1954-1975	1976-1985	1986-1995	After 1995	**Total**
Acient quarter	4.1%	59.2%	14.3%	18.4%	4.1%	**100%**
French quarter	24.1%	31.0%	20.7%	13.8%	10.3%	**100%**
Urban area (1954-1985)	4.3%	17.4%	37.0%	26.1%	15.2%	**100%**
Urban area (1985-2000)	6.3%	18.8%	15.0%	22.5%	37.5%	**100%**
Developing area	13.3%	26.7%	40.0%	6.7%	13.3%	**100%**
Left bank urban area	3.0%	42.4%	18.2%	24.2%	12.1%	**100%**
Suburban area	0.0%	33.3%	33.3%	11.1%	22.2%	**100%**
Total	**7.3%**	**31.4%**	**21.8%**	**20.3%**	**19.2%**	**100%**

Household's Composition

- *Household-size*

About 1601 people are registered to live in 371 households of the sample as members (permanent stay), guests (temporal stay), and house-helpers. Among the sample population, the share of females are 51.3% that higher than the rate of 50.03% in the City Population Census 1999 (Vietnam Institute of Sociology, 2004). The average size of the households is about 4.3 persons/household that slightly different from value 4.2 persons/household in the City Population Census 1999 (Vietnam Institute of Sociology, 2004). In the sample, 35.3 % households have at least 5 persons, 7 households shelter together more 9 persons and only 1 single-man-household. One third of the households have more than 2 generations that are living together.

- *Age of Population*

About 48.2% of population are in the mature working age (25-60 years), the group of less than 25 years old accounted for 36.4% and 15% of population are over 60 years.

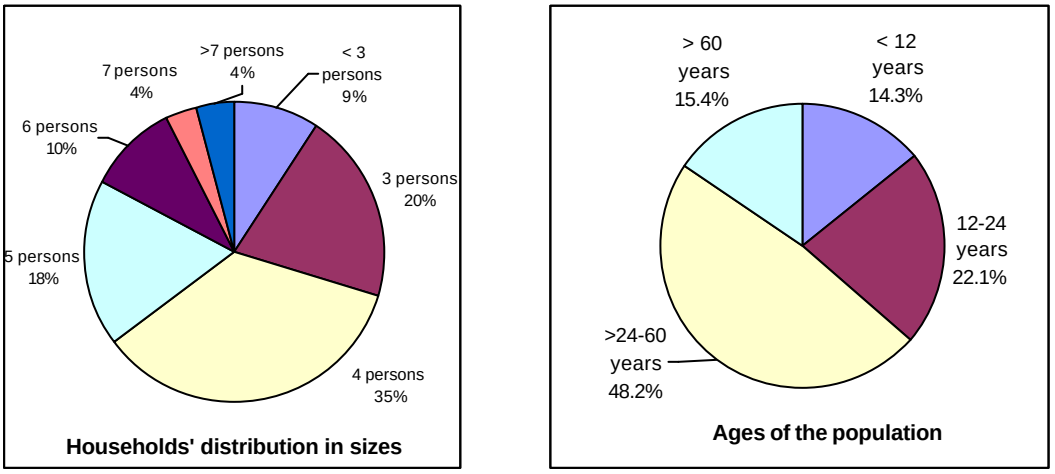


Figure C- 3: Sizes of the households and ages of population in Hanoi

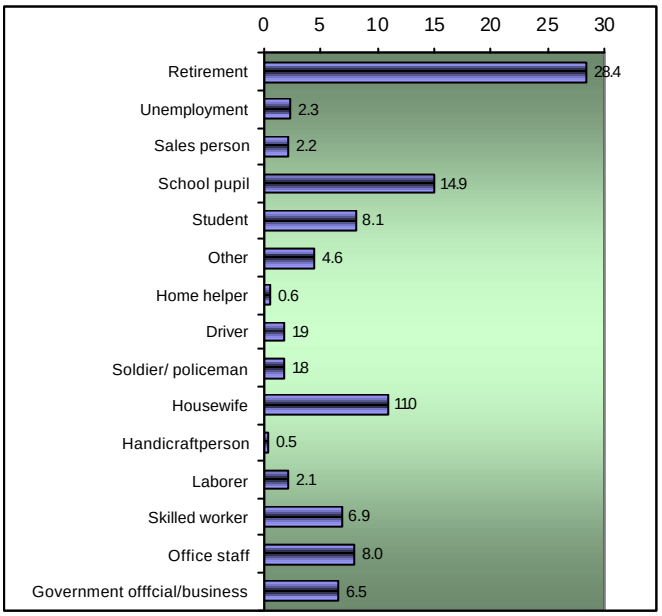
According to the City Population Census 1999, 44.5% of Hanoi population were between 25 and 59 years old and 8.6% population were over 59 years. The differences partly indicate a trend of aging in the society of Hanoi. This discussion was proved in the research of Vietnam Institute of Sociology (2004) that compared the population structure between City Population

Census 1999 and another in 1989. The 1989 survey indicated only 39% of population were between 25 and 59 years old, the younger group (less than 24) was accounted for 53 % , 6% higher than that of 1999 (Vietnam Institute of Sociology, 2004).

- *Memberships in the Households*

About 95% of the sample population are the registered members of the households, 3% are visited guests, 0.9% of them are stayed-guests, and the household-helpers are accounted for 1.1% (17 persons). There are 7 helpers are in the age less than 12 years.

- *Occupations of Population*

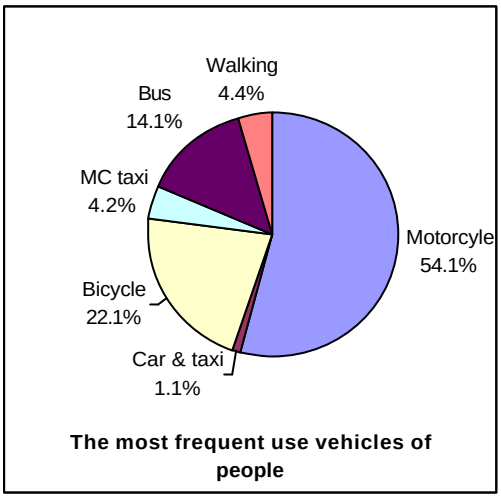


There are 28.4% retired persons among the sample population while the group of over 60 years is only accounted for 16%. This situation indicated partly impacts of the decentralization process of the state-owned enterprises and the reformation process of the administration sector. Many employees who were forced or voluntarily to get out of their work to joint the retired group when they are still in the working age limit (less than 61 years for males and 55 years for females). The unemployment group is only 2.3% that is slightly better than the figure overall urban are of Hanoi in 1999 (2.7%)

Figure C- 4: Occupations of population

- *Vehicle Use of People*

Data shows the domination of motorcycles is clear in practice and the bicycle's preference of people is extremely low. The bikes accounted for 36% of vehicle fleets but only 22.1% people answered that they use bicycle as the most frequent vehicle. Accounted for 4.2% total respondent, motorcycle taxi proves it is an influential paratransit mode, not many ordinary taxi services could get a preference as the motorcycle taxi as in Hanoi. Although it is not as good as in developed city, the bus service in Hanoi can be proud of the selection of 14.1% people while the survey in 2001 indicated only 5% population who known the bus service at that time (Hung, Truong et al., 2001).



In general, public transport service in Hanoi, including bus and motorcycle taxi, can be considered as female preferred modes, 56.7% MC taxi lovers and 60.4% bus fanners are women. Accounted for 33.8% of total children (less than 12 years), Bus ranked second under bicycle is the most preferred transport mode of Hanoi's children, 42.06%, and about 17.2 % of children are frequently walking for their trip.

Figure C- 5: Most frequent use vehicle

Household Income

Most of Vietnamese do not have a bank account and their income and expenditure are mostly cash-based. An unrealistic salary system is still working in Vietnam, especially in the governmental sectors, as an evidence of the former Stalinist economic system. In that situation, the corruption (time or money) is an effective way to redistribute the benefit of the economy to its people. Except the ones who have full time job in the private sector, most of government officials and state employees do not want to provide exact information about their income that mainly did not come from their official salary. It will not be a problem if the income is not a critical variable of consumption, including the transport expenditure of people. Therefore, the question of household income has to be asked with a big hope that the promise of non-identitical publishing will encourage people to give a right answer.

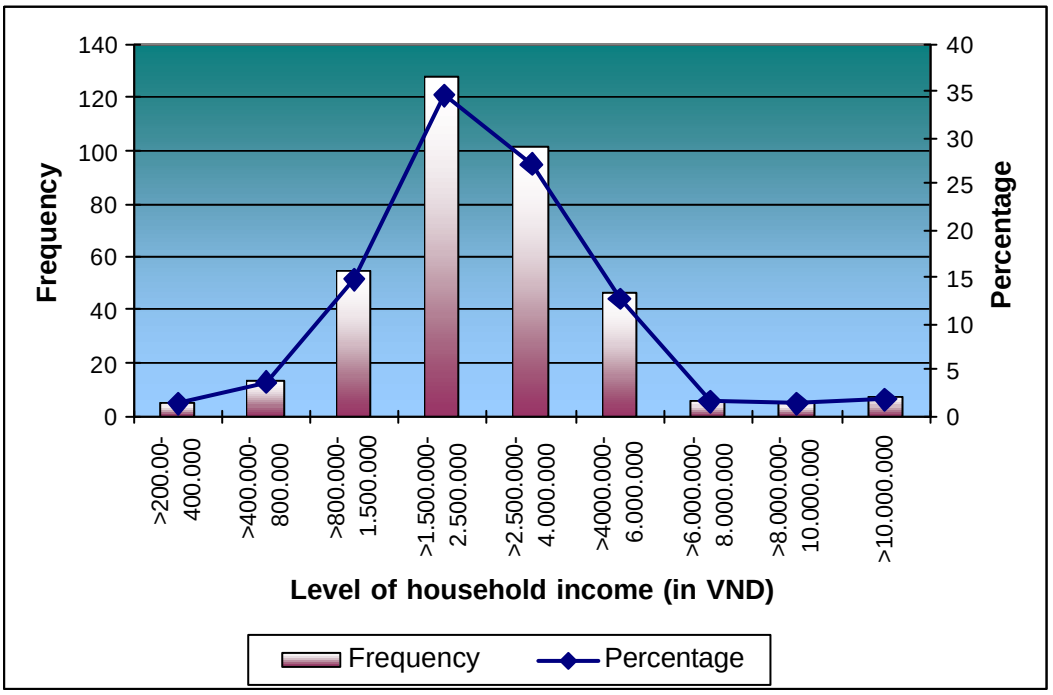


Figure C- 6: Monthly household income in Hanoi

There are 368 households provided their monthly rate of income (99.2%). Figure C- 6 indicates that the average household monthly income in Hanoi is about VND 2 million to VND 4 million (EUR100 to EUR200/month) or VND 0.5 million (EUR25) to VND 1 million (EUR 50) per capita per month. The rate is corresponded with the official figure of average GDP per capita in 2004, USD 990 per capita. The difference between 5% highest income families and 5% lowest income families is about 12 to 50 times. This situation indicates quite clear the actual gaps between rich and poor people in Hanoi.

Housing Condition

Since 1960s, Hanoi started to build multi-floors residential building blocks, in former Soviet style, but most of Hanoians today are still living in their self-constructed house. Only 21% households are residing in a total area of less than 50m2, including kitchen, toilette and parking places for their motorcycle or bicycles.

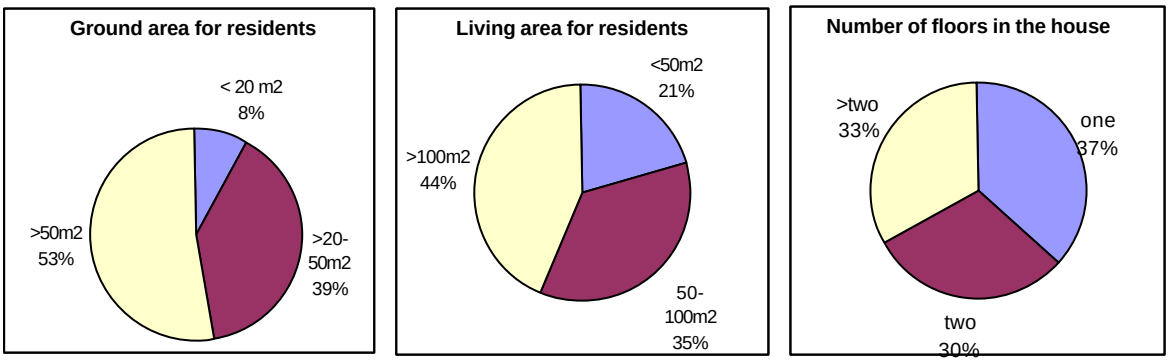


Figure C- 7: Typical housing condition in Hanoi

This good housing condition is also a very interesting point in the situation of low income but extremely high land use price society like Hanoi.

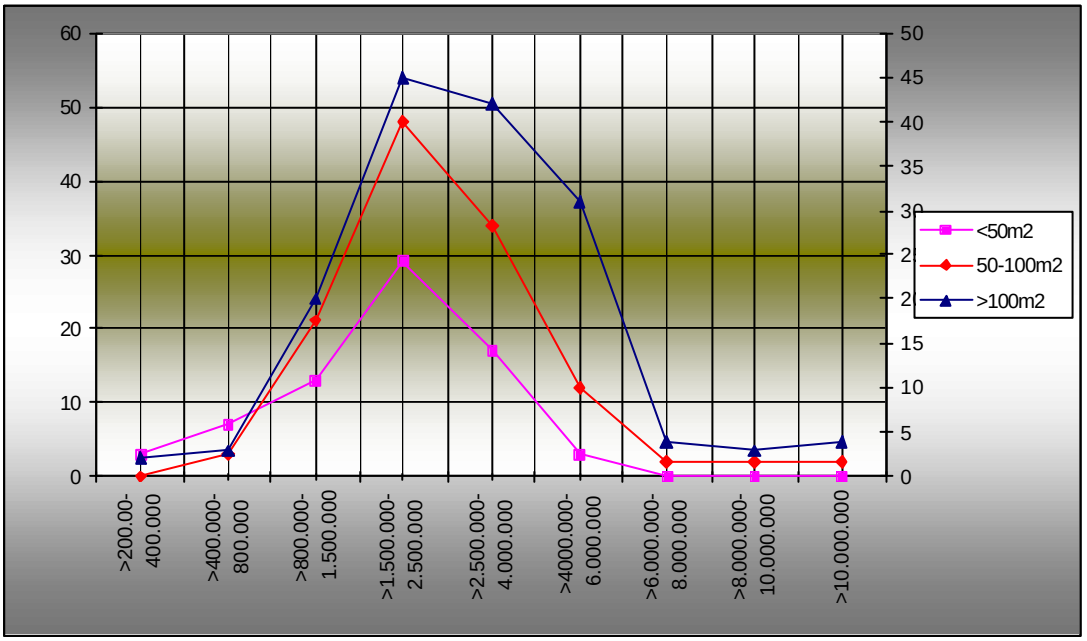


Figure C- 8: Income and housing condition in Hanoi

- **Accessibility of the Household**

Vehicles

- *Vehicle Ownerships*

Within the sample, 368 households provided information about their vehicle ownership (99.2%). There are only 6 autos (2 cars and 4 trucks) among 952 vehicles. This proves the auto ownership is only 3.7 autos /1000 inhabitants or 1.25 cars/1000 inhabitants that is much lower than the general car ownership of the city, 12 cars/1000 inhabitants (TEDI, 2004).

Table C- 5: Vehicle ownerships in Hanoi

Ward	Area	Average household size	Total vehicle ownership	Motorcycle ownership	Bicycle ownership
		(Person/Household)	*(Vehicle/1000 inhabitants)*	*(MCs/1000 inhabitants)*	*(Bicycles/1000 inhabitants)*
Cua Dong	Ancient Quarter	4.00	597	464	133
Hang Bai	French colonial quarter	4.68	561	449	112
O cho dua	Urban 1954-1985	4.47	580	406	161
Ngoc Khanh	Urban 1954-1985	4.06	638	515	108
Yen Hoa	Urban 1985-1995	4.25	610	500	110
Dinh Cong	Urban 1985-1995	4.12	685	494	191
Duc Giang	Left Bank urban area	4.02	567	393	164
Xuan Dinh	Developing area	4.88	551	359	192
Minh Khai	Suburban	4.85	539	327	212
Total sample		**4.32**	**598**	**438**	**156**

The survey team does not have any information about causes of this deviation, but it assumes that the stated-owned and companies' cars accounted for a high percentage among total cars and autos in Hanoi.

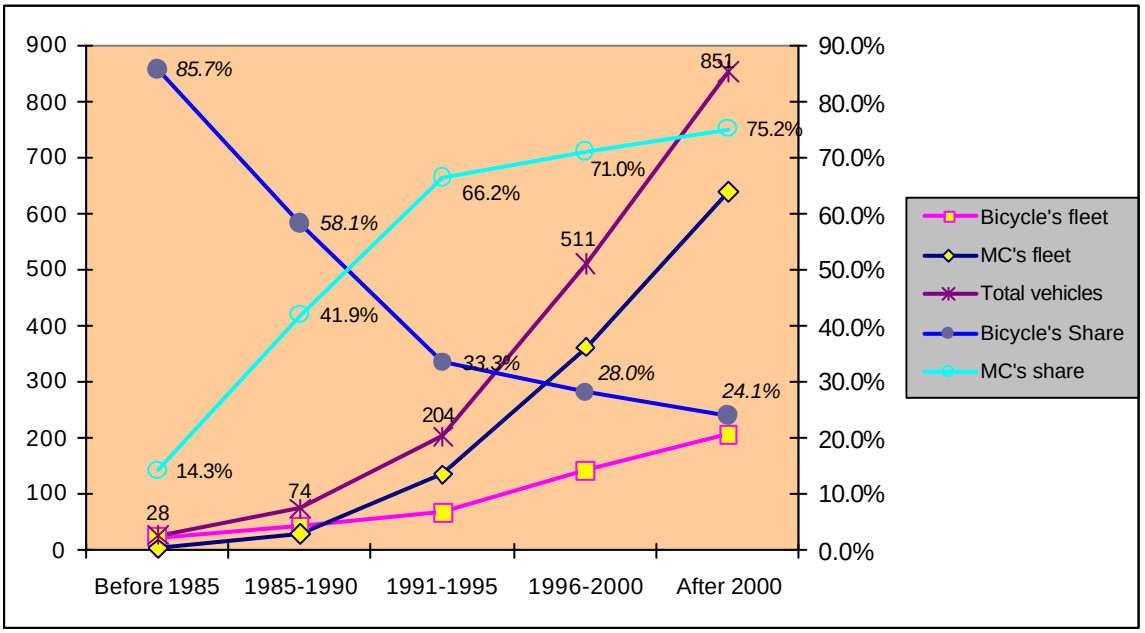


Figure C- 9: Development of vehicle fleets

There are 697 motorcycles (438 MCs/1000 inhabitants) and 249 bicycles (156 bicycles/1000 inhabitants). Only 15 motorcycles (2.2%) have a lower than 50-cm3 engine. The information

about license plates indicates that about 2% of motorized vehicles in the households of Hanoi have been registered in other provinces. Table C- 5 indicates that the household vehicle ownerships are different between the urban areas and the bicycle ownership is inversely proportional to the MCO. The MCOs in the city centre (Ancient and French colonial quarters) are lower than that in the areas that developed after 1954 and 1985. The main reasons are better road network plan and higher urban density (population and job). The MCOs in suburban and developing urban areas (including the left bank area) are the lowest but still significantly high.

As indicated in Figure C- 9, number vehicles in Hanoi was booming after 1990 as the effect of market economy application and Hanoi started to change from „city of bicycle“ to the city of motorcycle. Share of bicycles significantly reduced from 86% in 1985 to 24% at the end of 2004, while its motorized brother's share aggressively increased from 14% to 75% during the same period. The number of bicycles is also increasing but much slower than that of motorcycles.

- *Probability of Owning Vehicle*

As indicated in Figure C- 10, the probability of owning motorcycle is significantly proportional to the rate of household income. There are 349 households that owned at least one motorcycles (95%) and 207 households that owned at least two motorcycles and accounted for 56.8% total vehicle owning households (368).

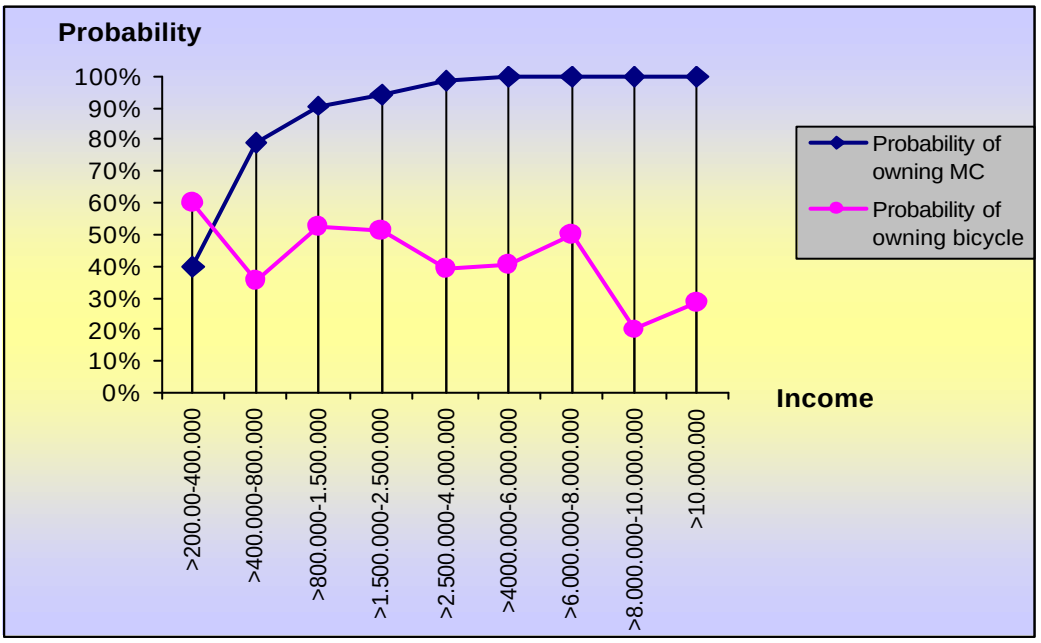


Figure C- 10: Household income and probability of owning motorcycle in Hanoi

Any household that earns more than VND 2.500.000 per month must own at least a motorcycle and 40% lowest income households can own a motorcycle. In contrast, the chance of owning bicycle is inversely proportional to the rate of household income and most of bicycle owning households have not more than one bicycle, 63.3%. Although the bicycle ownership and usage in Hanoi are reducing, 46% of total households are still having bicycle. The extremely low auto ownership among the sample does not allow any examination on the probability of owning auto in Hanoi.

- *Vehicle Age*

Information about year of purchasing of vehicle was provided only for 851 vehicles (89.4%). About 76% of total vehicles were purchased later than 1995. The ages of motorcycles prove the motorcycle boom in Hanoi in the last decade, 80% motorcycles fleet were purchased after 1995. Number of new purchase bicycles is also indicating the demand of Hanoians on using this transport mode.

Table C- 6: Year of purchasing of vehicles in Hanoi

Year of Purchasing	Bicycle	MC	Auto	Total	Percentage
Before 1985	24	4	0	28	3.3
1985-1990	19	27	0	46	5.4
1991-1995	25	104	1	130	15.3
1996-2000	75	228	4	307	36.1
After 2000	62	277	1	340	40.0
Total	**205**	**640**	**6**	**851**	**100**

As in the other cities, Hanoians are buying not only brand-new vehicles. In this sample, the new-buy-second-hand vehicles accounted for 13.3% total vehicle fleet. The second hand vehicles are normally cheaper but the operation's quality is much lower and the rate of emission is much higher than the new ones. The conditions of motorcycle fleet indicate that the share of second-hand group among the purchased motorcycles is reducing significantly.

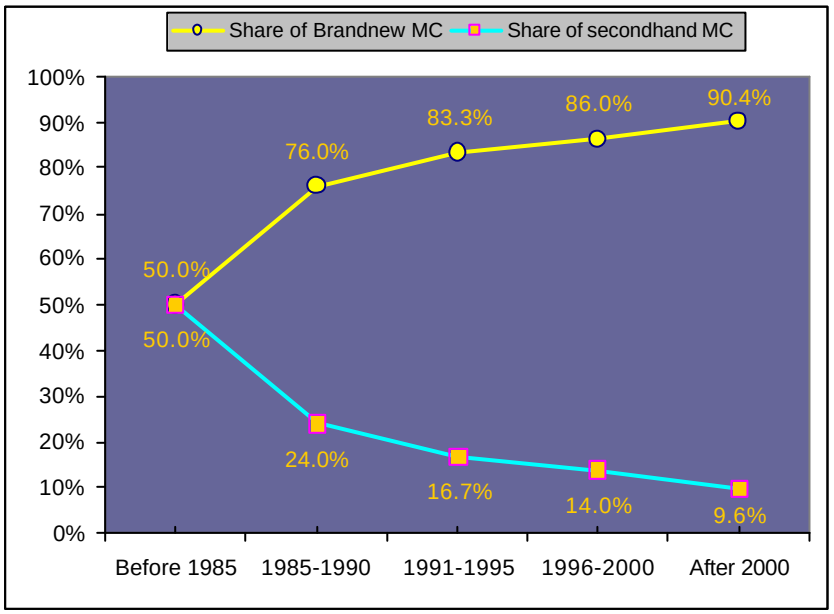


Figure C- 11: Purchase condition of motorcycles

According to the information of households in the sample, there were 2 brand-new and 2 second-hand motorcycles were purchased until 1985, but in the end of 2004 these households bought 246 brand-new motorcycles but only 26 second-hand ones. However, the absolute number of second-hand motorcycles is increasing. Among the sample, number of second-hand motorcycles increased from 2 in 1985 to 82 at the end of 2005. In the future,

share of second-hand vehicles may be increased according to the measure of new motorcycle registration's prohibition in Hanoi.

- *Obliged Vehicle Insurance*

The obliged vehicle insurance in Vietnam is applied in order to protect the vehicle owner, drivers and the third parties in cases of accidents. In this survey, information about insurance conditions is obtained for 608 motorized vehicles. All autos are insured while 15% motorcycles are not. This indicates a significant improvement in compare with the survey in Hanoi 2001, only 58% motorcycles were insured at that time (Hung, Truong et al., 2001). The emerging of insurance industry in Vietnam in the last few years is the main reason of this improvement.

- *Using of Vehicle*

As the traditional closed relationships between family's members, most of properties in the households are purchased from the contribution from the income of members. Vehicles are not exceptional. The using of vehicles are also effected by the tradition, 16.1% of vehicles are shared-using between the members of households. People are not only shared-using of autos or motorcycles. Only 26 bicycles were founded as sharing vehicles. There are less than 1% of vehicles are using for providing transport service and renting, including four of six autos. There are only 11 vehicles (1.2%) are founded as vehicles "for transporting goods only", including four autos (trucks).

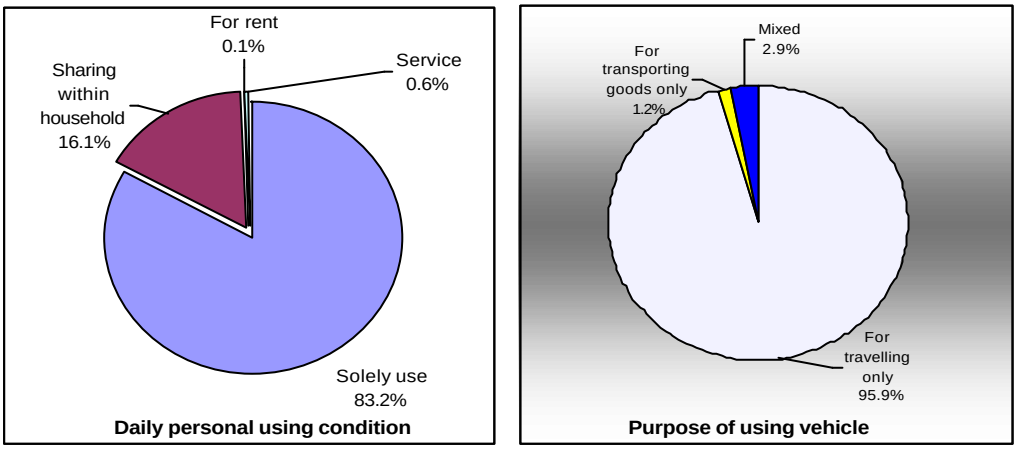


Figure C- 12: Vehicle using condition in households in Hanoi

Transport Infrastructure Access

There is no such information about the infrastructure access of the households in Vietnam. The surveyors observed the type of roads that directly access to the interviewed households. The distances to main roads (the collector and distributor roads) and to public transport services are also visual measured.

- *Road Access Conditions*

The survey found that 80% households are accessing to a type of road called alley that was developed from the traditional trail in the village where the urban area initiated. The alley has no standard, no design and it is formed and managed mostly by self-agreement between

households who resided along the alley. With a total ROW about less than 5 meters between walls or fences of houses, alleys handle all traffic, parking, and household business activities.

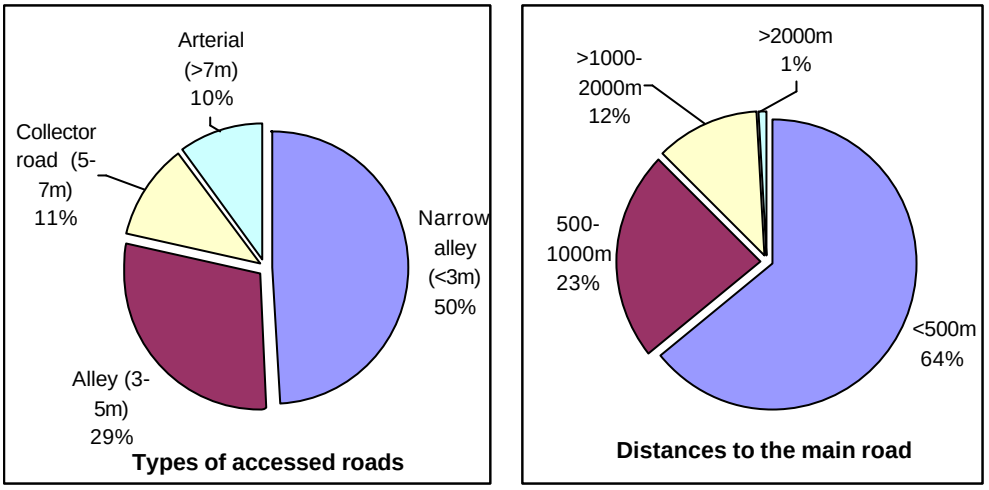


Figure C- 13: Road access conditions of the households in Hanoi

About 97% households answered that they do not have any plan or idea about changing of the accessed road type in the next 10 years. It will remain as a big obstacle for any four-wheel transport modes. Fortunately, 64% households located less than 500 meters from a distributor or collector road. This will be a good condition for four-wheel public transport services (bus & taxi) that can be provided not deeper that the level of distributor or collector road. However, only 57% of the alley-located households have distance less than 500 meters from the main road, the others located far enough for having a bike or motorcycle to cover the distance from the house to the main road.

- *Access to Public Transport Services*

The effected service area of current bus service in Hanoi is only 58% among the households of the sample. About 50% of the alley-located households are in the effected catchments of the bus service. The other half is in the undesired situation of accessing to any four-wheel public transport service.

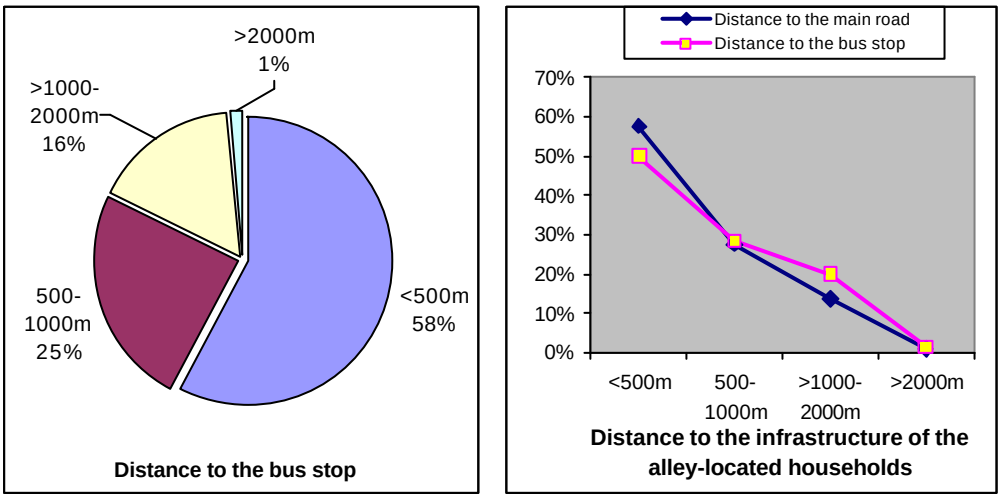


Figure C- 14: Public transport service access of the households in Hanoi

Households in the city centre, the socialist planned style (between 1954-1985) and the left bank town have better accessibility to the bus service and also to the main road while the others have much lower levels. The most problematic area in term of accessibility is the oil-stain development area (between 1985-2000), where the urban form is already stable and the land price is already very high (600 to 1500 EUR per square meter).

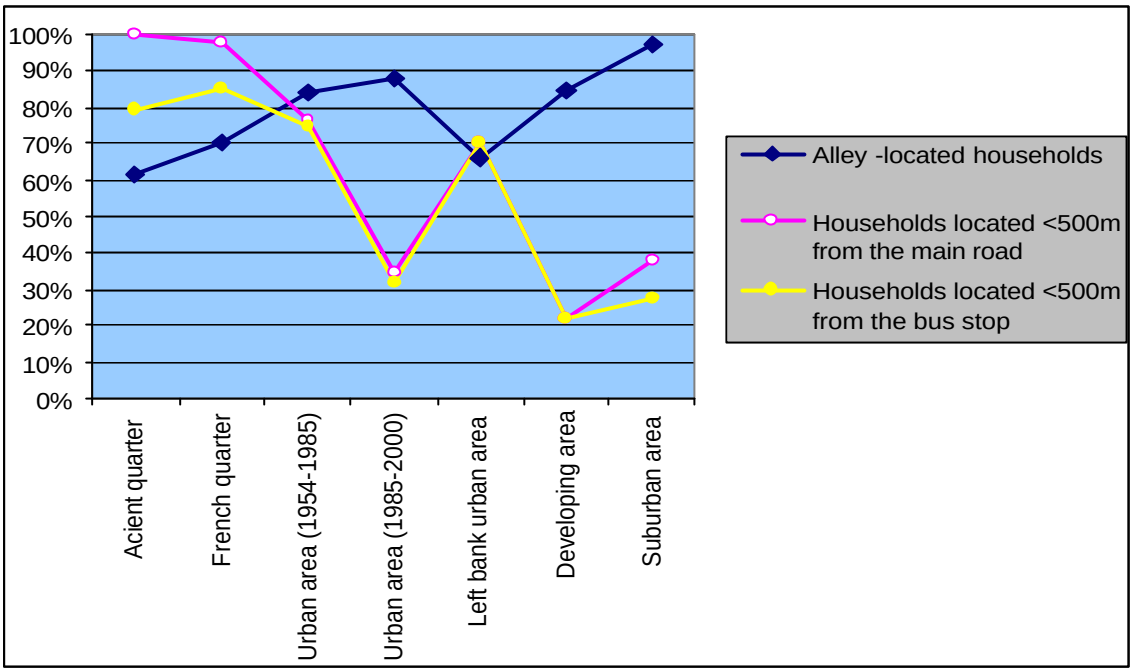


Figure C- 15: Access conditions in different areas in Hanoi

In this area, about 87.8% households located along the alley while only 35% of them located in the actual and potential service area of the bus service. The situation in the developing area and in the suburb is even worse. The old-stain development model is already functioning in these areas and their future may not brighter than the socialism style area. The better condition of left bank town is not in a sustainable case because the urbanized area there is still within one of two layers along the national road number 1A. If the current style urbanization would continue, its future may be more difficult.

Parking Condition

The survey found that 73.2% vehicles are parking inside the house when they are at home during daytime and 97.5% of them are inside the houses in the night. Normally, people park their motorcycles or bicycles directly in the kitchen and the living room. Most of the time, Hanoians enjoy their home-life (eating, playing, sleeping) with all pollutions and risks from the parked vehicles. With bicycles, there is no problem, the current situation prove that people are still happy with motorcycles. However, the demand for more space will be drastically increased if the car starts to come to their life. In fact, there is only one household can park its truck within its living area; the others have to park their auto in a priced public parking space in both daytime and night.

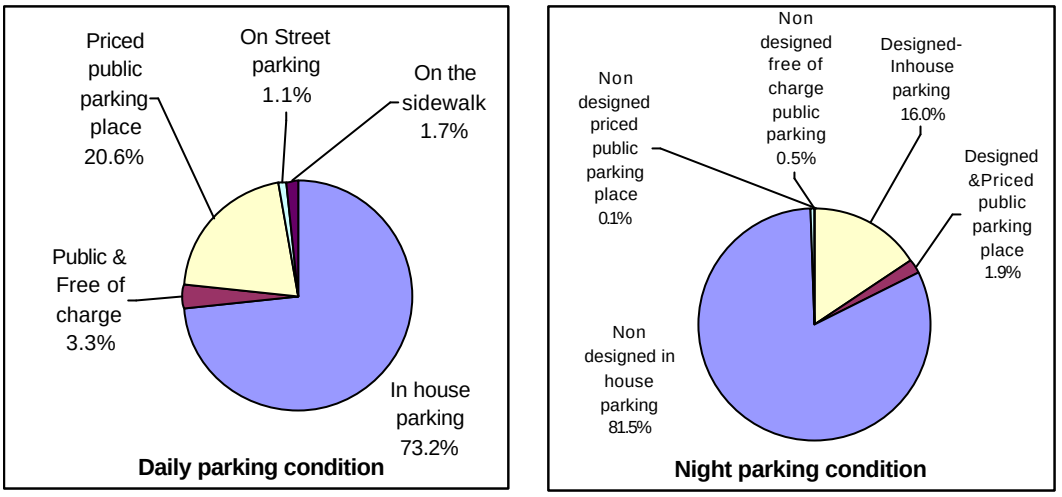
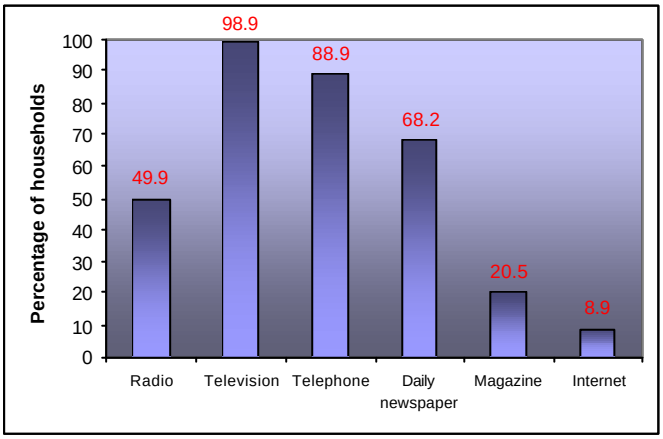


Figure C- 16: Parking conditions in Hanoi

Information Accessibility

The information accessibility of Hanoians is also included in the survey in order to accessing the feasible channels for any marketing or travel substitute measures in the future. Television is the most popular information media in Hanoi where the ordinary domestic television channels are providing without cost. Telephone and daily newspaper are also important, even their costs are not cheap.



The internet service is still in a low level by serving only 8.9% households mostly with expensive dial-up service. However, Hanoians have quite good opportunities to have internet access from internet cafe or centre where the service is providing with very low cost (15-20 cent/hour) with a reasonable quality.

Figure C- 17: information accessibility in Hanoi

Personal Mobility in Hanoi

- **Personal Information of the Travelers**

Living Areas of the Travellers

Some 626 persons voluntarily provided information of daily trip patterns as in the part IV of the questionnaire, but only 552 answered sheets can be accepted for data processing, accounted for 88.2%. The main reason of 74 failed answered sheets is the misunderstanding about questions and most of them come from Xuan Dinh (Developing area) and Minh Khai (Suburban area). However, the processed sample presents quite appropriate shares of travellers from different urban areas in Hanoi.

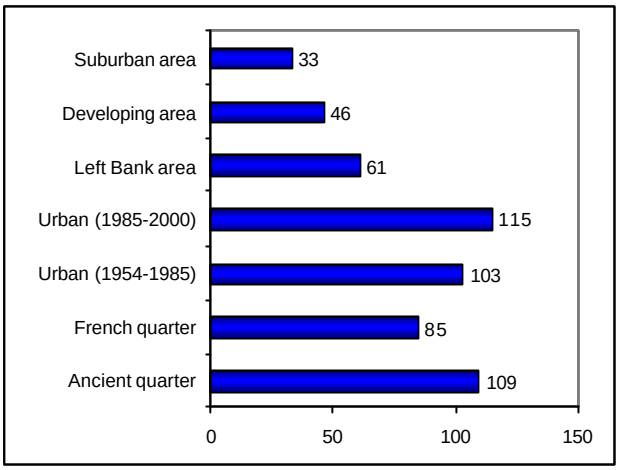


Figure C- 18: Spatial distribution of the travelers

Age and Sex of the Travellers

There were only 252 females among the processed sample, accounted for 45.7%. Among the travellers, 317 persons are in the ages between 25 and 60 years olds (57.4%), the younger groups accounted for 29% and the older one is 13.6%.

Occupations of the Travellers

The group of retired persons ranked first and followed by housewives, students and government officials and business.

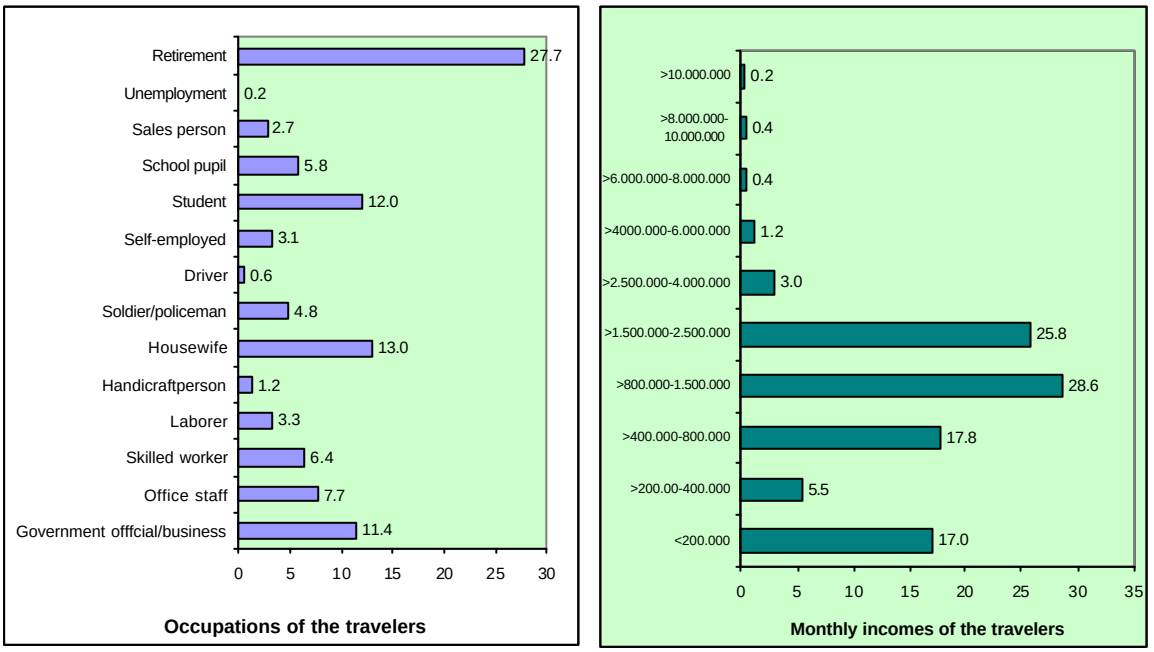


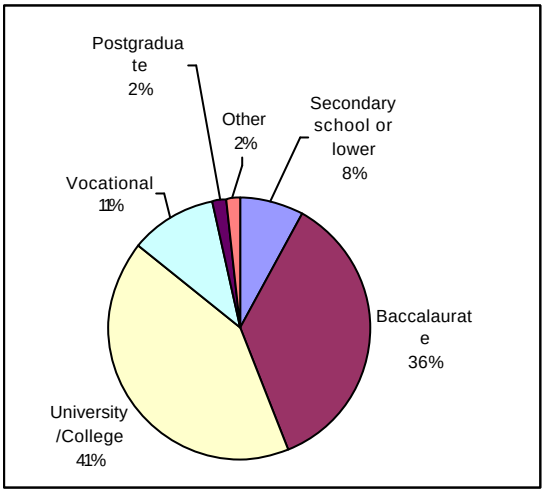
Figure C- 19: Occupational and income distribution of the travelers

Income of the travellers

About 72% of travellers have monthly income rates in between VND400.000 to VND 2.500.000. The group of less than VND200.000 monthly income persons included mainly students (27 over 76) and school pupils (59 over 76 persons), who answered their part-time

income (students) or pocket money (pupils). The education model does not allow many Vietnamese students to work in order to pay for their living costs.

Education of the Travellers



The educational structure of this sample is partly indicating the abnormal situation of education system in Vietnam. The number of vocational trained employees is extremely lower than the group of educated employees. In fact, Hanoi is shortage of skilled labours and many university and college graduates are working in the jobs that required not high academic knowledge but high working skill. However, high education people provide a good condition for traffic education measure.

Figure C- 20: Spatial distribution of the travelers

- **Daily Travel Patterns**

Personal Daily Trip Rate

- *Overview*

There are total 2201 trips were recorded from the answered sheets of 552 persons, who provided their travel patterns in a normal weekday of their life. Among the sample, the average number of daily trips is 3.99 trips/day and the average distance is about 3.88 km/trip (15.5 kilometres per day). This rate is double of that of the household survey in 2004 by TEDI (2004) that found the average trip rate in the urban area is about 1.92 trips/day. However, the rate is much lower that the rate founded by Rossmark and Derstroff (2004) who recorded the rates of 8.15 trip per day and 2.15 km per trip (11kilometres per day). These authors are also adopted the figure of German KONTIV 2002 with the rates about 3.9 trips/day and 11 kilometres per trip (43.1kilometres per day) (BMVBW, 2004). Therefore, the result of this survey indicates that people in a motorcycle dependent city are not less active in travelling than the German in term of trip number but the distance is much shorter. The main reason for that different in trip length is the urban density.

- *Daily trip Rate by Age and Sex*

With average number of daily trips of 4.05 trips/day, the males travelled more frequent than the females in the sample (3.92 trips/day). The results of average daily trips by ages are interesting. The oldest group of people is the most active group in travelling by the rate of 4.28 trips per day. The group of 25 to 60 years old people ranked second with the average daily trips are 4.09 trips/day. The children and youths have a same rate of 3.65 trips/day.

- *Living Area and Trip Rate*

The people of city centre (Ancient and French quarter) are much more active in travelling than the ones who live in the other areas. The lowest rates are belonging to the people who

are living in the developing area (3.59 trip/day) and old-stain urban areas (3.70 tip/day) where the access condition is worse. The suburban area people are also quite active in travelling. The average number daily trips there ranked third, after the city centre people.

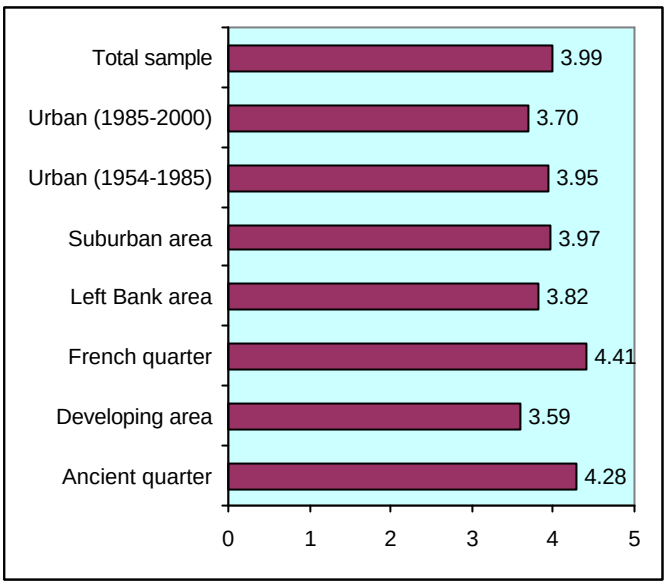
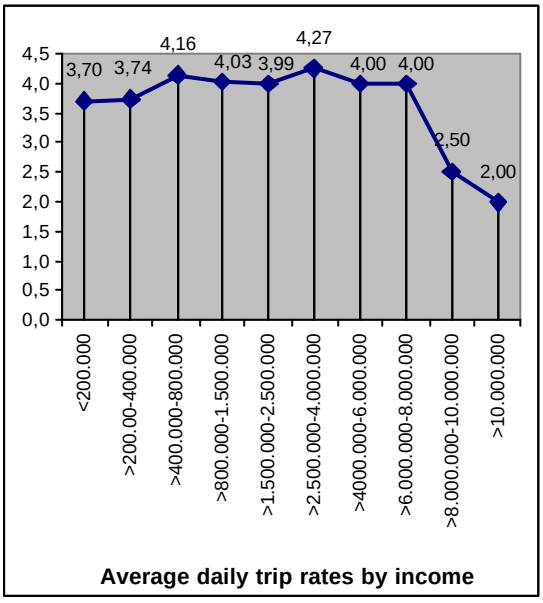


Figure C- 21: traveling activeness in different areas

- *Income and Trip Rate*

Among the sample, the middle-income groups are the most active travellers, while the highest-income people are the laziest group in travelling.



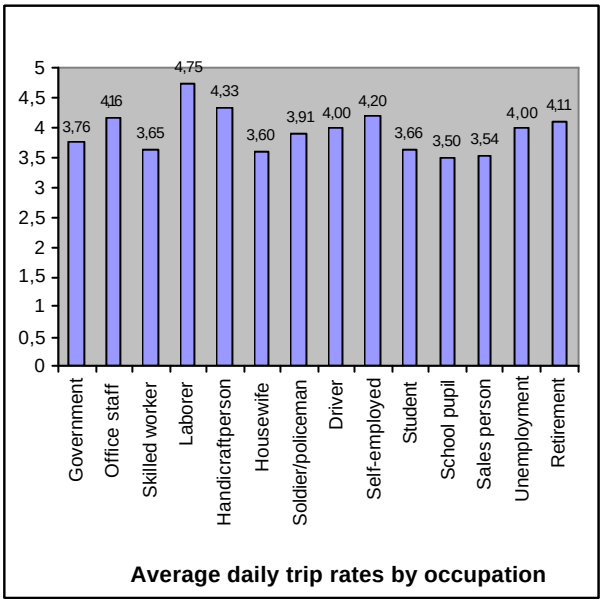


Figure C- 22: Average daily trip rate by income and occupation

- *Occupation and Trip Rate*

The ordinary labours, handicaps, and self-employed persons are the most active travellers (4.76 trips/day) and students and school children are travelling less (3.50 and 3.56 trips/day).

The drivers are surprisingly not the active travelling persons (4.0 trips/day, as the same as the un-employees). The retired persons are quite active.

Trip Patterns and Vehicles

- *Personal Trip Purposes and Mode*

In this survey, the working and schooling trips are accounted for 27.5% that is lower than the finding of TEDI (2004) that found a rate of 36.5% but it is higher than the figure of 21% in the KONTIV survey.

Table C- 7: Trip purposes by transport mode

	MC self driving	MC by others	MC taxi	Walking	Bicycle	Bus	Intermodal transport	Ordinary taxi	Car self driving	Car by other	Total
Working or business	14.97%	0.41%	0.87%	1.47%	1.06%	1.15%	1.01%	0.18%	0.09%	0.05%	**21.26%**
Schooling	1.79%	0.14%	0.69%	0.46%	1.01%	0.87%	1.10%	0.00%	0.00%	0.18%	**6.24%**
Shopping/Buying	3.08%	0.09%	0.46%	2.75%	0.51%	0.09%	0.18%	0.00%	0.00%	0.00%	**7.16%**
Eating	3.21%	0.14%	0.09%	1.97%	0.14%	0.28%	0.05%	0.00%	0.18%	0.00%	**6.06%**
Visiting friend/ relative	2.16%	0.28%	0.14%	0.55%	0.51%	0.05%	0.32%	0.05%	0.00%	0.00%	**4.04%**
Bringing/ picking up people	4.55%	0.05%	0.23%	0.14%	0.09%	0.18%	0.14%	0.00%	0.00%	0.00%	**5.37%**
Sport/ Leisure/ Entertainment	1.06%	0.05%	0.14%	2.94%	0.23%	0.60%	0.05%	0.00%	0.00%	0.00%	**5.05%**
Transporting goods	0.28%	0.00%	0.05%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**0.37%**
Returning	23.92%	1.01%	2.43%	8.68%	3.26%	2.62%	2.43%	0.05%	0.00%	0.05%	**44.44%**
Total	**55.00%**	**2.16%**	**5.10%**	**19.01%**	**6.80%**	**5.83%**	**5.28%**	**0.28%**	**0.28%**	**0.28%**	**100%**

TEDI (2004) founded that total of the other purpose trips is only 13.9%, which is less than the result of this survey (28.05%). In this survey, total share of shopping and eating trips is about 13.2% that is much lower than 23% in the finding of Rossmark and Derstroff (2004). The share of leisure/sport and entertainment trips is 5.05% that is almost double the finding of Rossmark and Derstroff (2004), but it is only one third of share the same purpose trips in the KONTIV survey in Germany (BMVBW, 2004)

Two third (62.36%) of the trips are made by motorcycles and motorcycle taxi. Accounted for 26.2% total vehicle fleet, bicycle is chosen for only 6.8% of trips. This figure is slightly lower than the figure (7.4%) in Rossmark and Derstroff (2004) survey but it is only one fourth of the finding in TEDI (2004) survey (23.2%). The walking trips are about 19% that is similar to the rate of TEDI (2004), 20.3%, but it is much lower Rossmark and Derstroff (2004), 30.9%. The public bus and bus-based intermodal transport mode are the choices of 5.83% and 5.23% of trips, respectively. Number of car and taxi trips is less than 0.85% of the total; this figure is similar to those in the other two surveys.

- *Distance of Trip and Vehicles*

The survey found 53.1% of the trips have a less than 2 km length. This indicates that at least more than half of the trips can be most effectively made by bicycle (35%) and walking (18.2%). In the case of Hanoi, the urban public transport can play as a vital mode among the trip lengths between 2 and 12 km. Except the over 15 km trips that are not recommended for

motorcycle, the rest of intra-urban trips that have between 2 to 15 km lengths can be made by motorcycles efficiently.

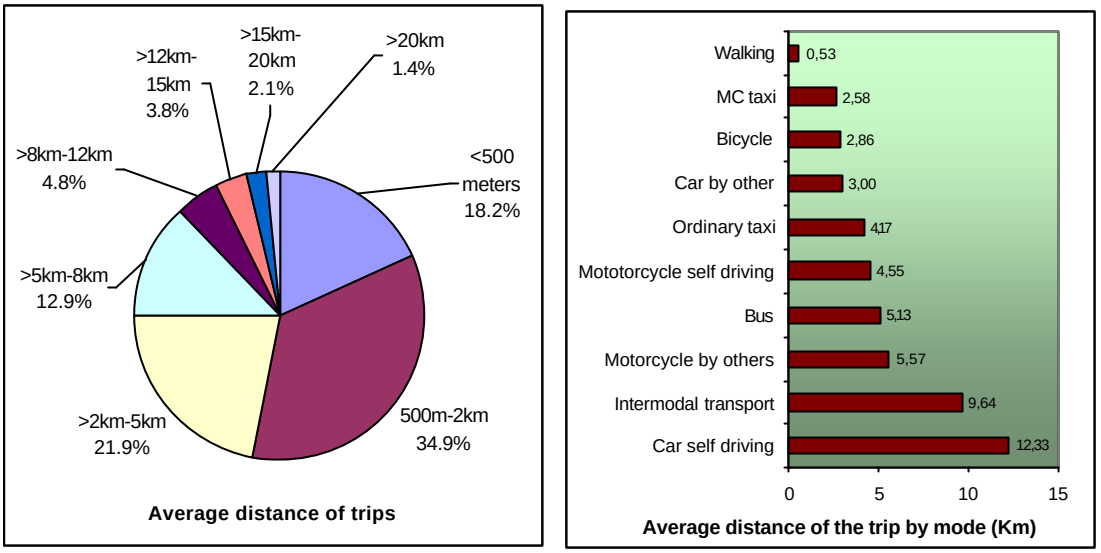


Figure C- 23: Average distance of the personal trips

The average of the trip length is 3.88 km, the average distance of motorcycle trips is about 4.43 kilometres, and the average length of automobile trips (car self-driving, car by others and ordinary taxi) is only 6.5 kilometres. There are only 2 car trips, accounted for 33 % of car self-driving trips and 11% of total automobile trips, that have a distance more than 20 kilometres. Therefore, most of the car trips in Hanoi are ineffective in term of travel distance.

- *Parking Condition of the Trips*

There is information of parking for only 1209 trips (54.9%) that means there is 9.6% parking required trips those parking information were not provided.

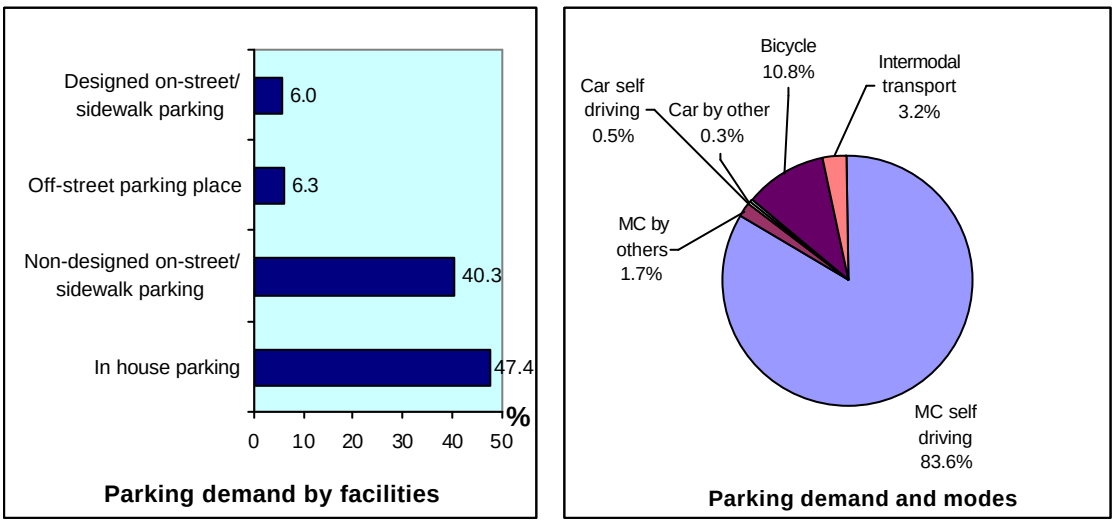


Figure C- 24: Parking demand and modes

The main share of parking demand is accounted for motorcycle self-driving (83.6%). Parking demand of 129 over 148 bicycle-trips were confirmed by the travellers and accounted for 10% of parking demand. Some 38 of 117 intermodal trips indicated demand for parking places, about 3.2% of the total parking demand.

Some 47.4 % of trips are parking inside the house the daily parking demands, while other 40.3% are parking on the street or sidewalk in the non-designed places. Only 12.3% parking demands are supplied by some kinds of designed-parking-facilities.

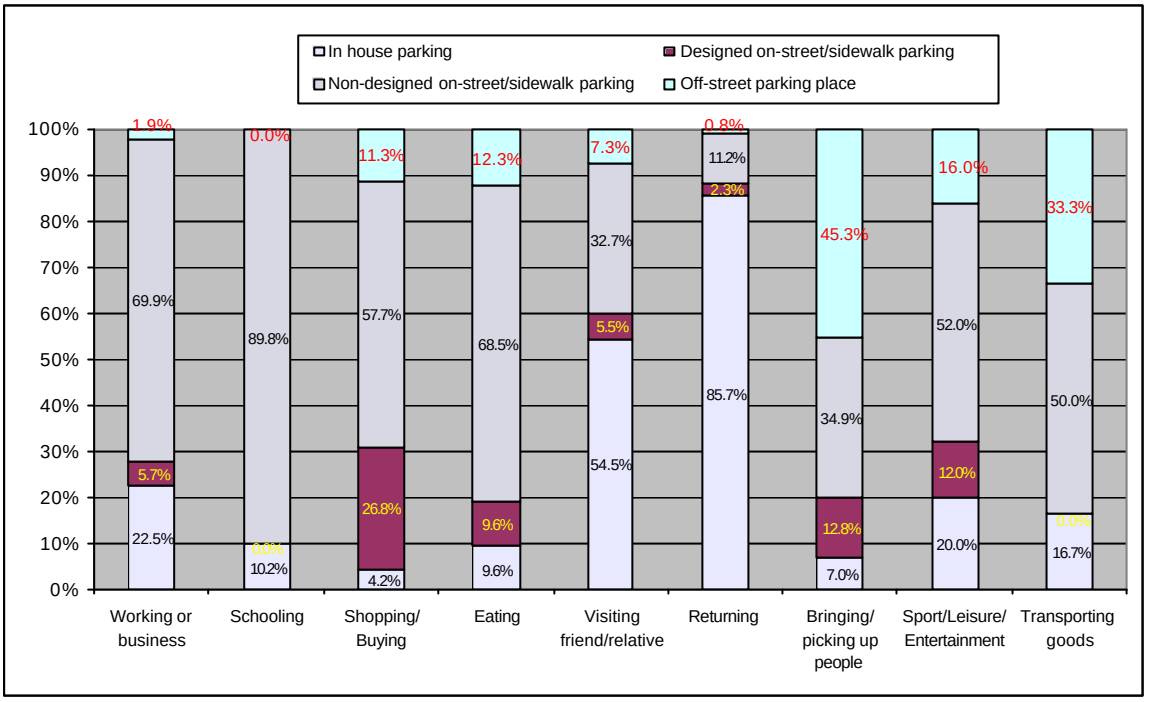


Figure C- 25: Trip purposes and parking facilities

In term of trip purposes, lack of designed parking facilities is significant for all trip categories. People have to park on the streets or sidewalks for 70% of their working and business trips; the rates for eating trips and shopping trips are 68.5% and 57.7% respectively. The most abnormal situation is for schooling trips in this sample. Normally, every universities or schools in Hanoi should have off-street parking lots inside the campus. However, the capacity of these parking lots is too limited. Due to the increase of schooling vehicular trips and lack of spaces, many schools in Hanoi have no place for parking, then they have mostly to use the sidewalks in front of school gate for parking demands of the scholars. According to Mr. Hoang Duy Hung, director of Hanoi Parking Company, the public parking lots in Hanoi are mostly for cars and covered only for 20% of current car parking demands (Suong, 2005).

- *Origin and Destination*

The trip ends cover all districts of Hanoi and 5 provinces in the surrounding areas. There are 1885 trips ended within the surveyed districts, accounted for 85.6 % (subtotal 1) and the trip ends within Hanoi is 2161 (98.1%). There are only 1.9% trips ended in the surrounding provinces. The survey indicated that Hoan Kiem (the city centre of business district) is the most attractive district in Hanoi. This district is the end of 33.6% total trips. According to the trip purposes, 27.8% total business and working trips, 50% eating trips, 38.5% shopping trips, and 36.9% sport/leisure/entertainment trips ended in Hoan Kiem.

Table C- 8: Origin –Destination matrix of the trips

Origin	Destination: Ba Dinh	Dong Da	Hoan Kiem	Cau Giay	Thanh Xuan	Long Bien	Tu Liem	Subtotal 1	Hai Ba Trung	Hoang Mai	Tay Ho	Gia Lam	Thanh Tri	Soc Son	Sutotal 2	X-Bac Ninh	X-Ha Tay	X-Hai Phong	X-Hung Yen	X-Phuc Yen	Total
Ba Dinh	98	29	49	25	5	3	8	**217**	10	1	2	0	0	0	**230**	0	2	0	0	0	**232**
Dong Da	37	113	44	22	15	1	8	**240**	8	1	0	1	0	1	**251**	0	0	0	1	0	**252**
Hoan Kiem	50	41	534	17	10	12	18	**682**	39	4	4	2	3	1	**735**	0	3	1	0	0	**739**
Cau Giay	33	19	15	79	1	1	10	**158**	3	2	3	1	1	0	**168**	0	1	0	0	0	**169**
Thanh Xuan	4	14	10	1	130	5	8	**172**	15	8	0	0	2	0	**197**	0	3	0	1	1	**202**
Long Bien	3	2	10	1	5	151	0	**172**	7	0	0	5	0	0	**184**	2	1	0	1	0	**188**
Tu Liem	9	8	19	10	8	0	190	**244**	6	2	1	0	0	0	**253**	1	2	0	0	0	**256**
Subtotal 1	**234**	**226**	**681**	**155**	**174**	**173**	**242**	**1,885**													
Hai Ba Trung	11	7	40	3	13	7	6		8	0	0	0	1	0	**96**	0	0	0	0	0	**96**
Hoang Mai	1	1	3	2	10	0	2		0	1	0	0	0	0	**20**	0	0	0	0	0	**20**
Tay Ho	1	1	5	2	0	0	1		0	0	0	0	0	0	**10**	0	0	0	0	0	**10**
Gia Lam	1	1	1	1	0	5	0		0	0	0	0	0	0	**9**	0	0	0	0	0	**9**
Thanh Tri	0	0	3	1	1	0	0		1	0	0	0	0	0	**6**	0	0	0	0	0	**6**
Soc Son	1	1	0	0	0	0	0		0	0	0	0	0	0	**2**	0	0	0	0	0	**2**
Subtotal 2	**249**	**237**	**733**	**164**	**198**	**185**	**251**		**97**	**19**	**10**	**9**	**7**	**2**	**2,161**						
X-Bac Ninh	0	0	0	0	0	2	1		0	0	0	0	0	0		0	0	0	0	0	**3**
X-Ha Tay	1	1	3	1	3	1	2		0	0	0	0	0	0		0	0	0	0	0	**12**
X-Hai Phong	0	0	1	0	0	0	0		0	0	0	0	0	0		0	0	0	0	0	**1**
X-Hung Yen	0	2	0	0	0	1	0		0	0	0	0	0	0		0	0	0	0	0	**3**
X-Phuc Yen	0	0	0	0	1	0	0		0	0	0	0	0	0		0	0	0	0	0	**1**
Total	**250**	**240**	**737**	**165**	**202**	**189**	**254**		**97**	**19**	**10**	**9**	**7**	**2**		**3**	**12**	**1**	**3**	**1**	**2,201**

Note

The locations that titled with pre-letter "X" are not in Hanoi province

Surveyed districts in Hanoi

The districts ar not included in the survey

For schooling, Hai Ba Trung is the most attractive district by having 22.05% number of school trips. There are 1295 intra-districts trips, accounted for 58.8% of the total trips and 68.7% of the trips within the surveyed districts. This indicates a good mixed land use in Hanoi.

The shares of intra-district trips ends indicated that the urban area that Hoan Kiem has better land uses mix among the city central districts (Ba Dinh, Dong Da, Hoan Kiem, Hai Ba Trung).

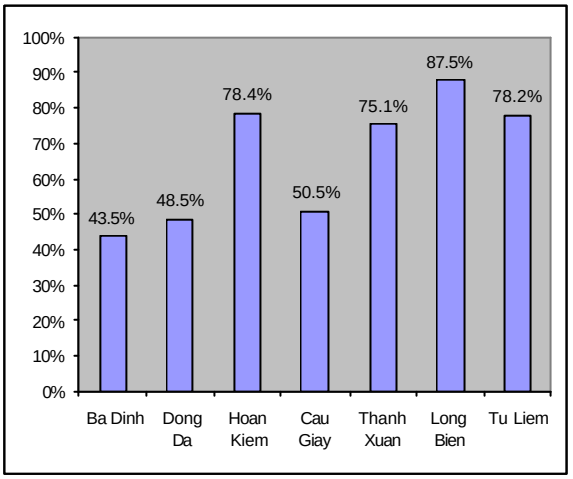


Figure C- 26: Share of intra-district trip ends

The figures of Thanh Xuan, Long Bien and Tu Liem indicate that the new urban districts in Hanoi also have good land use mix. Most of industrial jobs are located in these districts while the cheaper land price encourages people to reside there.

Conclusions

The survey indicated a clear picture of the socio-economic conditions of the households in Hanoi, which are strong backgrounds of the household's accessibility and personal mobility in a typical motorcycle dependent city. The main findings of this survey can be concluded as follows:

- **Socio-economic Conditions of Households**

Hanoians are still keeping the model of multi-generation family. Therefore, the household size there is large about 4.3 persons/household.

Hanoi has a young population with higher share of females to the males 51.3% versus 48.7%).

The rate of unemployment is low among population, but the rate of retired people is quite high because the shorter official working age.

In their opinion, Hanoi people selected motorcycle as the most frequent use vehicle, bicycle ranked second and bus was at the third position.

Public transport service in Hanoi (bus and motorcycle taxi) is female preferred modes. Bicycle, bus, and walking are the best three modes of the children.

The average household monthly income in Hanoi is about VND 2 millions to VND 4 million (EUR100 to EUR200/month) or VND 0.5 million (EUR25) to VND 1 million (EUR 50) per capita per month. The difference between 5% highest income families and 5% lowest income families is about 12 to 50 times.

Only 21% households are residing in a total area of less than 50m2, including kitchen, toilette and parking places for their motorcycle or bicycles. This good housing condition is also a very interesting point in the situation of low income but extremely high land use price society like Hanoi.

- **Accessibility of the Households**

There are total 952 vehicles, including 2 cars, 4 trucks (3.7 autos /1000 inhabitants), 697 motorcycles (438 MCs/1000 inhabitants), and 249 bicycles (156 bicycles/1000 inhabitants).

The MCOs in the city centre are lower than that in the areas that developed after 1954 and 1985. The main reasons are better road network plan and higher urban density (population and job). The MCOs in suburban and developing urban areas (including the left bank area) are the lowest but still high.

The survey found that the motorization in Hanoi is accelerating since 1990 as the effect of market economy application and Hanoi started to change from “city of bicycle” to the city of motorcycle.

Probability of owning motorcycle is significantly proportional to the rate of household income. In contrast, the chance of owning bicycle is inversely proportional to the rate of household income.

Vehicle fleet in Hanoi is quite new and the new-buy-second-hand vehicles accounted for 13.3% total vehicle fleet. However, the share of this group among the purchased motorcycles is reducing significantly. In the future, share of second-hand vehicles may be increased according to the measure of new motorcycle registration’s prohibition in Hanoi.

All autos and 85% motorcycles are insured; in 2001, only 58% motorcycles were insured.

So far, there is no such information about the infrastructure access of the households in Vietnam. The survey found that 80% households are accessing to a type of road called alley

(less than 5 meters width) that was developed from the traditional trail in the village where the urban area initiated. About 97% households have no plan and no information about any change of the accessed road type in the next 10 years.

Fortunately, 64% of total households located less than 500 meters from a distributor or collector road. However, only 57% of the alley-located households have distance less than 500 meters from the main road.

About 50% of the alley-located households are in the effected catchments of the bus service; the other half is in the undesired situation of accessing to any four-wheel public transport service.

Households in the city centre, the socialism's planned style (between 1954-1985) and the left bank town has better accessibility to the bus service.

The most problematic area in term of accessibility is the oil-stain development area (between 1985-2000). In this area, about 87.8% households located along the alley while only 35% of them located in the actual and potential service area of the bus service. The situation in the developing area and in the suburb is even worse.

In Hanoi, 73.2% vehicles are parking inside the house when they are at home during daytime and 97.5% of them are inside the houses in the night. Most of the time, people have to deal directly with all pollutions and risks from the parked vehicles, especially motorcycle.

Among the public media, television is the most popular information media in Hanoi where the ordinary domestic television channels are providing without cost. Telephone and daily newspaper are also wide use (even their costs are not cheap). The Internet service is still in a low level by serving only 8.9% households mostly with dial-up service. However, the cost of service of in Internet cafe or centre is low (15-20 cent/hour).

- **Personal Backgrounds**

About 626 persons voluntarily provided information of daily trip patterns, but only 552 answered sheets can be accepted for data processing (88.2%). The main reason of 74 failed answered sheets is the misunderstanding about questions.

In this sample, share of females is lower than males (45.7%), population is also young, and 72% of them have monthly income rates in between VND 400.000 to VND 2.500.000.

The educational structure of this sample is partly indicating the abnormal situation of education system in Vietnam. The number of vocational trained employees is extremely lower than the group of educated employees. However, high education people provide a good condition for traffic education measure.

- **Daily trip Patterns**

The average daily trip rate of 552 interviewees is about 3.99 trips/day per person (similar to a German). The average distance is about 3.88 kilometres per trip (about 1 third of a German trip, 11 kilometres per trip) and average personal daily travel distance is 15.5 kilometres per day. Therefore, people in a MDC are not less active in travelling than the German in term of trip number but their trip distance is much shorter.

In Hanoi, the males travelled more frequent than the females in the sample (4.02 trips versus 3.92 trips/day). Surprisingly, the oldest group of people is the most active group in travelling by the rate of 4.28 trips per day.

The people of city centre are much more active in travelling than the ones who live in the other areas. The suburban area people are also quite active in travelling.

The results shows that the middle-income groups are the most active travellers while the highest income people seem to be too lazy.

The ordinary labours, handicaps, and self-employed persons are the most active travellers (4.76 trips/day) and students and school children are travelling less (3.50 and 3.56 trips/day). The retired persons are quite active.

The working and schooling trips are accounted for 27.5%, the shopping and eating trips are about 13.2%, and the share of leisure/sport and entertainment trips is only 5.05%.

Two third of the trips made by motorcycles and motorcycle taxi (62.36%), but only 6.8% of trips are making by bicycle. The walking trips are about 19% while the public bus and bus-based intermodal transport mode are the choices of 5.83% and 5.23% of trips, respectively.

The survey found that 53.1% of the trips have a less than 2 kilometres length that can be most effectively made by bicycle (35%) and walking (18.2%).

The average distance of motorcycle trips (MC self-driving, MC by other and MC taxi) is about 4.43 kilometres and the average length of automobile trips (car self-driving, car by others and ordinary taxi) is only 6.5 kilometres. The car trips in Hanoi are ineffective in term of travel distance.

The motorcycle self-driving trips are accounted 83.6% of the total parking demand, while the intermodal trips are accounted for only 3.2% of the total parking demand.

The lack of designed parking facilities is significant for all trip purposes. People have to park on the streets or sidewalks for 70% of their working and business trips, the situations are similar for schooling, eating and shopping trips.

The trip ends cover all districts of Hanoi and 5 provinces in the surrounding areas. The survey indicated that Hoan Kiem (the CBD) is the most attractive district in Hanoi.

There are 1295 intra-districts trips, accounted for 58.8% of the total trips and 68.7% of the trips within the surveyed districts. This indicates a quite good mixed land use in Hanoi. The shares of intra-district trips ends indicated that the urban area that Hoan Kiem have better land-use mix in comparison with Ba Dinh and Dong Da. The new urban districts, Thanh Xuan, Long Bien and Tu Liem, also have good land use mix.

Sample of the survey form

PART I: CONTROL INFORMATION

Name of surveyor:……..……

Name of supervisor:……

Date of survey:……/……/2004

Household: ☐☐☐☐☐

PART II: HOUSEHOLD INFORMATION

Q1: Name of Household head:……..……..……..

Q2: Address: Location on the map: ☐☐

No.:…… Alley……

Street:……Phuong:……

Quan:…….. Year started to live in this address:……

Q3: Telephone number (if available): ☐☐☐☐☐☐☐☐☐

Q4: Household composition

No.	Age	Sex		Relationships			Occupation	most frequent use vehicle
		M	F	Member	Guest	Helpers		
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

Q5: Total monthly household income

1	under 200,000
2	201,000-400,000
3	401,000-800,000
4	801,000-1.5 million
5	1.501mil.-2.5 million
6	2.501mill-4.0million
7	4.001mill-6.0million
8	6.001mill-8.0million
9	8.001mill-10.0million
10	higher than 10.0mill.

Q6: Existing housing condition

Ground area	
1	<20 m2
2	21-50m2
3	>50m2

Using area	
1	<50m2
2	50-100m2
3	>100m2

Number of floor	
1	one
2	two
3	>2

Land use area	
1	Mixed
2	Residential only
3	Commercial/industrial
4	others

Q7: Planned Housing condition upto 2010

Ground area	
1	<20 m2
2	21-50m2
3	>50m2
4	No change

Using area	
1	<50m2
2	50-100m2
3	>100m2
4	No change

Number of floor	
1	one
2	two
3	>2
4	No change

PART III: MOBILITY CONDITION ☐

Q8: Existing access condition

	access road type
1	narrow alley (<3m)
2	alley (3-5m)
3	collector (>5-7m)
4	Aterial (>7m)

	distance to major road
1	<500m
2	501-1000m
3	1001-2000m
4	>2000m

	Distance to bus stop
1	<500m
2	501-1000m
3	1001-2000m
4	>2000m

Q9: Planned access condition up to 2010

	access road type
1	narrow alley (<3m)
2	alley (3-5m)
3	collector (>5-7m)
4	Aterial (>7m)
5	No change

	distance to major road
1	<500m
2	501-1000m
3	1001-2000m
4	>2000m

	Distance to bus stop
1	<500m
2	501-1000m
3	1001-2000m
4	>2000m

Q10: Vehicles in household

No.	Type	Year of purchase	Purchased condition		License Plate		Insurrance		Daily use	Purpose
			New	Old	Prov.	Let.-N.	YES	NO		
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

	Vehicle type
1	Bicycle
2	Cycle
3	Motorcycle<50cc
4	Motorcycle>50cc
5	Car (<5 pax)
6	Van/Lambretta (>5pax)
7	Truck
8	other (specify)

	Ownership type
1	Solely onwed
2	Jointly owned
3	Company issued
4	Rented
5	Borrowed

	Daily use
1	Solely use
2	Sharing (user numbers)
3	For rent/lend
4	Service
5	other: specify

	Purpose
1	For travelling only
2	For transporting good only
3	Mixed

Q10: Parking conditions

No.	Type	Day time parking					Nightime parking					
							Designed			Non-designed		
		In-house	free public	cost public	On-street	Footh path	In-house	free public	cost public	In-house	free public	cost public
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

Q12: What kind of media does the household regularly access

a. Radio ☐ c. Daily newspaper ☐ e. internet ☐

b. TV ☐ d. Magazine ☐ f. other (specify) ☐

PART IV: PERSONAL MOBILITY INFORMATION

Q13: a. Age: ☐☐ b.Sex: male female c.Household member No.: ☐☐ ☐☐☐

Q14: What is your field of employment: …… ☐

Q15: Total monthly income

1	under 200,000		6	2.501mill-4.0million
2	201,000-400,000		7	4.001mill-6.0million
3	401,000-800,000		8	6.001mill-8.0million
4	801,000-1.5 million		9	8.001mill-10.0million
5	1.501mil.-2.5 million		10	higher than 10.0mill.

Q16: What is your educational attainment?: …… ☐

Q17: What is your most frequently used vehicle at 2000? …… ☐

Q18: How is your daily travelling? Date:……/……/2004

We would like to request you to make a daily travelling diary as the following matrix. Please kindly keep in mind that we need your presentation of every trip that you make in a typical weekday (not Weekend and Holiday). Thank you very much for your kindness!

Trip number		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Purpose of trip	Business, Working										
	School										
	Shopping/buying										
	Eating										
	Visiting friend/relatives										
	Returning										
	Bringing or picking up people										
	Sport/leisure/entertainment										
	Transport or picking up good										
Mode please mark down every mode that use for the trip	**1**										
	2										
	3										
	4										
Origin (cell on the map):											
Destination (cell on the map):											
Distance :											
Starting time:											
Arrival time:											
Parking at destination	Nondesigned inhouse										
	Designed on the street or sidewalk										
	Non Designed on the street or sidewalk										
	off street parking place										
Posible by bus:											

**** Mode:***

1 Motorcycle self driving	2 Motorcycle by others	3 MC Taxi	4 Walking	5 Bus
6 Car self driving	7 Car by others	8 Taxi	9 Bicycle	10 Cyclo

Q18: Please write down the Origin and destination of the trips that you can not recognize on the map

	Trip.....	**Trip.....**
Origin		
Destination		
	Trip.....	**Trip.....**
Origin		
Destination		

Annex D. Expert Survey on Weighing of Assessment Criteria

Sample of Questionnaire

This questionnaire survey aims to get a proper rating of the importance of criteria, which are employed to assess candidate traffic management measures. Results of this questionnaire survey will be only used for scientific purposes of the Doctoral Thesis and the scientific work other researchers. Any information about the interviewee will only be published with the written permission of him or her.

Organization:

PART I: EXPERT'S INFORMATION Name (if agree)

Q1: What is your professional working position?

Q2: How long have you been working in the professional? years:

Q3: What is your highest professional degree?

PART II: EXPECTED EFFECTIVENESS

Q4: To achieve a sustainable urban transport system from the conditions of a motorcycle dependent city *(low-income, high density land use, motorcycle dominated traffic flow*), how should the goals of urban transport activities be ranked? {*from the most important (1) to the least important (4), the same rank can be given for different criteria}*

Goals	Rank
To ensure urban traffic safety (S)	give here your rank
To ensure urban mobility (M)	give here your rank
To protect urban environment and natural resources (EN)	give here your rank
To improve urban and regional economy (ECO)	give here your rank

Q5: Please formulate the goal-matrix according to the ranks that are given in question 4 and conduct a simple pairewise comparison between the goals by the following rule:

give "O" if two goals are equally important

give "+" if the basic goal is slightly more important than the other

Give "++" if the basic goal is significantly more important than the other

Give "+++" if the basic goal is extremely more important than the other

Goal-matrix

			Rank	1	2	3	4
Basic goals	Rank/	Title (abrv.)		title	title	title	title
	Rank 1:	title			give here your rate	give here your rate	give here your rate
	Rank 2:	title				give here your rate	give here your rate
	Rank 3:	title					give here your rate
	Rank 4:	title					

Q6: To ensure urban mobility in the conditions of a motorcycle dependent city , how should the objectives of TRAFFIC MANAGEMENT be ranked? ***(from the most important (1) to the least important (4) - the same rank can be given for different criteria)***

Objectives	Rank
To ensure equality in using transport properties (EQUAL)	give here your rank
To increase number of modal choices (CHOICE)	give here your rank
To increase productivity and efficiency of transport supply (P&E)	give here your rank
To increase capacity of transport supply (CAP)	give here your rank

Q7: Please formulate the objective-matrix according to the ranks that are given in question 6 and conduct a simple pairewise comparison between the objectives by the following rule:

give "O" if two objectives are equally important
give "+" if the basic objective is slightly more important than the other
Give "++" if the basic objective is significantly more important than the other
Give "+++" if the basic objective is extremely more important than the other

Objective-matrix

			Rank	1	2	3	4
Basic objectives	Rank/	Title (abrv.)		title	title	title	title
	Rank 1:	title			give here your rate	give here your rate	give here your rate
	Rank 2:	title				give here your rate	give here your rate
	Rank 3:	title					give here your rate
	Rank 4:	title					

Q8: To ensure urban traffic safety in the conditions of a motorcycle dependent city , which objective is more important than the other ? ***(give your rank from 1 to 2 - the same rank can be given for both)***

Objectives	Rank
To reduce frequency of traffic accident (FREQ)	give here your rank
To reduce severity of traffic accident (SEVE)	give here your rank

Q9: Please formulate the objective-matrix according to the ranks that are given in question 8 and conduct a simple pairewise comparison between the objectives by the following rule:

give "O" if two objectives are equally important
give "+" if the basic objective is slightly more important than the other
Give "++" if the basic objective is significantly more important than the other
Give "+++" if the basic objective is extremely more important than the other

Objective-matrix

			Rank	1	2
Basic objectives	Rank/	Title (abrv.)		title	title
	Rank 1:	title			give here your rate
	Rank 2:	title			

Q10: To protect urban environment and natural resources in the conditions of a motorcycle dependent city , how should the objectives of TRAFFIC MANAGEMENT be ranked? ***(from the most important (1) to the least important (4) - the same rank can be given for different criteria)***

Objectives	Rank
To reduce air pollution (AP)	give here your rank
To reduce noise pollution (NOISE)	give here your rank
To save energy (ENER)	give here your rank
To save urban space (SPACE)	give here your rank

Q11: Please formulate the objective-matrix according to the ranks that are given in question 10 and conduct a simple pairewise comparison between the objectives by the following rule:

give "O" if two objectives are equally important

give "+" if the basic objective is slightly more important than the other

Give "++" if the basic objective is significantly more important the other

Give "+++" if the basic objective is extremely more important the other

Objective-matrix

			Rank	1	2	3	4
Basic objectives	Rank/	Title (abrv.)		title	title	title	title
	Rank 1:	title			give here your rate	give here your rate	give here your rate
	Rank 2:	title				give here your rate	give here your rate
	Rank 3:	title					give here your rate
	Rank 4:	title					

Q12: To improve economy of the city and region the conditions of a motorcycle dependent city, how should the objectives of TRAFFIC MANAGEMENT be ranked? ***(from the most important (1) to the least important (3) - the same rank can be given for different criteria)***

Objectives	Rank
To reduce transport costs (TCOST)	give here your rank
To improve economic productivity and efficiency (ECO_P&E)	give here your rank
To improve economic attractiveness (ATTR)	give here your rank

Q13: Please formulate the objective-matrix according to the ranks that are given in question 12 and conduct a simple pairewise comparison between the objectives by the following rule:

give "O" if two objectives are equally important

give "+" if the basic objective is slightly more important than the other

Give "++" if the basic objective is significantly more important than the other

Give "+++" if the basic objective is extremely more important than the other

Objective-matrix

			Rank	1	2	3
Basic objectives	Rank/	Title (abrv.)		title	title	title
	Rank 1:	title			give here your rate	give here your rate
	Rank 2:	title				give here your rate
	Rank 3:	title				

PART III: BARRIERS IN IMPLEMENTATION

Q14: In the conditions of a motorcycle dependent city, how do you rank the difficulty of the BARRIERS in IMPLEMENTATION OF TRAFFIC MANAGEMENT MEASURES ? *(from the most difficult (1) to the least difficult (4)- the same rank can be given for different criteria)*

Barriers	Rank
Costs of measure (MCOST)	give here your rank
Required technical systems (TECH)	give here your rank
Required institutional participation (INST)	give here your rank
Required public acceptance (ACCEPT)	give here your rank

Q15: Please formulate the criteria-matrix according to the ranks that are given in question 4 and conduct a simple pairewise comparison between the criteria by the following rule:

give "O" if two criteria are equally difficult

give "+" if the basic criterion is slightly more difficult than the other

Give "++" if the basic criterion is significantly more difficult than the other

Give "+++" if the basic criterion is extremely more difficult than the other

Criteria-matrix

			Rank	1	2	3	4
Basic criteria	Rank/	Title (abrv.)		title	title	title	title
	Rank 1:	title			give here your rate	give here your rate	give here your rate
	Rank 2:	title				give here your rate	give here your rate
	Rank 3:	title					give here your rate
	Rank 4:	title					

Q16: To implement TRAFFIC MANAGEMENT MEASURES in a low-income city, what type of COST is more difficult to finance than the other?*(give your rank from 1 to 2- the same rank can be given for both)*

Sub-criteria	Rank
Investment cost (INV_COST)	give here your rank
Operation and maintenance cost (O&M_COST)	give here your rank

Q17: Please formulate the sub-criteria-matrix according to the ranks that are given in question 16 and conduct a simple pairewise comparison between the COSTS by the following rule:

give "O" if two sub-criteria are equally difficult

give "+" if the basic cost is slightly more difficult to finance than the other

Give "++" if the basic cost is significantly more difficult to finance than the other

Give "+++" if the basic cost is extremely more difficult to finance than the other

sub-criteria-matrix

			Rank	1	2
Basic costs	Rank/	Title (abrv.)		title	title
	Rank 1:	title			give here your rate
	Rank 2:	title			

Q18: To implement TRAFFIC MANAGEMENT MEASURES in a less-developed city, what type of existing TECHNICAL SYSTEMS is more difficult to change than the other? ***(give your rank from 1 to 2- the same rank can be given for both)***

Sub-criteria	Rank
Operation and control systems (OP&C)	give here your rank
Information systems (INS)	give here your rank

Q19: Please formulate the sub-criteria-matrix according to the ranks that are given in question 16 and conduct a simple pairewise comparison between the SYSTEMS by the following rule:

give "O" if two sub-criteria are equally difficult

give "+" if the basic system is slightly more difficult to change than the other

Give "++" if the basic system is significantly more difficult to change than the other

Give "+++" if the basic system is extremely more difficult to change than the other

sub-criteria-matrix

			Rank	1	2
Basic systems	Rank/	Title (abrv.)		title	title
	Rank 1:	title			give here your rate
	Rank 2:	title			

Q20: To implement TRAFFIC MANAGEMENT MEASURES in a less-developed city, how do you rank the importance of the participation of the two group of INSTITUTIONS ? ***(give your rank from 1 to 2- the same rank can be given for both)***

Sub-criteria	Rank
Transport related institutions (transport authorities, polices, operators (TRANS)	give here your rank
Political decision making levels (city, region, national) (POLITIC)	give here your rank

Q21: Please formulate the sub-criteria-matrix according to the ranks that are given in question 20 and conduct a simple pairewise comparison between two groups of INSTITUTIONS by the following rule:

give "O" if participations of both groups are equally important

give "+" if participation of the basic group is slightly more important than the other

Give "++" if participation of the basic group is significantly more important than the other

Give "+++" if participation of the basic group is extremely more important than the other

sub-criteria-matrix

			Rank	1	2
Basic groups	Rank/	Title (abrv.)		title	title
	Rank 1:	title			give here your rate
	Rank 2:	title			

Q22: To implement TRAFFIC MANAGEMENT MEASURES in a less-developed city, how do you rank the importance of the acceptance of the two groups of users and non-users in the society ? ***(give your rank from 1 to 2- the same rank can be given for both)***

Sub-criteria	Rank
Transport users (drivers, pedestrians, bicyclists, transit riders) (USER)	*give here your rank*
Non users (residents, vehicle manufacturers, others) (NON)	*give here your rank*

Q23: Please formulate the sub-criteria-matrix according to the ranks that are given in question 22 and conduct a simple pairewise comparison between two GROUPS by the following rule:

give "O" if acceptance of both groups are equally important

give "+" if acceptance of the basic group is slightly more important than the other

Give "++" if acceptance of the basic group is significantly more important than the other

Give "+++" if acceptance of the basic group is extremely more important than the other

sub-criteria-matrix

			Rank	1	2
Basic groups	**Rank/**	**Title (abrv.)**		*title*	*title*
	Rank 1:	*title*			*give here your rate*
	Rank 2:	*title*			

Thank you very much for your cooperation!

Calculating Weights of the Assessment Criteria

Record No.	**FGVV1**
Name:	Heiko Jentsch
Professional:	Traffic Engineer
Year of working:	8
Experience weight:	1,5
Degree:	Dipl. Ing

1. Effectiveness

Data Matrix

	S	M	EN	ECO
S	1	1,5	2	2,5
M	0,67	1	1,5	2
EN	0,50	0,67	1	1,5
ECO	0,40	0,50	0,67	1

Calculated matrix

	S	M	EN	ECO	Weigh
S	0,39	0,41	0,39	0,36	**0,39**
M	0,26	0,27	0,29	0,29	**0,28**
EN	0,19	0,18	0,19	0,21	**0,20**
ECO	0,16	0,14	0,13	0,14	**0,14**

1.1. To ensure urban mobility

Data Matrix

	CAP	P&E	CHOICE	EQUAL
CAP	1	1,5	1,5	2
P&E	0,67	1	1	1,5
CHOICE	0,67	1,00	1	1,5
EQUAL	0,50	0,67	0,67	1

Calculated matrix

	CAP	P&E	CHOICE	EQUAL	Weigh
CAP	0,35	0,36	0,36	0,33	**0,35**
P&E	0,24	0,24	0,24	0,25	**0,24**
CHOICE	0,24	0,24	0,24	0,25	**0,24**
EQUAL	0,18	0,16	0,16	0,17	**0,17**

1.2. To ensure urban traffic safety

Data Matrix

	SEVE	FREQ
SEVE	1	2
FREQ	0,50	1

Calculated matrix

	SEVE	FREQ	Weigh
SEVE	0,67	0,67	**0,67**
FREQ	0,33	0,33	**0,33**

1.3. To protect urban environment and natural resources

Data Matrix

	AP	NOISE	ENER	SPACE
AP	1	1	1	1
NOISE	1,00	1	1	1
ENER	1,00	1,00	1	1
SPACE	1,00	1,00	1,00	1

Calculated matrix

	AP	NOISE	ENER	SPACE	Weigh
AP	0,25	0,25	0,25	0,25	**0,25**
NOISE	0,25	0,25	0,25	0,25	**0,25**
ENER	0,25	0,25	0,25	0,25	**0,25**
SPACE	0,25	0,25	0,25	0,25	**0,25**

1.4. To improve urban and regional economy

Data Matrix

	ATTR	ECO_P&E	TCOST
ATTR	1	1,5	1,5
ECO_P&E	0,67	1	1
TCOST	0,67	1,00	1

Calculated matrix

	ATTR	ECO_P&E	TCOST	Weigh
ATTR	0,43	0,43	0,43	**0,43**
ECO_P&E	0,29	0,29	0,29	**0,29**
TCOST	0,29	0,29	0,29	**0,29**

2. Applicability

Data Matrix

	MCOST	TECH	ACCEPT	INST
MCOST	1	1,5	1,5	2
TECH	0,67	1	1	1,5
ACCEPT	0,67	1,00	1	1,5
INST	0,50	0,67	0,67	1

Calculated matrix

	MCOST	TECH	ACCEPT	INST	Weigh
MCOST	0,35	0,36	0,36	0,33	**0,35**
TECH	0,24	0,24	0,24	0,25	**0,24**
ACCEPT	0,24	0,24	0,24	0,25	**0,24**
INST	0,18	0,16	0,16	0,17	**0,17**

2.1. Costs of measure

Data Matrix

	O&M	INV
O&M	1	1,5
INV	0,67	1

Calculated matrix

	O&M	INV	Weigh
O&M	0,60	0,60	**0,60**
INV	0,40	0,40	**0,40**

2.2. Required technical systems

Data Matrix

	OP&C	INS
OP&C	1	1,5
INS	0,67	1

Calculated matrix

	OP&C	INS	Weigh
OP&C	0,60	0,60	**0,60**
INS	0,40	0,40	**0,40**

2.3. Required institutional participation

Data Matrix

	TRANS	POLITIC
TRANS	1	1
POLITIC	1,00	1

Calculated matrix

	TRANS	POLITIC	Weigh
TRANS	0,50	0,50	**0,50**
POLITIC	0,50	0,50	**0,50**

2.4. Required public acceptance

Data Matrix

	USER	NON
USER	1	1
NON	1,00	1

Calculated matrix

	USER	NON	Weigh
USER	0,50	0,50	**0,50**
NON	0,50	0,50	**0,50**

Record No.	**FGVV2**
Name:	Sven Kohoutek
Professional:	Traffic Engineer
Year of working:	3
Experience weigh	1
Degree:	Dipl. Ing

1. Effectiveness

Data Matrix

	M	ECO	S	EN
M	1	1,5	2	2
ECO	0,67	1	2	2
S	0,50	0,50	1	1,5
EN	0,50	0,50	0,67	1

Calculated matrix

	M	ECO	S	EN	Weigh
M	0,38	0,43	0,35	0,31	**0,37**
ECO	0,25	0,29	0,35	0,31	**0,30**
S	0,19	0,14	0,18	0,23	**0,18**
EN	0,19	0,14	0,12	0,15	**0,15**

1.1. To ensure urban mobility

Data Matrix

	P&E	CHOICE	EQUAL	CAP
P&E	1	1,5	2	2
CHOICE	0,67	1	1,5	1,5
EQUAL	0,50	0,67	1	1,5
CAP	0,50	0,67	0,67	1

Calculated matrix

	P&E	CHOICE	EQUAL	CAP	Weigh
P&E	0,38	0,39	0,39	0,33	**0,37**
CHOICE	0,25	0,26	0,29	0,25	**0,26**
EQUAL	0,19	0,17	0,19	0,25	**0,20**
CAP	0,19	0,17	0,13	0,17	**0,16**

1.2. To ensure urban traffic safety

Data Matrix

	FREQ	SEVE
FREQ	1	1
SEVE	1,00	1

Calculated matrix

	FREQ	SEVE	Weigh
FREQ	0,50	0,50	**0,50**
SEVE	0,50	0,50	**0,50**

1.3. To protect urban environment and natural resources

Data Matrix

	SPACE	AP	NOISE	ENER
SPACE	1	1,5	1,5	2,5
AP	0,67	1	1	2
NOISE	0,67	1,00	1	2
ENER	0,40	0,50	0,50	1

Calculated matrix

	SPACE	AP	NOISE	ENER	Weigh
SPACE	0,37	0,38	0,38	0,33	**0,36**
AP	0,24	0,25	0,25	0,27	**0,25**
NOISE	0,24	0,25	0,25	0,27	**0,25**
ENER	0,15	0,13	0,13	0,13	**0,13**

1.4. To improve urban and regional economy

Data Matrix

	ECO_P&E	TCOST	ATTR
ECO_P&E	1	2	2
TCOST	0,50	1	2
ATTR	0,50	0,50	1

Calculated matrix

	ECO_P&E	TCOST	ATTR	Weigh
ECO_P&E	0,50	0,57	0,40	**0,49**
TCOST	0,25	0,29	0,40	**0,31**
ATTR	0,25	0,14	0,20	**0,20**

2. Applicability

Data Matrix

	MCOST	ACCEPT	TECH	INST
MCOST	1	1	1,5	2
ACCEPT	1,00	1	1,5	2
TECH	0,67	0,67	1	1,5
INST	0,50	0,50	0,67	1

Calculated matrix

	MCOST	ACCEPT	TECH	INST	Weigh
MCOST	0,32	0,32	0,32	0,31	**0,32**
ACCEPT	0,32	0,32	0,32	0,31	**0,32**
TECH	0,21	0,21	0,21	0,23	**0,22**
INST	0,16	0,16	0,14	0,15	**0,15**

2.1. Costs of measure

Data Matrix

	O&M	INV
O&M	1	1,5
INV	0,67	1

Calculated matrix

	O&M	INV	Weigh
O&M	0,60	0,60	**0,60**
INV	0,40	0,40	**0,40**

2.2. Required technical systems

Data Matrix

	OP&C	INS
OP&C	1	1,5
INS	0,67	1

Calculated matrix

	OP&C	INS	Weigh
OP&C	0,60	0,60	**0,60**
INS	0,40	0,40	**0,40**

2.3. Required institutional participation

Data Matrix

	POLITIC	TRANS
POLITIC	1	1,5
TRANS	0,67	1

Calculated matrix

	POLITIC	TRANS	Weigh
POLITIC	0,60	0,60	**0,60**
TRANS	0,40	0,40	**0,40**

2.4. Required public acceptance

Data Matrix

	USER	NON
USER	1	2
NON	0,50	1

Calculated matrix

	USER	NON	Weigh
USER	0,67	0,67	**0,67**
NON	0,33	0,33	**0,33**

Record No.	**FGVV3**
Name:	Wolfgang Kittler
Professional	Traffic Engineer
Year of working:	2
Experience weigl	1
Degree:	Dipl. Ing

1. Effectiveness

Data Matrix

	M	S	ECO	EN
M	1	1,5	2,5	2,5
S	0,67	1	1,5	2
ECO	0,40	0,67	1	1,5
EN	0,40	0,50	0,67	1

Calculated matrix

	M	S	ECO	EN	Weigh
M	0,41	0,41	0,44	0,36	**0,40**
S	0,27	0,27	0,26	0,29	**0,27**
ECO	0,16	0,18	0,18	0,21	**0,18**
EN	0,16	0,14	0,12	0,14	**0,14**

1.1. To ensure urban mobility

Data Matrix

	CAP	P&E	CHOICE	EQUAL
CAP	1	1,5	2	2
P&E	0,67	1	1,5	2
CHOICE	0,50	0,67	1	1,5
EQUAL	0,50	0,50	0,67	1

Calculated matrix

	CAP	P&E	CHOICE	EQUAL	Weigh
CAP	0,38	0,41	0,39	0,31	**0,37**
P&E	0,25	0,27	0,29	0,31	**0,28**
CHOICE	0,19	0,18	0,19	0,23	**0,20**
EQUAL	0,19	0,14	0,13	0,15	**0,15**

1.2. To ensure urban traffic safety

Data Matrix

	FREQ	SEVE
FREQ	1	1,5
SEVE	0,67	1

Calculated matrix

	FREQ	SEVE	Weigh
FREQ	0,60	0,60	**0,60**
SEVE	0,40	0,40	**0,40**

1.3. To protect urban environment and natural resources

Data Matrix

	AP	NOISE	ENER	SPACE
AP	1	1,5	2	2,5
NOISE	0,67	1	1,5	2
ENER	0,50	0,67	1	1,5
SPACE	0,40	0,50	0,67	1

Calculated matrix

	AP	NOISE	ENER	SPACE	Weigh
AP	0,39	0,41	0,39	0,36	**0,39**
NOISE	0,26	0,27	0,29	0,29	**0,28**
ENER	0,19	0,18	0,19	0,21	**0,20**
SPACE	0,16	0,14	0,13	0,14	**0,14**

1.4. To improve urban and regional economy

Data Matrix

	ECO_P&E	TCOST	ATTR
ECO_P&E	1	1,5	2
TCOST	0,67	1	1,5
ATTR	0,50	0,67	1

Calculated matrix

	ECO_P&E	TCOST	ATTR	Weigh
ECO_P&E	0,46	0,47	0,44	**0,46**
TCOST	0,31	0,32	0,33	**0,32**
ATTR	0,23	0,21	0,22	**0,22**

2. Applicability

Data Matrix

	TECH	MCOST	ACCEPT	INST
TECH	1	1	1,5	2
MCOST	1,00	1	1,5	2
ACCEPT	0,67	0,67	1	1,5
INST	0,50	0,50	0,67	1

Calculated matrix

	TECH	MCOST	ACCEPT	INST	Weigh
TECH	0,32	0,32	0,32	0,31	**0,32**
MCOST	0,32	0,32	0,32	0,31	**0,32**
ACCEPT	0,21	0,21	0,21	0,23	**0,22**
INST	0,16	0,16	0,14	0,15	**0,15**

2.1. Costs of measure

Data Matrix

	INV	O&M
INV	1	1,5
O&M	0,67	1

Calculated matrix

	INV	O&M	Weigh
INV	0,60	0,60	**0,60**
O&M	0,40	0,40	**0,40**

2.2. Required technical systems

Data Matrix

	OP&C	INS
OP&C	1	1,5
INS	0,67	1

Calculated matrix

	OP&C	INS	Weigh
OP&C	0,60	0,60	**0,60**
INS	0,40	0,40	**0,40**

2.3. Required institutional participation

Data Matrix

	TRANS	POL
TRANS	1	2
POL	0,50	1

Calculated matrix

	TRANS	POL	Weigh
TRANS	0,67	0,67	**0,67**
POL	0,33	0,33	**0,33**

2.4. Required public acceptance

Data Matrix

	USER	NON
USER	1	2
NON	0,50	1

Calculated matrix

	USER	NON	Weigh
USER	0,67	0,67	**0,67**
NON	0,33	0,33	**0,33**

Record No.	FGVV4
Name:	Axel Wolfermann
Professional:	Traffic Engineer
Year of working:	2
Experience weigh	1
Degree:	Dipl. Ing

1. Effectiveness

Data Matrix

	S	M	EN	ECO
S	1	2	2	2,5
M	0,50	1	1	1
EN	0,50	1,00	1	1,5
ECO	0,40	1,00	0,67	1

Calculated matrix

	S	M	EN	ECO	Weigh
S	0,42	0,40	0,43	0,42	**0,42**
M	0,21	0,20	0,21	0,17	**0,20**
EN	0,21	0,20	0,21	0,25	**0,22**
ECO	0,17	0,20	0,14	0,17	**0,17**

1.1. To ensure urban mobility

Data Matrix

	CAP	P&E	EQUAL	CHOICE
CAP	1	1,5	2	2,5
P&E	0,67	1	1,5	2,5
EQUAL	0,50	0,67	1	2
CHOICE	0,40	0,40	0,50	1

Calculated matrix

	CAP	P&E	EQUAL	CHOICE	Weigh
CAP	0,39	0,42	0,40	0,31	**0,38**
P&E	0,26	0,28	0,30	0,31	**0,29**
EQUAL	0,19	0,19	0,20	0,25	**0,21**
CHOICE	0,16	0,11	0,10	0,13	**0,12**

1.2. To ensure urban traffic safety

Data Matrix

	SEVE	FREQ
SEVE	1	2
FREQ	0,50	1

Calculated matrix

	SEVE	FREQ	Weigh
SEVE	0,67	0,67	**0,67**
FREQ	0,33	0,33	**0,33**

1.3. To protect urban environment and natural resources

Data Matrix

	AP	NOISE	SPACE	ENER
AP	1	1,5	1,5	2
NOISE	0,67	1	1	1,5
SPACE	0,67	1,00	1	1,5
ENER	0,50	0,67	0,67	1

Calculated matrix

	AP	NOISE	SPACE	ENER	Weigh
AP	0,35	0,36	0,36	0,33	**0,35**
NOISE	0,24	0,24	0,24	0,25	**0,24**
SPACE	0,24	0,24	0,24	0,25	**0,24**
ENER	0,18	0,16	0,16	0,17	**0,17**

1.4. To improve urban and regional economy

Data Matrix

	ATTR	ECO_P&E	TCOST
ATTR	1	1,5	2
ECO_P&E	0,67	1	1,5
TCOST	0,50	0,67	1

Calculated matrix

	ATTR	ECO_P&E	TCOST	Weigh
ATTR	0,46	0,47	0,44	**0,46**
ECO_P&E	0,31	0,32	0,33	**0,32**
TCOST	0,23	0,21	0,22	**0,22**

2. Applicability

Data Matrix

	INST	MCOST	ACCEPT	TECH
INST	1	1	2,5	2,5
MCOST	1,00	1	2	2,5
ACCEPT	0,40	0,50	1	2
TECH	0,40	0,40	0,50	1

Calculated matrix

	INST	MCOST	ACCEPT	TECH	Weigh
INST	0,36	0,34	0,42	0,31	**0,36**
MCOST	0,36	0,34	0,33	0,31	**0,34**
ACCEPT	0,14	0,17	0,17	0,25	**0,18**
TECH	0,14	0,14	0,08	0,13	**0,12**

2.1. Costs of measure

Data Matrix

	INV	O&M
INV	1	1
O&M	1,00	1

Calculated matrix

	INV	O&M	Weigh
INV	0,50	0,50	**0,50**
O&M	0,50	0,50	**0,50**

2.2. Required technical systems

Data Matrix

	OP&C	INS
OP&C	1	1
INS	1,00	1

Calculated matrix

	OP&C	INS	Weigh
OP&C	0,50	0,50	**0,50**
INS	0,50	0,50	**0,50**

2.3. Required institutional participation

Data Matrix

	TRANS	POL
TRANS	1	1
POL	1,00	1

Calculated matrix

	TRANS	POL	Weigh
TRANS	0,50	0,50	**0,50**
POL	0,50	0,50	**0,50**

2.4. Required public acceptance

Data Matrix

	USER	NON
USER	1	2
NON	0,50	1

Calculated matrix

	USER	NON	Weigh
USER	0,67	0,67	**0,67**
NON	0,33	0,33	**0,33**

Record No.	**UTC1**
Name:	Nguyen Thi Thanh Hoa
Professional:	Traffic Engineer
Year of working:	3
Experience weight	1
Degree:	M.Eng

1. Effectiveness

Data Matrix

	ECO	M	S	EN
ECO	1	1,5	2	2
M	0,67	1	1,5	2
S	0,50	0,67	1	1,5
EN	0,50	0,50	0,67	1

Calculated matrix

	ECO	M	S	EN	Weigh
ECO	0,38	0,41	0,39	0,31	**0,37**
M	0,25	0,27	0,29	0,31	**0,28**
S	0,19	0,18	0,19	0,23	**0,20**
EN	0,19	0,14	0,13	0,15	**0,15**

1.1. To ensure urban mobility

Data Matrix

	P&E	CAP	CHOICE	EQUAL
P&E	1	1	1,5	2
CAP	1,00	1	1,5	2
CHOICE	0,67	0,67	1	2
EQUAL	0,50	0,50	0,50	1

Calculated matrix

	P&E	CAP	CHOICE	EQUAL	Weigh
P&E	0,32	0,32	0,33	0,29	**0,31**
CAP	0,32	0,32	0,33	0,29	**0,31**
CHOICE	0,21	0,21	0,22	0,29	**0,23**
EQUAL	0,16	0,16	0,11	0,14	**0,14**

1.2. To ensure urban traffic safety

Data Matrix

	SEVE	FREQ
SEVE	1	2
FREQ	0,50	1

Calculated matrix

	SEVE	FREQ	Weigh
SEVE	0,67	0,67	**0,67**
FREQ	0,33	0,33	**0,33**

1.3. To protect urban environment and natural resources

Data Matrix

	ENER	AP	SPACE	NOISE
ENER	1	1	1,5	2
AP	1,00	1	1,5	2
SPACE	0,67	0,67	1	1,5
NOISE	0,50	0,50	0,67	1

Calculated matrix

	ENER	AP	SPACE	NOISE	Weigh
ENER	0,32	0,32	0,32	0,31	**0,32**
AP	0,32	0,32	0,32	0,31	**0,32**
SPACE	0,21	0,21	0,21	0,23	**0,22**
NOISE	0,16	0,16	0,14	0,15	**0,15**

1.4. To improve urban and regional economy

Data Matrix

	ATTR	ECO_P&E	TCOST
ATTR	1	1,5	1,5
ECO_P&E	0,67	1	1
TCOST	0,67	1,00	1

Calculated matrix

	ATTR	ECO_P&E	TCOST	Weigh
ATTR	0,43	0,43	0,43	**0,43**
ECO_P&E	0,29	0,29	0,29	**0,29**
TCOST	0,29	0,29	0,29	**0,29**

2. Applicability

Data Matrix

	INST	ACCEPT	TECH	MCOST
INST	1	1	1,5	2
ACCEPT	1,00	1	1,5	2
TECH	0,67	0,67	1	1,5
MCOST	0,50	0,50	0,67	1

Calculated matrix

	INST	ACCEPT	TECH	MCOST	Weigh
INST	0,32	0,32	0,32	0,31	**0,32**
ACCEPT	0,32	0,32	0,32	0,31	**0,32**
TECH	0,21	0,21	0,21	0,23	**0,22**
MCOST	0,16	0,16	0,14	0,15	**0,15**

2.1. Costs of measure

Data Matrix

	O&M	INV
O&M	1	2
INV	0,50	1

Calculated matrix

	O&M	INV	Weigh
O&M	0,67	0,67	**0,67**
INV	0,33	0,33	**0,33**

2.2. Required technical systems

Data Matrix

	OP&C	INS
OP&C	1	2
INS	0,50	1

Calculated matrix

	OP&C	INS	Weigh
OP&C	0,67	0,67	**0,67**
INS	0,33	0,33	**0,33**

2.3. Required institutional participation

Data Matrix

	TRANS	POLITIC
TRANS	1	2
POLITIC	0,50	1

Calculated matrix

	TRANS	POLITIC	Weigh
TRANS	0,67	0,67	**0,67**
POLITIC	0,33	0,33	**0,33**

2.4. Required public acceptance

Data Matrix

	USER	NON
USER	1	1,5
NON	0,67	1

Calculated matrix

	USER	NON	Weigh
USER	0,60	0,60	**0,60**
NON	0,40	0,40	**0,40**

Record No.	**UTC2**
Name:	Le Thu Huyen
Professional:	Economist
Year of working:	3
Experience weight	1
Degree:	M.Sc

1. Effectiveness

Data Matrix

	M	ECO	S	EN
M	1	1,5	2	2,5
ECO	0,67	1	1,5	2
S	0,50	0,67	1	1,5
EN	0,40	0,50	0,67	1

Calculated matrix

	M	ECO	S	EN	Weigh
M	0,39	0,41	0,39	0,36	**0,39**
ECO	0,26	0,27	0,29	0,29	**0,28**
S	0,19	0,18	0,19	0,21	**0,20**
EN	0,16	0,14	0,13	0,14	**0,14**

1.1. To ensure urban mobility

Data Matrix

	P&E	CAP	CHOICE	EQUAL
P&E	1	1,5	2	2,5
CAP	0,67	1	1,5	2
CHOICE	0,50	0,67	1	1,5
EQUAL	0,40	0,50	0,67	1

Calculated matrix

	P&E	CAP	CHOICE	EQUAL	Weigh
P&E	0,39	0,41	0,39	0,36	**0,39**
CAP	0,26	0,27	0,29	0,29	**0,28**
CHOICE	0,19	0,18	0,19	0,21	**0,20**
EQUAL	0,16	0,14	0,13	0,14	**0,14**

1.2. To ensure urban traffic safety

Data Matrix

	SEVE	FREQ
SEVE	1	1,5
FREQ	0,67	1

Calculated matrix

	SEVE	FREQ	Weigh
SEVE	0,60	0,60	**0,60**
FREQ	0,40	0,40	**0,40**

1.3. To protect urban environment and natural resources

Data Matrix

	AP	NOISE	ENER	SPACE
AP	1	1	1,5	2
NOISE	1,00	1	1,5	2
ENER	0,67	0,67	1	1,5
SPACE	0,50	0,50	0,67	1

Calculated matrix

	AP	NOISE	ENER	SPACE	Weigh
AP	0,32	0,32	0,32	0,31	**0,32**
NOISE	0,32	0,32	0,32	0,31	**0,32**
ENER	0,21	0,21	0,21	0,23	**0,22**
SPACE	0,16	0,16	0,14	0,15	**0,15**

1.4. To improve urban and regional economy

Data Matrix

	ECO_P&E	TCOST	ATTR
ECO_P&E	1	1,5	2
TCOST	0,67	1	1,5
ATTR	0,50	0,67	1

Calculated matrix

	ECO_P&E	TCOST	ATTR	Weigh
ECO_P&E	0,46	0,47	0,44	**0,46**
TCOST	0,31	0,32	0,33	**0,32**
ATTR	0,23	0,21	0,22	**0,22**

2. Applicability

Data Matrix

	TECH	INST	MCOST	ACCEPT
TECH	1	1,5	2	2,5
INST	0,67	1	1,5	2
MCOST	0,50	0,67	1	1,5
ACCEPT	0,40	0,50	0,67	1

Calculated matrix

	TECH	INST	MCOST	ACCEPT	Weigh
TECH	0,39	0,41	0,39	0,36	**0,39**
INST	0,26	0,27	0,29	0,29	**0,28**
MCOST	0,19	0,18	0,19	0,21	**0,20**
ACCEPT	0,16	0,14	0,13	0,14	**0,14**

2.1. Costs of measure

Data Matrix

	INV	O&M
INV	1	2
O&M	0,50	1

Calculated matrix

	INV	O&M	Weigh
INV	0,67	0,67	**0,67**
O&M	0,33	0,33	**0,33**

2.2. Required technical systems

Data Matrix

	OP&C	INS
OP&C	1	2
INS	0,50	1

Calculated matrix

	OP&C	INS	Weigh
OP&C	0,67	0,67	**0,67**
INS	0,33	0,33	**0,33**

2.3. Required institutional participation

Data Matrix

	POLITIC	TRANS
POLITIC	1	1,5
TRANS	0,67	1

Calculated matrix

	POLITIC	TRANS	Weigh
POLITIC	0,60	0,60	**0,60**
TRANS	0,40	0,40	**0,40**

2.4. Required public acceptance

Data Matrix

	NON	USER
NON	1	1,5
USER	0,67	1

Calculated matrix

	NON	USER	Weigh
NON	0,60	0,60	**0,60**
USER	0,40	0,40	**0,40**

Record No.	**UTC4**
Name:	Chu Cong Minh
Professional:	Traffic Engineer
Year of working:	6
Experience weight:	1,5
Degree:	M.Eng

1. Effectiveness

Data Matrix

	S	EN	ECO	M
S	1	1,5	2	2,5
EN	0,67	1	1,5	2
ECO	0,50	0,67	1	1
M	0,40	0,50	1,00	1

Calculated matrix

	S	EN	ECO	M	Weigh
S	0,39	0,41	0,36	0,38	**0,39**
EN	0,26	0,27	0,27	0,31	**0,28**
ECO	0,19	0,18	0,18	0,15	**0,18**
M	0,16	0,14	0,18	0,15	**0,16**

1.1. To ensure urban mobility

Data Matrix

	CAP	P&E	EQUAL	CHOICE
CAP	1	2	2,5	2,5
P&E	0,50	1	2	2,5
EQUAL	0,40	0,50	1	1
CHOICE	0,40	0,40	1,00	1

Calculated matrix

	CAP	P&E	EQUAL	CHOICE	Weigh
CAP	0,43	0,51	0,38	0,36	**0,42**
P&E	0,22	0,26	0,31	0,36	**0,28**
EQUAL	0,17	0,13	0,15	0,14	**0,15**
CHOICE	0,17	0,10	0,15	0,14	**0,14**

1.2. To ensure urban traffic safety

Data Matrix

	SEVE	FREQ
SEVE	1	1,5
FREQ	0,67	1

Calculated matrix

	SEVE	FREQ	Weigh
SEVE	0,60	0,60	**0,60**
FREQ	0,40	0,40	**0,40**

1.3. To protect urban environment and natural resources

Data Matrix

	AP	NOISE	SPACE	ENER
AP	1	1	2	2
NOISE	1,00	1	2	2
SPACE	0,50	0,50	1	1,5
ENER	0,50	0,50	0,67	1

Calculated matrix

	AP	NOISE	SPACE	ENER	Weigh
AP	0,33	0,33	0,35	0,31	**0,33**
NOISE	0,33	0,33	0,35	0,31	**0,33**
SPACE	0,17	0,17	0,18	0,23	**0,19**
ENER	0,17	0,17	0,12	0,15	**0,15**

1.4. To improve urban and regional economy

Data Matrix

	ATTR	ECO_P&E	TCOST
ATTR	1	1,5	1,5
ECO_P&E	0,67	1	1
TCOST	0,67	1,00	1

Calculated matrix

	ATTR	ECO_P&E	TCOST	Weigh
ATTR	0,43	0,43	0,43	**0,43**
ECO_P&E	0,29	0,29	0,29	**0,29**
TCOST	0,29	0,29	0,29	**0,29**

2. Applicability

Data Matrix

	ACCEPT	MCOST	TECH	INST
ACCEPT	1	1,5	1,5	2,5
MCOST	0,67	1	1,5	2,5
TECH	0,67	0,67	1	1,5
INST	0,40	0,40	0,67	1

Calculated matrix

	ACCEPT	MCOST	TECH	INST	Weigh
ACCEPT	0,37	0,42	0,32	0,33	**0,36**
MCOST	0,24	0,28	0,32	0,33	**0,29**
TECH	0,24	0,19	0,21	0,20	**0,21**
INST	0,15	0,11	0,14	0,13	**0,13**

2.1. Costs of measure

Data Matrix

	INV	O&M
INV	1	1
O&M	1,00	1

Calculated matrix

	INV	O&M	Weigh
INV	0,50	0,50	**0,50**
O&M	0,50	0,50	**0,50**

2.2. Required technical systems

Data Matrix

	OP&C	INS
OP&C	1	2
INS	0,50	1

Calculated matrix

	OP&C	INS	Weigh
OP&C	0,67	0,67	**0,67**
INS	0,33	0,33	**0,33**

2.3. Required institutional participation

Data Matrix

	POLITIC	TRANS
POLITIC	1	2
TRANS	0,50	1

Calculated matrix

	POLITIC	TRANS	Weigh
POLITIC	0,67	0,67	**0,67**
TRANS	0,33	0,33	**0,33**

2.4. Required public acceptance

Data Matrix

	USER	NON
USER	1	2,5
NON	0,40	1

Calculated matrix

	USER	NON	Weigh
USER	0,71	0,71	**0,71**
NON	0,29	0,29	**0,29**

Record No.	**CONS1**
Name:	Hosomi Akira
Professional:	Transport Planner
Year of working:	10
Experience weigh	2
Degree:	Dr.Eng

1. Effectiveness

Data Matrix

	M	S	ECO	EN
M	1	1	1,5	2
S	1,00	1	1,5	2
ECO	0,67	0,67	1	1,5
EN	0,50	0,50	0,67	1

Calculated matrix

	M	S	ECO	EN	Weigh
M	0,32	0,32	0,32	0,31	**0,32**
S	0,32	0,32	0,32	0,31	**0,32**
ECO	0,21	0,21	0,21	0,23	**0,22**
EN	0,16	0,16	0,14	0,15	**0,15**

1.1. To ensure urban mobility

Data Matrix

	CHOICE	EQUAL	CAP	P&E
CHOICE	1	1,5	2	2,5
EQUAL	0,67	1	1,5	2
CAP	0,50	0,67	1	1,5
P&E	0,40	0,50	0,67	1

Calculated matrix

	CHOICE	EQUAL	CAP	P&E	Weigh
CHOICE	0,39	0,41	0,39	0,36	**0,39**
EQUAL	0,26	0,27	0,29	0,29	**0,28**
CAP	0,19	0,18	0,19	0,21	**0,20**
P&E	0,16	0,14	0,13	0,14	**0,14**

1.2. To ensure urban traffic safety

Data Matrix

	SEVE	FREQ
SEVE	1	2
FREQ	0,50	1

Calculated matrix

	SEVE	FREQ	Weigh
SEVE	0,67	0,67	**0,67**
FREQ	0,33	0,33	**0,33**

1.3. To protect urban environment and natural resources

Data Matrix

	AP	NOISE	SPACE	ENER
AP	1	1	1,5	1,5
NOISE	1,00	1	1,5	1,5
SPACE	0,67	0,67	1	1
ENER	0,67	0,67	1,00	1

Calculated matrix

	AP	NOISE	SPACE	ENER	Weigh
AP	0,30	0,30	0,30	0,30	**0,30**
NOISE	0,30	0,30	0,30	0,30	**0,30**
SPACE	0,20	0,20	0,20	0,20	**0,20**
ENER	0,20	0,20	0,20	0,20	**0,20**

1.4. To improve urban and regional economy

Data Matrix

	ECO_P&E	ATTR	TCOST
ECO_P&E	1	1	1,5
ATTR	1,00	1	1,5
TCOST	0,67	0,67	1

Calculated matrix

	ECO_P&E	ATTR	TCOST	Weigh
ECO_P&E	0,38	0,38	0,38	**0,38**
ATTR	0,38	0,38	0,38	**0,38**
TCOST	0,25	0,25	0,25	**0,25**

2. Applicability

Data Matrix

	ACCEPT	INST	MCOST	TECH
ACCEPT	1	1,5	2	2
INST	0,67	1	1,5	2
MCOST	0,50	0,67	1	1
TECH	0,50	0,50	1,00	1

Calculated matrix

	ACCEPT	INST	MCOST	TECH	Weigh
ACCEPT	0,38	0,41	0,36	0,33	**0,37**
INST	0,25	0,27	0,27	0,33	**0,28**
MCOST	0,19	0,18	0,18	0,17	**0,18**
TECH	0,19	0,14	0,18	0,17	**0,17**

2.1. Costs of measure

Data Matrix

	O&M	INV
O&M	1	1,5
INV	0,67	1

Calculated matrix

	O&M	INV	Weigh
O&M	0,60	0,60	**0,60**
INV	0,40	0,40	**0,40**

2.2. Required technical systems

Data Matrix

	OP&C	INS
OP&C	1	1,5
INS	0,67	1

Calculated matrix

	OP&C	INS	Weigh
OP&C	0,60	0,60	**0,60**
INS	0,40	0,40	**0,40**

2.3. Required institutional participation

Data Matrix

	TRANS	POLITIC
TRANS	1	1
POLITIC	1,00	1

Calculated matrix

	TRANS	POLITIC	Weigh
TRANS	0,50	0,50	**0,50**
POLITIC	0,50	0,50	**0,50**

2.4. Required public acceptance

Data Matrix

	USER	NON
USER	1	2
NON	0,50	1

Calculated matrix

	USER	NON	Weigh
USER	0,67	0,67	**0,67**
NON	0,33	0,33	**0,33**

Record No.	**CONS2**
Name:	Tetsuji Masujima
Professional:	Transport Planner
Year of working:	11
Experience weight	2
Degree:	Dr.Eng

1. Effectiveness

Data Matrix

	M	S	EN	ECO
M	1	1	1	1,5
S	1,00	1	1,5	2
EN	1,00	0,67	1	1,5
ECO	0,67	0,50	0,67	1

Calculated matrix

	M	S	EN	ECO	Weigh
M	0,27	0,32	0,24	0,25	**0,27**
S	0,27	0,32	0,36	0,33	**0,32**
EN	0,27	0,21	0,24	0,25	**0,24**
ECO	0,18	0,16	0,16	0,17	**0,17**

1.1. To ensure urban mobility

Data Matrix

	P&E	CHOICE	CAP	EQUAL
P&E	1	1	1,5	2
CHOICE	1,00	1	1,5	1,5
CAP	0,67	0,67	1	1,5
EQUAL	0,50	0,67	0,67	1

Calculated matrix

	P&E	CHOICE	CAP	EQUAL	Weigh
P&E	0,32	0,30	0,32	0,33	**0,32**
CHOICE	0,32	0,30	0,32	0,25	**0,30**
CAP	0,21	0,20	0,21	0,25	**0,22**
EQUAL	0,16	0,20	0,14	0,17	**0,17**

1.2. To ensure urban traffic safety

Data Matrix

	SEVE	FREQ
SEVE	1	1,5
FREQ	0,67	1

Calculated matrix

	SEVE	FREQ	Weigh
SEVE	0,60	0,60	**0,60**
FREQ	0,40	0,40	**0,40**

1.3. To protect urban environment and natural resources

Data Matrix

	AP	ENER	NOISE	SPACE
AP	1	1,5	1,5	2
ENER	0,67	1	1,5	1,5
NOISE	0,67	0,67	1	1,5
SPACE	0,50	0,67	0,67	1

Calculated matrix

	AP	ENER	NOISE	SPACE	Weigh
AP	0,35	0,39	0,32	0,33	**0,35**
ENER	0,24	0,26	0,32	0,25	**0,27**
NOISE	0,24	0,17	0,21	0,25	**0,22**
SPACE	0,18	0,17	0,14	0,17	**0,16**

1.4. To improve urban and regional economy

Data Matrix

	ECO_P&E	TCOST	ATTR
ECO_P&E	1	1	2
TCOST	1,00	1	1,5
ATTR	0,50	0,67	1

Calculated matrix

	ECO_P&E	TCOST	ATTR	Weigh
ECO_P&E	0,40	0,38	0,44	**0,41**
TCOST	0,40	0,38	0,33	**0,37**
ATTR	0,20	0,25	0,22	**0,22**

2. Applicability

Data Matrix

	INST	MCOST	ACCEPT	TECH
INST	1	2	2,5	2,5
MCOST	0,50	1	1,5	2
ACCEPT	0,40	0,67	1	2
TECH	0,40	0,50	0,50	1

Calculated matrix

	INST	MCOST	ACCEPT	TECH	Weigh
INST	0,43	0,48	0,45	0,33	**0,43**
MCOST	0,22	0,24	0,27	0,27	**0,25**
ACCEPT	0,17	0,16	0,18	0,27	**0,20**
TECH	0,17	0,12	0,09	0,13	**0,13**

2.1. Costs of measure

Data Matrix

	O&M	INV
O&M	1	1,5
INV	0,67	1

Calculated matrix

	O&M	INV	Weigh
O&M	0,60	0,60	**0,60**
INV	0,40	0,40	**0,40**

2.2. Required technical systems

Data Matrix

	INS	OP&C
INS	1	2
OP&C	0,50	1

Calculated matrix

	INS	OP&C	Weigh
INS	0,67	0,67	**0,67**
OP&C	0,33	0,33	**0,33**

2.3. Required institutional participation

Data Matrix

	POLITIC	TRANS
POLITIC	1	1,5
TRANS	0,67	1

Calculated matrix

	POLITIC	TRANS	Weigh
POLITIC	0,60	0,60	**0,60**
TRANS	0,40	0,40	**0,40**

2.4. Required public acceptance

Data Matrix

	USER	NON
USER	1	1,5
NON	0,67	1

Calculated matrix

	USER	NON	Weigh
USER	0,60	0,60	**0,60**
NON	0,40	0,40	**0,40**

Record No.	**CONS3**
Name:	TAKAGI Michimasa
Professional:	Traffic Engineer
Year of working:	30
Experience weigh	2
Degree:	BSc.Eng

1. Effectiveness

Data Matrix

	EN	S	M	ECO
EN	1	1	2	2,5
S	1,00	1	2	2,5
M	0,50	0,50	1	1,5
ECO	0,40	0,40	0,67	1

Calculated matrix

	EN	S	M	ECO	Weigh
EN	0,34	0,34	0,35	0,33	**0,34**
S	0,34	0,34	0,35	0,33	**0,34**
M	0,17	0,17	0,18	0,20	**0,18**
ECO	0,14	0,14	0,12	0,13	**0,13**

1.1. To ensure urban mobility

Data Matrix

	CHOICE	P&E	CAP	EQUAL
CHOICE	1	1	1,5	1,5
P&E	1,00	1	1	1,5
CAP	0,67	1,00	1	1
EQUAL	0,67	0,67	1,00	1

Calculated matrix

	CHOICE	P&E	CAP	EQUAL	Weigh
CHOICE	0,30	0,27	0,33	0,30	**0,30**
P&E	0,30	0,27	0,22	0,30	**0,27**
CAP	0,20	0,27	0,22	0,20	**0,22**
EQUAL	0,20	0,18	0,22	0,20	**0,20**

1.2. To ensure urban traffic safety

Data Matrix

	SEVE	FREQ
SEVE	1	2
FREQ	0,50	1

Calculated matrix

	SEVE	FREQ	Weigh
SEVE	0,67	0,67	**0,67**
FREQ	0,33	0,33	**0,33**

1.3. To protect urban environment and natural resources

Data Matrix

	AP	NOISE	SPACE	ENER
AP	1	1	2	1,5
NOISE	1,00	1	1,5	1,5
SPACE	0,50	0,67	1	1,5
ENER	0,67	0,67	0,67	1

Calculated matrix

	AP	NOISE	SPACE	ENER	Weigh
AP	0,32	0,30	0,39	0,27	**0,32**
NOISE	0,32	0,30	0,29	0,27	**0,29**
SPACE	0,16	0,20	0,19	0,27	**0,21**
ENER	0,21	0,20	0,13	0,18	**0,18**

1.4. To improve urban and regional economy

Data Matrix

	ATTR	ECO_P&E	TCOST
ATTR	1	1,5	2
ECO_P&E	0,67	1	1,5
TCOST	0,50	0,67	1

Calculated matrix

	ATTR	ECO_P&E	TCOST	Weigh
ATTR	0,46	0,47	0,44	**0,46**
ECO_P&E	0,31	0,32	0,33	**0,32**
TCOST	0,23	0,21	0,22	**0,22**

2. Applicability

Data Matrix

	INST	ACCEPT	MCOST	TECH
INST	1	1	2	2
ACCEPT	1,00	1	2	2
MCOST	0,50	0,50	1	1,5
TECH	0,50	0,50	0,67	1

Calculated matrix

	INST	ACCEPT	MCOST	TECH	Weigh
INST	0,33	0,33	0,35	0,31	**0,33**
ACCEPT	0,33	0,33	0,35	0,31	**0,33**
MCOST	0,17	0,17	0,18	0,23	**0,19**
TECH	0,17	0,17	0,12	0,15	**0,15**

2.1. Costs of measure

Data Matrix

	O&M	INV
O&M	1	1,5
INV	0,67	1

Calculated matrix

	O&M	INV	Weigh
O&M	0,60	0,60	**0,60**
INV	0,40	0,40	**0,40**

2.2. Required technical systems

Data Matrix

	OP&C	INS
OP&C	1	2
INS	0,50	1

Calculated matrix

	OP&C	INS	Weigh
OP&C	0,67	0,67	**0,67**
INS	0,33	0,33	**0,33**

2.3. Required institutional participation

Data Matrix

	POLITIC	TRANS
POLITIC	1	2,5
TRANS	0,40	1

Calculated matrix

	POLITIC	TRANS	Weigh
POLITIC	0,71	0,71	**0,71**
TRANS	0,29	0,29	**0,29**

2.4. Required public acceptance

Data Matrix

	USER	NON
USER	1	2,5
NON	0,40	1

Calculated matrix

	USER	NON	Weigh
USER	0,71	0,71	**0,71**
NON	0,29	0,29	**0,29**

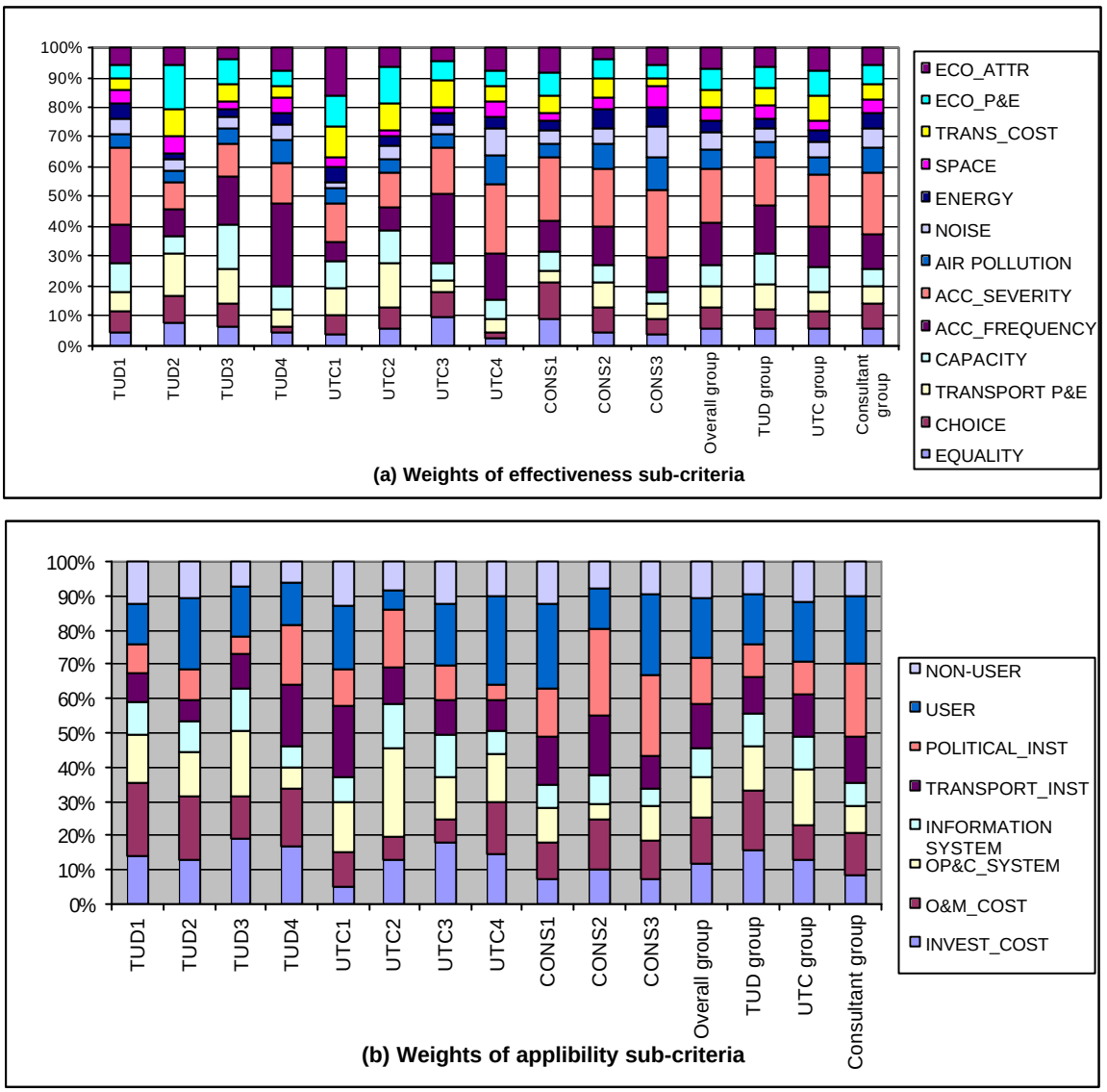


Figure D- 1:The weights of sub-criteria

Annex E. Qualitative Assessment of Traffic Management Measures

Public Transport Measures

PT1- Public Transport Routing Improvement

- **Description**

This measure focuses on extension, rerouting or relocating of the stops of a line, a part of network or overall network in order to adjust the service area of existing public transport service. In the MDCs, the routing improvement focuses mainly on adjusting and establishing the routes in order to serve higher travel demand land uses. Scope of this measure is limited within the existing supply capacity (infrastructure, fleets, and control equipments). Only minor investments for adjusting of infrastructure, fleets, control equipments, feeder services are considered. New investments for road/ rail track expansion, construction of major stops and interchanges or purchasing of main control equipments and major number of vehicles on a transit line are excluded.

- **Assessment**

This measure is highly effective, especially in ensuring urban mobility and safety. The impacts on protecting environment and natural resources are also high but ranked fourth only because that public transport service in MDCs is road-based with diesel bus fleet.

PT 1	Public Transport Routing Improvement							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X	Y	Y		

Effectiveness			ES = 2,44	●
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⦿
1.2. To increase modal choices	●	3.2. To reduce noise		⦿
1.3. To increase transport *P&E***	●	3.3. To save energy		⦿
1.4. To increase transport capacity	⦿	3.4. To save urban space		●
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		⦿
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		⦿
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		⦿
		4.3. To improve economic attractiveness		●

Applicability			DS = 1,25	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⦿
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		⊙
2.1. Operation/control systems	⊙	4.1. Users		⊙
2.2. Information systems	⊙	4.2. Non-users		⊙

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; O= Non

* *UTP* = urban transport properties;
** P&E = Productivity and Efficiency;

Figure E- 1: Assessment of measure PT 1: Routing Improvement

On the other hand, this measure will face only low level of difficulty in application (DS=1,25). The most concerned barrier is the cost of measure (medium level), while other barriers are at low level of difficulty. According to the terms of selection, this measure is selected into the *first priority group* of recommended measures. Detail assessment results are presented in Table E-1.

Table E- 1: Detail assessment of measure PT 1: Routing Improvement

PT 1	Public Transport Routing Improvement							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X	Y	Y		

Effectiveness			ES = 2,44	●
Goal 1 : To ensure mobility	●	2,72	**Goal 3: To protect environment**	⦿ 2,203
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⦿ 2
Although, lack of urban road space normally creates some negative impacts on ROW for IMV and truck in rerouting and extending service area of public transport lines, this measure increases opportunity to use UTP of all people in the targeted area.			Shifting of travel demand from IMV to PT will help to reduce the air pollution. However, most of public transport vehicles in MDCs are still producing air pollution directly, especially the diesel buses.	
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⦿ 2
This measure provides opportunity of using public transport service for all people within the rearranged service area. In MDCs, public transport is normally affordable and being considered as the accessible transport mode for the major social group. If the subsidy available, the low income people could have opportunity to use, otherwise, they have to limited their travel ability within walking and cycling, even for long distance trip. On the other hand, the improvement of PT will pull up use of NMT in general. Therefore, a high level of impact on increasing modal choice is normally achieved by this measure.			Shifting of travel demand from IMV to PT will help to reduce the noise pollution. However, most of public transport vehicles in MDCs are still producing noise directly or indirectly, especially the diesel buses .	
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	⦿ 2
In case of rerouting to the new demand generator, the available capacity of PT lines is better utilising. In case of avoiding new demand generator, the quality of over-crowded PT service is significant improving. Therefore, productivity and efficiency of PT service is increased significantly in both cases.			Shifting of travel demand from IMV to PT will help to save the energy of transportation. However, the efficiency of energy use for public transport is not high during off-peak period. On the other hand, most of buses in MDCs are using old engine models, therefore, one can not expect a high level of saving energy by this measure.	
1.4. To increase transport capacity	⦿	2	*3.4. To save urban space*	● 3
This measure does not emphasise to change service frequency of targeted PT lines. On one hand, the available PT capacity is enable for the new coverage area. On the other hand, the service may be disable for some area. In the optimal case, the effective capacity of PT is significantly increased.			This measure requires only minor additional urban space and ROW if there is need for new additional stops/stations or extension of route length. However, the shifting to travel demand from IMV to PT will be a big gain for this objective, especially in the MDCs traffic flow.	
Goal 2: To ensure traffic safety	●	2,43	**Goal 4: To improve economy**	⦿ 2,34
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	⦿ 2
Shifting of travel demand from IMV to PT will be significantly reduce the potential conflicts in the traffic flow, especially in the MDCs. Therefore, this measure is highly appreciated as a effective solution to reduce accident frequency in the coverage area of the PT lines.			Rerouting of PT lines in many cases created significant improvement of productivity, efficiency and also quality of PT service with very low cost. An urban scale public transport network reform can achieve a big success by attracting travellers from IMVs. Therefore, a high level of in reducing transport cost can be achieved by this measure.	
			4.2. To improve economic P&E	⦿ 2
2.2. To reduce accident severity	⦿	2	Although the productivity and efficiency of transport sector are significantly improved by this measure, the general reductions of trip distance or time for passengers could not easily identified. For some people, travel time and distance were reduced, but those of other people may could increased. The optimal case is total reduction is significantly bigger than total increase.	
Shifting of travel demand from IMVs to Public transport services helps to reduce severe accidents, which causes by IMVs (between IMVs, IMVs and NMVs and pedestrians).			*4.3. To improve economic attractiveness*	● 3
			In MDCs, an increase of public transport and NMT choices, especially in the city centres, has been recognised as the big gain of the employers in in the targeted areas by avoiding the problem of lacking parking places. Tourisms and entertainment industries are also highly benefited.	

(Cont.)

Table E-1: Detail assessment of measure PT 1: Routing Improvement (Cont.)

Applicability			DS = 1,25	⊙
Criteria 1: Cost of measure	⊙	**1,472**	**Criteria 3: Institutional participation**	◉	**1,484**
1.1. Investment cost	◉	2	3.1. Transport related institutions	◉	2
As the description of this measure, the absolute new infrastructure is excluded. Some minor investments in strengthening the road surface or modifying and providing some stops and stations may be needed.			Rerouting of public transport lines in MDCs normally required agreements and participations from other transport operators, transport and planning authorities. This measure may be a simple action of only one public transport operator, but it always requires highest level of difficulties in this aspect.		
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙	1
The change of PT routing to any road will create only minor additional maintenance cost to the road and stations.			This measure normally requires only the approval of city political bodies (mayor and council).		
Criteria 2: Technical systems	⊙	**1**	**Criteria 4: Public acceptance**	⊙	**1**
2.1. Operation/control systems	⊙	1	4.1. Users	⊙	1
Only some adjustments of local operation systems in the adjusted sections are required.			There maybe some blames from passengers who have to extend their walking distance to the changed stops or even few of them may have no more convenient access to PT lines.		
2.2. Information systems	⊙	1	4.2. Non-users	⊙	1
Only some adjustments of local information systems in the adjusted sections are required.			Some negative effects from bus operations on urban environment along extended sections could be considered.		

PT2- Public Transport Scheduling Improvement

- **Description**

This measure focuses on adjustments of service time, schedule (arrival and departure time at stops/stations), service frequency (vehicles per hour), stop frequency (stops per kilometre) of the public transport service in order to maximise the productivity and production efficiency of the existing public transport supply capacity. An integrated schedule of all public transport services is also important to improve service efficiency in overall network and to reduce the transfer time for passengers. For urban public transport lines, an all-day-high-frequency service is desirable, while a two-peak capacity service is more suitable for the sub-urban and commuter transit lines. The number of stops will be increased with the urban transit lines. In contrast, the reduction of some minor stops in order to provide express service is more suitable, for the longer transit lines (to serve the industrial zones or other sub-urban activities centres, airports…). This measure will be limited on optimising the existing resources (vehicles, control equipments and human resources), only minor procurements, such as some vehicles, minor control equipments, or some more employees, can be included.

- **Assessment**

Scheduling improvement is one of the most effective measures, especially in ensuring urban mobility and safety. The impacts on protecting environment and natural resources are also high but rated lower than others because that public transport service in MDCs is road-based with diesel bus fleet. On the other hand, this measure will face only low level of difficulty in application (DS=1,41). In detail, it will face a medium level of difficulty in cost and technical systems, while other barriers are at low level of difficulty.

PT 2	Public Transport Scheduling Improvement							TE
AT1	**AT2**	**AT3**	**ST1**	**ST2**	**ST3**	**CT1**	**CT2**	**CT3**
				X		Y	Y	

Effectiveness			ES = 2,52	●
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⦿
1.2. To increase modal choices	●	3.2. To reduce noise		⦿
1.3. To increase transport *P&E***	●	3.3. To save energy		⦿
1.4. To increase transport capacity	⦿	3.4. To save urban space		●
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		⦿
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		●
		4.3. To improve economic attractiveness		●

Applicability			DS = 1,41	⊙
Criteria 1: Cost of measure	⦿	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⦿
1.1. Operation cost	⦿	3.2. Political institutions		⊙
Criteria 2: Technical systems	⦿	**Criteria 4: Public acceptance**		⊙
2.1. Operation/control systems	⦿	4.1. Users		○
2.2. Information systems	⦿	4.2. Non-users		⊙

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 2: Assessment of measure PT 2: Scheduling Improvement

According to the terms of selection, this measure is selected into the *first priority group* of recommended measures. Detail assessment results are presented in Table E-2.

Table E- 2 Detail assessment of measure PT 2: Scheduling Improvement

PT 2	Public Transport Scheduling Improvement							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X		Y	Y	

Effectiveness			ES = 2,52	●
Goal 1 : To ensure mobility	●	2,72	**Goal 3: To protect environment**	⦿ 2,203
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⦿ 2
Although, lack of urban road space normally creates some negative impacts on ROW for IMV and truck when the bus frequency is increased significantly, this measure increases opportunity to use UTP of all people in the targeted area.			Shifting of travel demand from IMV to PT will help to reduce the air pollution. However, most of public transport vehicles in MDCs are still producing air pollution directly, especially the diesel buses.	
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⦿ 2
This measure provides opportunity of using public transport service for all people within the rearranged service area. In MDCs, public transport is normally affordable and being considered as the accessible transport mode for the major social group. If the subsidy available, the low income people could have opportunity to use, otherwise, they have to limited their travel ability within walking and cycling, even for long distance trip. Integrated schedule between PT lines significantly increases opportunity of using PT service for all people of the city. On the other hand, the improvement of PT will pull up use of NMT. Therefore, a high level of impact on increasing modal choice is normally achieved by this measure.			Shifting of travel demand from IMV to PT will help to reduce the noise pollution. However, most of public transport vehicles in MDCs are still producing noise directly or indirectly, especially the diesel buses .	
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	⦿ 2
In case of increasing service frequency, the available public urban road is better utilising. In case of reducing service frequency, the available public transport vehicles can be used for the other purpose or the operation cost can be reduced. Therefore, in the high level of impacts on this objective can be given to the measure in both cases.			Shifting of travel demand from IMV to PT will help to save the energy of transportation. However, the efficiency of energy use for public transport is not high during off-peak period. On the other hand, most of buses in MDCs are using old engine models, therefore, one can not expect a high level of saving energy by this measure.	
1.4. To increase transport capacity	⦿	2	*3.4. To save urban space*	● 3
The increase of service frequency of certain PT lines provides new capacity for the coverage areas during the targeted periods, in which frequency of other lines may be reduced properly . In the case of integrated schedule, uniform capacity of overall urban public transport network is increased impressively.			This measure normally requires only minor additional urban space and ROW if there is need for modification of additional stops/stations, terminals. However, the shifting to travel demand from IMV to PT will be a big gain for this objective, especially in the MDCs.	
Goal 2: To ensure traffic safety	●	2,43	**Goal 4: To improve economy**	● 2,70
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	⦿ 2
Shifting of travel demand from IMV to PT will be significantly reduce the potential conflicts in the traffic flow, especially in the MDCs. Therefore, this measure is highly appreciated as a effective solution to reduce accident frequency in the coverage area of the PT lines.			In MDCs, improvements of PT service schedule (increase of service frequency during peak hours, integrated schedule) are significantly attracting travellers from IMVs by reducing of waiting and transferring time. This save a quite huge expenditure from using IMVs (motorcycles) and for provision of parking facilities at the demand generators (universities, schools, enterprises, parks, hospital)	
			4.2. To improve economic P&E	● 3
2.2. To reduce accident severity	⦿	2	As mentioned above, this measure helps to reduce of waiting and transferring time for PT passengers. In case of integrated schedule, the average distance of PT passengers can be reduced if the information could be well provided.	
Shifting of travel demand from IMVs to Public transport services helps to reduce severe accidents, which causes by IMVs (between IMVs, IMVs and NMVs and pedestrians).			*4.3. To improve economic attractiveness*	● 3
			This measure can strongly help the economic attractiveness of the targeted city by providing a time saving PT services. On the other hand, accessibility of different land uses and areas within the city is significantly improved if the integrated scheduling could be applied on the strategic PT network.	

(Cont.)

Table E-2: Detail assessment of measure PT 2: Scheduling Improvement (Cont.)

Applicability			DS = 1,41		⊙
Criteria 1: Cost of measure	⦿	**2**	**Criteria 3: Institutional participation**	⦿	**1,484**
1.1. Investment cost	⦿	2	3.1. Transport related institutions	⦿	2
As the description of this measure, some minor investments in purchasing a few vehicles or some operation and control equipments are the maximal expenditure for this measure. In this measure, the application of integrated scheduling is considered in the case all operation/control and information systems are already available for overall network and only some minor expenditures are allowed to readjust the connection, communication and programming.			At the business level and under the full-deregulated public transport market, improving of schedule does not require any additional institutions (only the operator). However, this change may require at least the involvements of public transport authorities. In the case of an integrated schedule network, participation of other operators is also required.		
1.1. Operation cost	⦿	2	3.2. Political bodies	⊙	1
Increase of frequency and prolong of vehicle operation time may ask for significant increase in maintenance cost and employees (drivers)			This measure may requires an approval of city government if the public transport service is subsidised by public finance.		
Criteria 2: Technical systems	⦿	**2**	**Criteria 4: Public acceptance**	⊙	**0,375**
2.1. Operation/control systems	⦿	2	4.1. Users	○	0
Only some adjustments of local operation systems in the adjusted sections are required. In the case of integrated schedule, an urban scale adjustment of the central computerised operation system is required.			This measure is highly supported by public transport and NMT users. Some IMV drivers are affected by high frequency of bus operation, but there was so far no opposition.		
2.2. Information systems	⦿	2	4.2. Non-users	⊙	1
Only some adjustments of local information systems in the adjusted sections are required. In the case of integrated schedule, urban scale adjustments of the information system are required.			Some negative effects from bus operations on urban environment could be considered in cases of increasing bus service frequency.		

PT3- Improvement of Physical Accesses to Public Transport Services

- **Description**

This measure is to ensure the safe and convenient access ways from the traffic demand generators to the stops and stations of public transport service. In MDCs, this measure focuses on some activities as (i) reservation of the safe sidewalks to transit stops/stations, (ii) provision of safe crossing facilities to the transit stops/stations, (iii) improvement stop-vehicle interface (high level stops) in order to provide faster, safer and more convenient boarding and alighting for passengers, (iv) improvement of connections between long-distance transport services and urban public transport services within main transports (main railway stations, main intercity bus stations, airports…), (v) improvement of connections between parking facilities and public transport service, and (vi) provision of feeder services for public transport.

- **Assessment**

This measure has a medium level of effectiveness (ES=2,08). The only high effectiveness criterion is urban mobility, while the other criteria are at medium level. In contrast, this measure faces only low level of difficulty in application (DS=0,84) with only a concerned difficulty of investment cost of measure, while the other barriers are at low level of difficulty, esepcially no opposition of public is experienced. According to the terms of selection, this measure is selected into the *second priority group* of recommended measures. Detail assessment results are presented in Table E-3.

PT 3	Physical Access Improvement							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X		Y		

Effectiveness			ES = 2,08	⦿
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⦿
1.2. To increase modal choices	●	3.2. To reduce noise		⦿
1.3. To increase transport *P&E***	⦿	3.3. To save energy		⦿
1.4. To increase transport capacity	⦿	3.4. To save urban space		⊙
Goal 2: To ensure traffic safety	⦿	**Goal 4: To improve economy**		⦿
2.1. To reduce accident frequency	⦿	4.1. To reduce transport costs		⦿
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		⦿
		4.3. To improve economic attractiveness		⦿

Applicability			DS = 0,84	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		O
2.1. Operation/control systems	⊙	4.1. Users		O
2.2. Information systems	⊙	4.2. Non-users		O

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; O= Non ** UTP* = urban transport properties; *** P&E* = Productivity and Efficiency;

Figure E- 3: Assessment of measure PT 3: Physical Access Improvement

Table E- 3: Detail Assessment of measure PT 3: Physical Access Improvement

PT 3	Physical Access Improvement							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X		Y		

Effectiveness		ES =	2,08	⦿
Goal 1 : To ensure mobility	●	**2,46**	**Goal 3: To protect environment**	⦿	**1,797**
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⦿	2
This measure ensure the ROW for public transport users and pedestrians without significant affect to the ROW of other transport modes.			Shifting of travel demand from IMV to PT will help to reduce the air pollution. However, most of public transport vehicles in MDCs are still producing air pollution directly, especially the diesel buses.		
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⦿	2
This measure provides opportunity of using public transport service for all people within the coverage area. In MDCs, public transport is normally affordable and being considered as the most accessible transport mode for the major social group. On the other hand, this measure strongly encourages people to walk for their PT trips and for shorter trips by ensuring good pedestrian environment.			Shifting of travel demand from IMV to PT will help to reduce the noise pollution. However, most of public transport vehicles in MDCs are still producing noise directly or indirectly, especially the diesel buses .		
*1.3. To increase transport P&E***	⦿	2	*3.3. To save energy*	⦿	2
Well implementation of this measure opens good opportunity to increase the utilisation of available public transport capacity. However, the final impact depends very much on the characteristics of the service. A already over-crowded PT service may not benefited much from this measure. Therefore, a medium level of impact is suitable.			Shifting of travel demand from IMV to PT will help to save the energy of transportation. However, the efficiency of energy use for public transport is not high during off-peak period. On the other hand, most of buses in MDCs are using old engine models, therefore, one can not expect a high level of saving energy by this measure.		
1.4. To increase transport capacity	⦿	2	*3.4. To save urban space*	⊙	1
Although no new capacity is created by this measure, other available PT capacity is newly enable for the new traffic demand generators, to which the physical access is improved, especially in the case of P+R facilities or provision of feeder transport services.			For improving only bus top or station this measure requires only minor additional urban space. However, a considerable area of extra urban land is normally required to provide P+R facilities or some sections of sidewalk. On the other hand, a moderate level of shifting travel demand from IMVs to PT is expected from this measure. Therefore, a low level of impact on saving urban space is given to this measure.		
Goal 2: To ensure traffic safety	⦿	**2,00**	**Goal 4: To improve economy**	⦿	**2,00**
2.1. To reduce accident frequency	⦿	2	*4.1. To reduce transport cost*	⦿	2
Shifting of travel demand from IMV to PT will reduce significantly potential conflicts in the traffic flow, especially in the MDCs. As discussed above, the total amount of shifting demand by this measure may not high as its earlier two colleagues.Therefore, a medium level of impact is preferably given to this measure.			A moderate level of shifting demand from IMVs to PT is expected from this measure. In addition, some amount of shifting travel demand from IMVs to walking, especially for the short trips, which performed around the improved area. Therefore, a medium level of impact on reduction of transport cost is expected from this measure.		
			4.2. To improve economic P&E	⦿	2
			In the case of low productivity PT service, implementation of this measure can help to improve productivity and efficiency of PT as an major service sector in the urban economy. The improvement of accesses also help to reduce walking, waiting an boarding time of passengers.		
2.2. To reduce accident severity	⦿	2			
This measures helps to reduce severe accidents, which causes by conflicts between pedestrians and motorised vehicles at the crossing points or at the public transport stops and stations.			*4.3. To improve economic attractiveness*	⦿	2
			This measure significantly improves attractiveness of surrounding area of stops and stations and the urban areas, to which the physical accesses are improved.		

(Cont.)

Table E-3: Detail Assessment of measure PT 3: Physical Access Improvement (Cont.)

Applicability			AS = 0,84	⊙
Criteria 1: Cost of measure	⊙	**1,472**	**Criteria 3: Institutional participation**	⊙	**1**
1.1. Investment cost	◉	2	3.1. Transport related institutions	⊙	1
As the description of this measure, the absolute new infrastructure is excluded. Some minor investments in upgrading stops/stations, providing pedestrian crossing facilities, providing P+R lots or some sidewalk sections are needed.			This measure requires normally implemented by transport authorities and/or the operators of airports or stations only. In some case, participation of traffic police is required, but seldom.		
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙	1
This measure creates only minor additional maintenance cost to the road and stations.			This measure normally requires only the approval of city political bodies (mayor and council).		
Criteria 2: Technical systems	⊙	**1**	**Criteria 4: Public acceptance**	○	**0**
2.1. Operation/control systems	⊙	1	4.1. Users	○	0
Only some adjustments of local operation systems in the adjusted sections are required.			This measure normally gains high support of PT users, and also of IMV drivers where connection between parking facilities and public transport services is provided.		
2.2. Information systems	⊙	1	4.2. Non-users	○	0
Only some adjustments of local information systems in the adjusted sections are required.			This measure normally has no opposition from people, who live in the surrounding area of the improved facilities.		

PT4- Public Transport Right-of-Way Prioritisation

- **Description**

This measure reserves priority of using Right-of-Way on road links and at intersections for public transport vehicles (buses, trams, taxi). In MDCs, this measure usually requires minor expansions of roadway an/or procurements of some new traffic signal systems in order to achieve the uniformity of the Right-of-Way for public transport. Experiences in MDCs showed that temporary and marking-only bus lanes and/or bus lanes without signal priority are insufficient to achieve effectiveness. In most of the cases, physical separation lane and traffic signal priority at intersection are essential requirements for this measure. The most difficult issue of this measure is the uniformity of the Right-of-Way along the targeted public transport lines. The level of priority is normally degraded in the city centre where the road width is not sufficient for provision of a transit lane. Therefore, a mix use between bus and car (HOV) or between bus and motorcycle has to be accepted in this situation. Level of priority is defined by time of application and characteristics of the right-of-way at intersections and on the road links. If traffic flow is mixed by buses and motorcycle, traffic signal priority is ineffective. On the other hand, the mixed bus and car lane can be considered as solution to discourage the car driving in the city centre.

- **Assessment**

This measure is one of the most effective measures (ES=2,59), especially in ensuring urban mobility, safety, and economic improvement (see Figure E- 4).

PT 4	Public Transport Right-of- Way Prioritisation							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X	Y	Y		

Effectiveness			ES = 2,59	●
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	⦿	3.1. To reduce air pollutions		⦿
1.2. To increase modal choices	●	3.2. To reduce noise		⦿
1.3. To increase transport *P&E***	●	3.3. To save energy		⦿
1.4. To increase transport capacity	⦿	3.4. To save urban space		⦿
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		●
2.2. To reduce accident severity	●	4.2. To improve economic P&E		⦿
		4.3. To improve economic attractiveness		●

Applicability			DS = 1,89	⦿
Criteria 1: Cost of measure	⦿	**Criteria 3: Institutional participation**		⦿
1.1. Investment cost	⦿	3.1. Transport related institutions		●
1.1. Operation cost	⦿	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		⦿
2.1. Operation/control systems	⊙	4.1. Users		⦿
2.2. Information systems	⊙	4.2. Non-users		●

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿ = Medium; ⊙=Low; O= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 4: Assessment of measure PT 4: Right-of-Way Prioritisation

The impact on protecting environment and natural resources is at medium only because that public transport service in MDCs is road-based with diesel bus fleet and the prioritisation ROW is normally asking for additional urban space. On the other hand, this measure has a medium level of difficulty in application (DS=1,89) with concerned difficulty of barrier in cost,

required institutional participation, and public acceptance. To implement this measure, participation of all transport related institutions are required. In addition, this measure normally faces strong opposition of IMV drivers and land users (if additional space is required for widening road). According to the terms of selection, this measure is selected into the *second priority group* of recommended measures. Detail assessment results are presented in Table E-4.

Table E- 4: Detail assessment of measure PT 4: Public Transport ROW prioritisation

PT 1	Public Transport Routing Improvement							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X	Y	Y		

Effectiveness			ES = 2,44	●
Goal 1 : To ensure mobility	●	2,72	**Goal 3: To protect environment**	⦿ 2,203
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⦿ 2
Although, lack of urban road space normally creates some negative impacts on ROW for IMV and truck in rerouting and extending service area of public transport lines, this measure increases opportunity to use UTP of all people in the targeted area.			Shifting of travel demand from IMV to PT will help to reduce the air pollution. However, most of public transport vehicles in MDCs are still producing air pollution directly, especially the diesel buses.	
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⦿ 2
This measure provides opportunity of using public transport service for all people within the rearranged service area. In MDCs, public transport is normally affordable and being considered as the accessible transport mode for the major social group. If the subsidy available, the low income people could have opportunity to use, otherwise, they have to limited their travel ability within walking and cycling, even for long distance trip. On the other hand, the improvement of PT will pull up use of NMT in general. Therefore, a high level of impact on increasing modal choice is normally achieved by this measure.			Shifting of travel demand from IMV to PT will help to reduce the noise pollution. However, most of public transport vehicles in MDCs are still producing noise directly or indirectly, especially the diesel buses .	
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	⦿ 2
In case of rerouting to the new demand generator, the available capacity of PT lines is better utilising. In case of avoiding new demand generator, the quality of over-crowded PT service is significant improving. Therefore, productivity and efficiency of PT service is increased significantly in both cases.			Shifting of travel demand from IMV to PT will help to save the energy of transportation. However, the efficiency of energy use for public transport is not high during off-peak period. On the other hand, most of buses in MDCs are using old engine models, therefore, one can not expect a high level of saving energy by this measure.	
1.4. To increase transport capacity	⦿	2	*3.4. To save urban space*	● 3
This measure does not emphasise to change service frequency of targeted PT lines. On one hand, the available PT capacity is enable for the new coverage area. On the other hand, the service may be disable for some area. In the optimal case, the effective capacity of PT is significantly increased.			This measure requires only minor additional urban space and ROW if there is need for new additional stops/stations or extension of route length. However, the shifting to travel demand from IMV to PT will be a big gain for this objective, especially in the MDCs traffic flow.	
Goal 2: To ensure traffic safety	●	2,43	**Goal 4: To improve economy**	⦿ 2,34
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	⦿ 2
Shifting of travel demand from IMV to PT will be significantly reduce the potential conflicts in the traffic flow, especially in the MDCs. Therefore, this measure is highly appreciated as a effective solution to reduce accident frequency in the coverage area of the PT lines.			Rerouting of PT lines in many cases created significant improvement of productivity, efficiency and also quality of PT service with very low cost. An urban scale public transport network reform can achieve a big success by attracting travellers from IMVs. Therefore, a high level of in reducing transport cost can be achieved by this measure.	
			4.2. To improve economic P&E	⦿ 2
2.2. To reduce accident severity	⦿	2	Although the productivity and efficiency of transport sector are significantly improved by this measure, the general reductions of trip distance or time for passengers could not easily identified. For some people, travel time and distance were reduced, but those of other people may could increased. The optimal case is total reduction is significantly bigger than total increase.	
Shifting of travel demand from IMVs to Public transport services helps to reduce severe accidents, which causes by IMVs (between IMVs, IMVs and NMVs and pedestrians).			*4.3. To improve economic attractiveness*	● 3
			In MDCs, an increase of public transport and NMT choices, especially in the city centres, has been recognised as the big gain of the employers in in the targeted areas by avoiding the problem of lacking parking places. Tourist and entertainment industries are also benefited.	

(Cont.)

Table E-4: Detail assessment of measure PT 4: Public Transport ROW prioritisation (Cont.)

Applicability					DS = 1,89	⦿
Criteria 1: Cost of measure	⦿	**2**	**Criteria 3: Institutional participation**		⦿	**1,968**
1.1. Investment cost	⦿	2	3.1. Transport related institutions		●	3
As the description of this measure, the absolute new infrastructure is excluded. Some minor investments in widening some road sections, procuring some traffic signal equipments or modifying and providing some stops and stations may be needed.			Prioritising ROW for public transport lines in MDCs normally required agreements and participations from other transport operators, police, transport and planning authorities.			
1.1. Operation cost	⦿	2	3.2. Political bodies		⊙	1
The change of PT routing to any road will create considerable additional maintenance cost to the road and stations.			This measure normally requires only the approval of city political bodies (mayor and council).			
Criteria 2: Technical systems	⊙	**1**	**Criteria 4: Public acceptance**		⦿	**2,375**
2.1. Operation/control systems	⊙	1	4.1. Users		⦿	2
Only some adjustments of local operation systems in the adjusted sections are required. The opportunity of having an urban scale bus lane project is seldom.			This measure normally gains strong support of PT users, and also of IMV drivers where the road is wide enough to ensure ROW of IMVs. In the cases of lacking road space and the ROW of IMVs would have to reduce for public transport, the opposition of IMV drivers are very strong. Many projects were cancelled or replaced by this force. therefore, a medium level of difficulty is given to this measure.			
2.2. Information systems	⊙	1	4.2. Non-users		●	3
Only some adjustments of local information systems in the adjusted sections are required.			Opposition of land users is considerable in the cases additional land is required to provide sufficient ROW for bus lanes. This measure also faces difficult opposition of residents due to negative environmental impacts from high concentration of bus services along certain corridors may			

PT5- Public Transport User's Incentives

- **Description**

Governments and/or employers provide some incentives for the transit users (employees) in order to reduce their out-of-pocket payment in using the public transport services. The incentives can be a general fare reduction for all transit users, or the more sophisticated subsidy program to provide incentives for the special group of riders (frequent riders, children, students, senior citizens...) or in specific period (for off-peak hour riders). The incentive can be a direct reduction of transit fare, a reduction parking-price at the park and ride places. The incentive can also be indirectly applied through the exemption of taxes and duties for the public transport operators.

- **Assessment**

This measure has a general high level of impact in term of effectiveness, especially the high effectiveness in ensuring urban mobility and traffic safety improvement. In detail, this measure has a medium level of effectiveness in protecting environment and natural resources. Although it has a high rate on saving urban space, the impacts on other criteria are given medium level only because that public transport service in MDCs is road-based with diesel bus fleet. The economic goal is affected by a huge financial requirement for the incentives. In term of applicability, this measure faces a big challenge of financing the incentives, but the other barriers are very easy in comparison with those of other measures, especially it faces no difficulty in technical requirements and public acceptance (DS=0,78). According to the terms of selection, this measure is selected into the *first priority group* of recommended measures. Detail assessment results are presented in Table E-5.

PT 5	Public Transport User's Incentives							ECO
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X				Y

Effectiveness			ES = 2,44	●
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⦿
1.2. To increase modal choices	●	3.2. To reduce noise		⦿
1.3. To increase transport *P&E***	⦿	3.3. To save energy		⦿
1.4. To increase transport capacity	○	3.4. To save urban space		●
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		⦿
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		⦿
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		⦿
		4.3. To improve economic attractiveness		●

Applicability			DS = 0,78	⊙
Criteria 1: Cost of measure	⦿	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⊙	3.1. Transport related institutions		⊙
1.1. Operation cost	●	3.2. Political institutions		⊙
Criteria 2: Technical systems	○	**Criteria 4: Public acceptance**		○
2.1. Operation/control systems	○	4.1. Users		○
2.2. Information systems	○	4.2. Non-users		○

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 5: assessment of measure PT5: Public Transport User's Incentives

Table E- 5: Detail assessment of measure PT5: Public Transport User's Incentives

PT 5	Public Transport User's Incentives							ECO
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X				Y

Effectiveness			ES = 2,44	●
Goal 1 : To ensure mobility	●	2,72	**Goal 3: To protect environment**	⦿ 2,203
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⦿ 2
Although no physical impact is created on ROW of any transport mode, this measure is an important economic tool to balance public subsidy and social cost between public transport users and IMV drivers. The subsidy for PT users normally comes from gasoline tax or revenue from road pricing program for IMVs.			Shifting of travel demand from IMV to PT will help to reduce the air pollution. However, most of public transport vehicles in MDCs are still producing air pollution directly, especially the diesel buses.	
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⦿ 2
By this measure, public transport in MDCs is normally affordable and being considered as the most accessible transport mode for major social group. By different forms of incentive, this measure provides opportunity of using public transport service for all people within the coverage area, especially low-income group, students, children. Therefore, a high level of impact on increasing modal choices for people can be achieved by this measure.			Shifting of travel demand from IMV to PT will help to reduce the noise pollution. However, most of public transport vehicles in MDCs are still producing noise directly or indirectly, especially the diesel buses .	
*1.3. To increase transport P&E***	⦿	3	*3.3. To save energy*	⦿ 2
The incentives are normally provided to encourage people to use available PT capacity, to save further investment for road and parking facilities, and to maximising use to the existing road surface. However, the amount of subsidy is quite high to create negative impact on efficiency of public transport. Therefore, a medium level of impact on increasing transport productivity and efficiency is given.			Shifting of travel demand from IMV to PT will help to save the energy of transportation. However, the efficiency of energy use for public transport is not high during off-peak period. On the other hand, most of buses in MDCs are using old engine models, therefore, one can not expect a high level of saving energy by this measure.	
1.4. To increase transport capacity	○	2	*3.4. To save urban space*	● 3
No new capacity is expected to be provided by this measure, but this measure encourage operators to maintain high service capacity. On the other hand, this measure enable available service capacity to the users, who were unable to afford service before implementation of measure.			This measure requires no additional urban space and ROW, while it strongly encourage people to shift their transport mode from IMV to PT. A high impact on saving urban space can be achieved by this measure in most of the cases.	
Goal 2: To ensure traffic safety	●	2,43	**Goal 4: To improve economy**	⦿ 2,34
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	⦿ 2
Shifting of travel demand from IMV to PT will significantly reduce the potential conflicts in the traffic flow, especially in the MDCs. This measure can be considered as one of the most effective safety scheme, which does not create any physical change on urban traffic flow.			In MDCs, this measure has been recognised as the most important scheme to encourage people to use public transport service , especially to shift travel demand from motorcycles to public transport. However, a considerable amount of finance is required to subsidy the use of PT service. Therefore, a medium level of impact on reducing transport cost is given to this measure.	
			4.2. To improve economic P&E	⦿ 2
2.2. To reduce accident severity	⦿	2	In the case of low productivity PT service, implementation of this measure can help to improve productivity and efficiency of PT as an major service sector in the urban economy. The impact on shifting travellers from IMVs to public helps to eliminate traffic congestion, especially during peak periods, therefore, it helps to reduce travel time of both PT users and the remaining IMV drivers	
Shifting of travel demand from IMVs to Public transport services helps to reduce severe accidents, which causes by IMVs (between IMVs, IMVs and NMVs and pedestrians).				
			4.3. To improve economic attractiveness	● 3
			In MDCs, an increase of public transport and NMT choices, especially in the city centres, has been recognised as the big gain of the employers in in the targeted areas by avoiding the problem of lacking parking places. Tourisms and entertainment industries are also highly benefited.	

(Cont.)

Table E-5: Detail assessment of measure PT5: Public Transport User's Incentives (Cont.)

Applicability				DS = 0,78	⊙
Criteria 1: Cost of measure	⦿	**2,055**	**Criteria 3: Institutional participation**	⊙	**1**
1.1. Investment cost	⊙	1	3.1. Transport related institutions	⊙	1
This measure normally does not ask for any investment in fixed infrastructure or expensive control facilities, the costs for study and documentation are normally the only required amounts.			This measure requires participation of public transport operators (in normal cases of subsidy from public finance).		
1.1. Operation cost	●	3	3.2. Political bodies	⊙	1
In contrast, the annual budget for subsidy is significantly increased. In MDCs, the subsidy is normally accounted for 20% to 40% operation cost of urban public transport service. For special groups (students, children) , the subsidy is normally counted for 50 to 70% of price.			In normal cases of subsidy from public finance, this measure normally requires only the approval of city political bodies (mayor and council).		
Criteria 2: Technical systems	○	**0**	**Criteria 4: Public acceptance**	○	**0**
2.1. Operation/control systems	○	0	4.1. Users	○	0
No control or operation system is required.			This measure is strongly supported by all public transport users.		
2.2. Information systems	○	0	4.2. Non-users	○	0
No adjustment of information system is required.			No opposition of non-users is expected from this measure.		

PT6- Public Transport Information Improvement

- **Description**

This measure aims to provide to passengers and operators required information about situation of the available public transport services in order to attract travellers to use public transport (traveller information) and to improve productivity and efficiency of service (operator information). The *traveller information* can be provided by the operators or by other parties (e.g. public transport management centre, tourist information centre…). The *operator information* is normally provided by operators themselves or by public transport management centre (but seldom).

Information services are also categorised by two groups: *static information service* and *dynamic information service*. The *static information* service includes planned information about transport mode, service area, network, stop location, time schedule, integration possibility, and ticket price, level of service… The static information can be provided through different channels, for example a simple information board with map and schedule at the stops/station or public area, transport map and printed timetable at information kiosks, telephone inquiry services, website…. A reliable static information service is affordable in the case of MDCs. The *dynamic informatio*n service includes real-time information about public transport service at the specific moment according to demands of passenger and operator, for example the actual arrival and departure time of coming vehicle, next stop/station, alighting/boarding doors, the rerouting of the lines, adjusted schedule, vehicle performance conditions. The dynamic information must be provided by real-time communication media, for example, automatic vehicle location system, and dynamic voice or text messages on-board or at the transit top/station, radio, or mobile phone. The low level of development of information infrastructure in the developing countries and the high cost of the equipment are the main difficulties to apply the real-time passenger information service in the MDCs.

- **Assessment**

As presented in Figure E-6, this measure is among the most effective traffic management measures (ES =2,53) in MDCs. In detail, the impact on mobility, safety and economic are at high level, while it achieved a same medium rate on protecting environment and natural resource as other public transport measures. In the aspect of applicability, a routine public transport information service is highly applicable in MDCs with a low very difficulty level (DS=0,51). The only concerned difficulty of this measure is to get participation of transport authorities and public transport operators. According to the terms of selection, this measure is selected into the *first priority group* of recommended measures. Detail assessment results are presented in Table E-6.

PT 6	Public Transport Information Improvement							IN
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X	Y			Y

Effectiveness			ES = 2,53	●
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⦿
1.2. To increase modal choices	●	3.2. To reduce noise		⦿
1.3. To increase transport *P&E***	●	3.3. To save energy		⦿
1.4. To increase transport capacity	⦿	3.4. To save urban space		⦿
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		●
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		●
		4.3. To improve economic attractiveness		●

Applicability			DS = 0,51	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⊙	3.1. Transport related institutions		⦿
1.1. Operation cost	⊙	3.2. Political institutions		○
Criteria 2: Technical systems	○	**Criteria 4: Public acceptance**		○
2.1. Operation/control systems	○	4.1. Users		○
2.2. Information systems	○	4.2. Non-users		○

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 6:Assessment of measure PT 6: Public Transport Information Improvement

Table E- 6: Detail assessment of measure PT 6: Public Transport Information Improvement

PT 6	Public Transport Information Improvement							IN
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X	Y			Y

Effectiveness			ES =	2,53	●
Goal 1 : To ensure mobility	●	**2,72**	**Goal 3: To protect environment**	⦿	**2**
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⦿	2
In the condition of MDCs, a well-designed information service, with sufficient contents and accessible media of provision, is very important tool to provide all people in the coverage area an equal opportunity to know and to understand about the public transport service, which is available in the city.			Shifting of travel demand from IMV to PT will help to reduce the air pollution. However, most of public transport vehicles in MDCs are still producing air pollution directly, especially the diesel buses.		
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⦿	2
Although , decisions to use public transport service of travellers depends mainly on the nature of the service (network, schedule, time, cost, comfortable), a good information service is very important condition that help travellers to ensure that they have public transport service (with certain level of quality) as an transport alternative to IMVs. On the other hand, well-designed information service helps operators to develop its market size by improvement of its service image.			Shifting of travel demand from IMV to PT will help to reduce the noise pollution. However, most of public transport vehicles in MDCs are still producing noise directly or indirectly, especially the diesel buses .		
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	⦿	2
Good service information consider as the most effective scheme to improve productivity and efficiency of public transport capacity, to save further investment for road and parking facilities, and to maximising use to the existing road surface. This measure creates a higher level of impact on increasing transport productivity and efficiency.			Shifting of travel demand from IMV to PT will help to save the energy of transportation. However, the efficiency of energy use for public transport is not high during off-peak period. In addition, most of buses in MDCs are using old engine models, therefore, one can not expect a high level of saving energy by this measure.		
1.4. To increase transport capacity	⦿	2	*3.4. To save urban space*	⦿	2
Although no absolute new capacity is provided to people in MDCs, improvements of information service enable the idle existing service capacity for the one who are not able to use service due to lack of information.			This measure requires no additional urban space and ROW, while it encourage people to shift their transport mode from IMV to PT. However, scale of impact of this measure on shifting travel demand from IMVs to public transport is limited. Therefore, a medium level of impact on saving urban space is given to this measure.		
Goal 2: To ensure traffic safety	●	**2,43**	**Goal 4: To improve economy**	●	**3,00**
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	●	3
Although, there are still counter arguments on safety improvement impact of the public transport information service due to its indirect impact, shifting travellers from IMVs to public transport by serving good information is significant. Proportionally, frequency of accidents is reduced. Therefore, a high level of impact can be expected from this measure.			Good information significantly improves reliability, productivity, efficiency and also quality of PT service with very low cost. An urban scale public transport information service improvement can achieve a big success by attracting travellers from IMVs.		
			4.2. To improve economic P&E	●	3
2.2. To reduce accident severity	⦿	2	Good information help travellers to decide right time, right destination and optimal routing for their trip, thus, both travel distance and time of trips can be significantly reduced with this measure.		
Attracting travellers to use public transport, this measures helps to reduce severe accidents, which causes by IMVs.					
			4.3. To improve economic attractiveness	●	3
			Although, quality and availability of public transport are the most important factors, the well-informed service is always attractive for travellers than the bad one, especially for strangers and tourists. In MDCs, improvement of information of existing public transport systems is one of the key changes to strengthen the service and further to improve the economic attractiveness of the coverage areas.		

(Cont.)

Table E-6: Detail assessment of measure PT 6: Public Transport Information

Applicability					DS = 0,51	⊙
Criteria 1: Cost of measure	⊙	**1**	**Criteria 3: Institutional participation**		⊙	**0,968**
1.1. Investment cost	⊙	1	3.1. Transport related institutions		◉	2
This measure requires some cost for study, planning and design of the information architecture, service organisational function and structure.			The improvement of public transport information service requires normally participation of public transport operators and authorities.			
1.1. Operation cost	⊙	1	3.2. Political bodies		○	0
In most of the cases, this measures requires a minor additional cost for updating and disseminating information to passenger (to update and print the map, to update and maintain the website, or to advertise on the public media)			A routine public transport information service does not requires any approval of the political bodies.			
Criteria 2: Technical systems	○	**0**	**Criteria 4: Public acceptance**		○	**0**
2.1. Operation/control systems	○	0	4.1. Users		○	0
No additional operation/control system is required in the case of providing routine information service.			This measure is strongly supported by all public transport users.			
2.2. Information systems	○	0	4.2. Non-users		○	0
A static information service does not requires any sophisticated information system, it can use the general public information channels (newspapers, TV, radio, or internet) to disseminate the public transport information.			The improvement of public transport information service is strongly supported by the non-users.			

Improvement (Cont.)

PT7- Public Transport Management Centre

- **Description**

This measure is to create an organisation, Public Transport Management Centre (PTMC) that would play as a coordinator and/or distributor of different public transport operators in order to optimise the use of available public transport capacity and to attract travellers to use public transport services instead of other transport modes.

As a coordinator, Public Transport Management Centre is actively participating in the process of planning and designing public transport services in the city and region (e.g. the Verkehrsverbund in Germany, or PTMCs in Hanoi and Hochiminh City in Vietnam). In the role a distributor, the PTMC will procure the transit service of operators at a market price and selling it back to the users by a distribution system (e.g. the Verkehrsverbund in Germany). PTMC can also play a key role in providing public transport information to passengers and to operators (e.g. Verkerhsmanagement Zentrum Berlin).

Normally, PTMC is considered as a public agency or a state owned enterprise in where public transport is not fully decentralised (e.g. the Verkehrsverbund in Germany, or PTMCs in Hanoi and Hochiminh City in Vietnam). In some cases, the PTMC's services can be provided by a private operator if public transport in the city is fully privatised. However, there is no example for this model in the real world. It is necessary to emphasize that the PTMC concept in this study does not include the function of a service operator (as the Régie Autonome des Transports Parisiens (RATP) in Paris)

- **Assessment**

As shown in Figure E- 7, Public Transport Management Centre has a very high level of effectiveness (ES = 2,72). For example, the establishments of PTMC in Hanoi and Hochiminh City (Vietnam) were considered as the most important change of public transport service there last decade.

In detail, this measure is highly appreciated in ensuring urban mobility, improving economy and especially traffic safety, especially by reducing of accidents with public transport vehicles. As similar to other public transport measures in MDCs, this measure is given a medium rate of impact on protecting environment and natural resources because that public transport service in MDCs is road-based with diesel bus fleet.

In term of applicability, this measure has a low level of difficulty in application (DS=1,20) with the main concerned barrier in cost, especially operation cost. The establishment of PTMC itself does not inquire any additional traffic control and operation system technical system, but the information systems are required in the case PTMC takes care for public transport information service.

The establishment of PTMC requires participation of transport authorities and operators. It also requires approvals of city political decision makers if the city subsidy is paying via PTMC. According to the terms of selection, this measure is selected into the *first priority group* of recommended measures. Detail assessment results are presented in Table E-7.

PT 7	Public Transport Management Centre							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X		Y	Y	

Effectiveness			ES = 2,72	●
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⦿
1.2. To increase modal choices	●	3.2. To reduce noise		⦿
1.3. To increase transport *P&E***	●	3.3. To save energy		⦿
1.4. To increase transport capacity	⦿	3.4. To save urban space		⦿
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		⦿
2.2. To reduce accident severity	●	4.2. To improve economic P&E		●
		4.3. To improve economic attractiveness		●

Applicability			DS = 1,20	⊙
Criteria 1: Cost of measure	●	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⦿
1.1. Operation cost	●	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		○
2.1. Operation/control systems	○	4.1. Users		○
2.2. Information systems	⦿	4.2. Non-users		○

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 7: Assessment of measure PT 7: Public Transport Management Centre

Table E- 7: Detail assessment of measure PT 7: Public Transport Management Centre

PT 7	Public Transport Management Centre							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X		Y	Y	

Effectiveness			ES =	2,72	●
Goal 1 : To ensure mobility	●	2,72	**Goal 3: To protect environment**	⦿	2
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⦿	2
Ideally, one of the main functions of PTMC is to provide equal opportunities for different operators in providing public transport service. In this aspect, PTMC can be considered as an overall city scale of optimising and equalising use of public properties in public transport system.			The impact on reducing air pollution of this measure is normally difficult to evaluate. However, a large scale impact on optimisation of public transport service operation can be achieved by good network planning, proper service quality standard, and quality management service. Therefore, a medium level of impact can be given to this measure.,		
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⦿	2
The PTMC coordinates different operators to provide an integrated public transport service with a largest coverage area, not only at the city scale, but up to the regional level. The opportunity to use public transport and NMT is provided for people overall city.			The impact on reducing noise of this measure is normally difficult to evaluate. However, a large scale impact on optimisation of public transport service operation can be achieved by good network planning, proper service quality standard, and quality management service. Therefore, a medium level of impact can be given to this measure.,		
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	⦿	2
Here is no doubt in giving a high appreciation for this measure in this objective, especially in the cases PTMC plays a hybrid role, combination between authority and business. With an effective coordination, the conventional discrete services of different operators are integrated. Furthermore, by PTMC, other public transport prioritisation measures can be efficiently implemented, for example public transport incentive, integrated schedule, public transport information service...			The impact on saving energy of this measure is normally difficult to evaluate. However, a large scale impact on optimisation of public transport service operation can be achieved by good network planning, proper service quality standard, and quality management service. Therefore, a medium level of impact can be given to this measure.,		
1.4. To increase transport capacity	⦿	2	*3.4. To save urban space*	⦿	2
For the supply side, the synergy effects of integration significantly increase the total capacity of the system without needs for a large investment. For the demand side, the integration enables opportunity for travellers to use the supply capacity which was difficult to access before.			The integration of services opens opportunity to optimise the use of stops, stations, and road space. Therefore, a high impact on saving urban space is given to this measure.		
Goal 2: To ensure traffic safety	●	3,00	**Goal 4: To improve economy**	●	3,00
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	⦿	3
A very large scale of impact on attracting travellers from IMVs to use public transport service can be expected by having a well functioned PTMC (coordination, distribution and information provision). Therefore, a high level of impact on reducing accident frequency can be given to this measure.			This measure improve significantly productivity, efficiency and also quality of PT service . An urban scale public transport network reform can achieve a big success by attracting travellers from IMVs.		
			4.2. To improve economic P&E	●	3
			Good coordination helps public transport operators to optimise the routing and scheduling of their service network. For passengers, both travel distance and time of trips can be significantly reduced with this measure.		
2.2. To reduce accident severity	●	3			
Attracting travellers to use public transport, this measures helps to reduce severe accidents, which causes by IMVs. Moreover, coordination service of PTMC helps to avoid the high fatality accidents due to the "bus races" on the road, esepcially during peak hour.			*4.3. To improve economic attractiveness*	●	3
			In most of the cases, the PTMC plays as a key organisation to ensure a fair competitive public transport market. Therefore, it improve the attractiveness of public transport sector. On the other hand, an integrated and efficient public transport system significantly improves the attractiveness of the city and region.		

(Cont.)

Table E-7: Detail assessment of measure PT 7: Public Transport Management Centre (Cont.)

Applicability			AS = 1,20	⊙
Criteria 1: Cost of measure	●	**2,528**	**Criteria 3: Institutional participation**	⊙	**1,484**
1.1. Investment cost	⦿	2	3.1. Transport related institutions	⦿	2
As the description, provisions of building and administrative equipment are required.			In MDCs the establishment of a PTMC normally required agreements and participations of transport operators and , transport authorities.		
1.1. Operation cost	●	3	3.2. Political bodies	⊙	1
High operation cost is required to afford new office, equipments and employees.			This measure normally requires only the approval of city political bodies (mayor and council).		
Criteria 2: Technical systems	⊙	**0,854**	**Criteria 4: Public acceptance**	○	**0**
2.1. Operation/control systems	○	0	4.1. Users	○	0
This measure does not require any additional new system or any change of operation system of the public transport operators.			This measure is strongly supported by all public transport users.		
2.2. Information systems	⦿	2	4.2. Non-users	○	0
In the case the PTMC plays the role of travellers information service provider, a city scale of information system is required to collect and disseminate the information.			This measure is strongly supported by the non-users.		

PT8- Smart Ticketing System

- **Description**

This measure aims to encourage travellers using public transport service by providing a customer-friendly sale system, an integrated ticketing service between different operators, and a flexible fare mechanism (off-peak reduction, combi-ticket, group ticket). By the customer-friendly sale system, this measure allows passengers to pay the transit fare by different media (prepaid cards, post-paid cards, mobile phone, internet…). This function helps to minimise time and other disturbances of ticket purchasing for both user and operator (one payment for different modes/sections of a trip or within a period). By flexible fare system, this measures helps to avoid such situations of over-crowded or empty public transport vehicles. Thus, it ensures both the service quality and revenue of operators.

In the MDCs, the simple printed forms of prepaid card (daily, weekly or monthly cards) for frequent users by zone pricing mechanism are feasible models of smart ticketing system. These models can be applied for single or multi-lines according to the level of integration between operators. The public transport management centre can play a very effective role as a coordinator between different operators to implement smart ticketing service. In MDCs, the smart ticketing system normally plays as the most effective channel to implement the public transport users incentive measure.

- **Assessment**

In general, this measure has a medium level of impact. The impact on mobility and economic are highly respected while it achieved a medium rate on ensuring traffic safety and on protecting environment and natural resource (as other public transport measures).

PT 8	Smart Ticketing System							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X	Y			

Effectiveness			ES = 2,01	⦿
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⦿
1.2. To increase modal choices	⦿	3.2. To reduce noise		⦿
1.3. To increase transport *P&E***	⦿	3.3. To save energy		⦿
1.4. To increase transport capacity	○	3.4. To save urban space		●
Goal 2: To ensure traffic safety	⦿	**Goal 4: To improve economy**		⦿
2.1. To reduce accident frequency	⦿	4.1. To reduce transport costs		⦿
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		⦿
		4.3. To improve economic attractiveness		●

Applicability			DS = 0,72	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		○
2.1. Operation/control systems	○	4.1. Users		○
2.2. Information systems	⊙	4.2. Non-users		○

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 8: Assessment of measure PT 8: Smart Ticketing System

In term of applicability, this measure is highly applicable in MDCs (DS=0,72). Although a considerable amount of investment cost for selling system is required, this measure does not require additional operation or control systems, except some minor adjustments of information (for updating ticket price information). In principle, this measure does not require participation of authorities or political approval. However, public transport service usually requires certain subsidy from city budget. Therefore, a participation of transport authority and approvals of city political bodies are required. According to the terms of selection, this measure is selected into the *second priority group* of recommended measures. Detail assessment results are presented in Table E-8.

Table E- 8: Detail assessment of measure PT 8: Smart Ticketing System

PT 8	Smart Ticketing System							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X	Y			

Effectiveness			ES =	2,01	⦿
Goal 1 : To ensure mobility	●	**1,65**	**Goal 3: To protect environment**	⦿	**2,203**
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⦿	2
This measure encourages all people using public transport without any discouragement to other transport modes.			Shifting of travel demand from IMV to PT will help to reduce the air pollution. However, most of public transport vehicles in MDCs are still producing air pollution directly, especially the diesel buses.		
1.2. To increase modal choices	⦿	2	*3.2. To reduce noise*	⦿	2
A moderate level of impact on increasing modal choices could be achieved in the case implementing this measure alone without any finance incentive. The opportunity of using public transport service is limited only to the group of medium-income people, who can afford the normal price of PT.			Shifting of travel demand from IMV to PT will help to reduce the noise pollution. However, most of public transport vehicles in MDCs are still producing noise directly or indirectly, especially the diesel buses .		
*1.3. To increase transport P&E***	⦿	2	*3.3. To save energy*	⦿	2
For any public transport service, improvement of sale system aims to increase productivity and efficiency of the available supply capacity. In MDCs, the public transport capacity is efficient using only during certain peak period. In the rest of time, vehicles run with low and very low occupancy. Therefore, a smart ticketing system can attract IMV drivers to use public transport service during off-peak period, during week-end, or in special events (sport or trade exhibition). Therefore, a medium level of impact can be expected from this measure.			Shifting of travel demand from IMV to PT will help to save the energy of transportation. However, the efficiency of energy use for public transport is not high during off-peak period. On the other hand, most of buses in MDCs are using old engine models, therefore, one can not expect a high level of saving energy by this measure.		
1.4. To increase transport capacity	○	0	*3.4. To save urban space*	●	3
No capacity is expected to be provided by this measure			The smart ticketing system opens opportunity to optimise the use of stops, stations, and road space. Therefore, a high impact on saving urban space is given to this measure.		
Goal 2: To ensure traffic safety	⦿	**2,00**	**Goal 4: To improve economy**	⦿	**2,34**
2.1. To reduce accident frequency	⦿	2	*4.1. To reduce transport cost*	⦿	2
A medium level of impact on shifting travel demand from IMVs to public transport service is maximum expected from this measure if it implements individually. Proportionally, a medium level of impact on reducing accident frequency is expected from this measure.			This measure is appreciated as an important scheme to improve the productivity and efficiency of PT. However, implementing this measure only is not sufficient to attract the motorcycle drivers, especially the students. Therefore, a medium level of impact on reducing transport cost is given to this measure.		
			4.2. To improve economic P&E	⦿	2
2.2. To reduce accident severity	⦿	2	Significant reductions of purchasing time of passengers and boarding time in operation of PT service are considered as considerable saving for the economy. Therefore a medium rate of impact on improving economic productivity and efficiency is given to this measure.		
Attracting travellers to use public transport, this measures helps to reduce severe accidents, which causes by IMVs.			*4.3. To improve economic attractiveness*	●	3
			In general, a smart ticketing system plays a quite important role for an effective public transport service. On the other hand, an accessible sale system in public transport plays an important role in promoting tourism of the city.		

(Cont.)

Table E-8: Detail assessment of measure PT 8: Smart Ticketing System (Cont.)

Applicability			AS = 0,72	⊙
Criteria 1: Cost of measure	⊙	**1,472**	**Criteria 3: Institutional participatior**	⊙	**1**
1.1. Investment cost	◉	2	3.1. Transport related institutions	⊙	1
The investment for a smart ticketing system is not high if the infrastructure is already available. Some modifications of software and adjustments of ticket vendors are required. IN MDCs, the manual distribution system of monthly or weekly tickets also requires only few additional equipment. However, a total new smart sale channel with new ticket vendors and equipment normally asks for a considerable investment.			This measure normally requires participation of distributors or PTMC in the case of outsourced distribution service.		
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙	1
The change of PT routing to any road will create only minor additional maintenance cost of the equipments.			In most of the cases, a new pricing system for public transport requires an approval of the city government if there is subsidy from public budget.		
Criteria 2: Technical systems	⊙	**0,427**	**Criteria 4: Public acceptance**	○	**0**
2.1. Operation/control systems	○	0	4.1. Users	○	0
No additional operation/control system is required.			This measure is strongly supported by all public transport users.		
2.2. Information systems	⊙	1	4.2. Non-users	○	0
Some minor adjustment of information system is required for providing information about new prices.			This measure is strongly supported by the non-users.		

PT9- Paratransit Improvement

- **Description**

Paratransit provides demand responsive public transport service, which operates without fixed schedule and fixed route by the low capacity vehicles such as minibus, passenger car, motorcycle, tri-cycle…. The main advantage of paratransit is the ability to provide door-to-door service and freedom for passengers. With the connection to the main transport interchanges, paratransit will provide a complementary and feeder service for the mass transit service by its door-to-door ability that is the main disadvantage of the mass transit. The connection of paratransit service to the residential areas or activities centres will provide a public transport choice for people in the areas where the mass transit services are not provided. In this case, the paratransit become the most important service for the weak travellers groups (elders, children, disabilities), who are facing difficulties in travel by themselves by either IMV or mass transit, especially with high-step buses or trains.

The disadvantages of paratransit are quite many in comparison with the IMV and public transport. Except the ordinary taxi, which normally provides a high reliability (e.g. 24 hour by telephone), clear image (e.g. distinguished colour) and organised (e.g. central operation) service, the other paratransit services contains disadvantages of unreliable (e.g. catching by chance), low image (e.g. difficult to distinguish from IMV), unorganised (e.g. individual operation by driver), and low quality vehicle (the drivers are normally poor).

This measure is to regulate the paratransit service in order to improve the quality and image of the paratransit services. In term of organisation, the drivers and vehicles must be registered at the local transport authorities or police in order to get a certificate of providing paratransit service. The paratransit drivers can organise themselves in certain form of organisation (e.g. a self-management unit), which can register and operate its service in the designated areas (e.g. specific passengers' waiting points). The organisation can also provide some kind of control services for the operators in order to avoid conflicts between them (e.g. first-come-first serve rule for taking passenger). To improve service image, minibus service should operate along certain routes or service points, and paratransit vehicles (minibus, motorcycle, and tricycle) should be painted in the colours that distinguish them from the other vehicles. On the other hand, designated waiting points for paratransit vehicles should be considered as a standard requirement in planning and management of transport surface at main transport interchanges, residential areas or activities centres (hotel, hospital, shopping centres…).

- **Assessment**

In general, this measure has a medium level of effectiveness, except the low level of impact on protecting environment and natural resources. However, this measure is appreciated on improving urban traffic safety, mobility, and economy, especially in creating jobs. In term of applicability, this measure faces very low difficulty level in application (DS=0,71). Although, a considerable amount of investment cost to provide waiting areas for paratransit vehicles, this measure require low operation cost and minor changes of technical systems.

PT9	Paratransit Improvement							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X		X		

Effectiveness			ES = 1,74	⦿
Goal 1 : To ensure mobility	⦿	**Goal 3: To protect environment**		⊙
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⊙
1.2. To increase modal choices	●	3.2. To reduce noise		⊙
1.3. To increase transport *P&E***	⊙	3.3. To save energy		⊙
1.4. To increase transport capacity	○	3.4. To save urban space		⦿
Goal 2: To ensure traffic safety	⦿	**Goal 4: To improve economy**		⦿
2.1. To reduce accident frequency	⦿	4.1. To reduce transport costs		⦿
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		⊙
		4.3. To improve economic attractiveness		●

Applicability			DS = 0,71	⊙
Criteria 1: Cost of measure	⦿	**Criteria 3: Institutional participation**		⦿
1.1. Investment cost	⦿	3.1. Transport related institutions		⦿
1.1. Operation cost	⊙	3.2. Political institutions		○
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		○
2.1. Operation/control systems	○	4.1. Users		○
2.2. Information systems	⊙	4.2. Non-users		○

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 9: Assessment of measure PT 9: Paratransit Improvement

In principle, this measure does not require participation of many authorities, but a big number of operators. In principle, no approval of city political bodies is required. According to the terms of selection, this measure is selected into the *second priority group* of recommended measures. Detail assessment results are presented in Table E-9.

Table E- 9: Detail assessment of measure PT 9: Paratransit regulation

PT9	Paratransit Improvement							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X		X		

Effectiveness			ES =	1,74	⦿
Goal 1 : To ensure mobility	⦿	**1,65**	**Goal 3: To protect environment**	⊙	**1,203**
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⊙	1
Improvement of paratransit in MDCs is a most important measure in ensuring equality in using UTP. On one hand, this is a complementary service for mass transit. On the other hand, it provides accessibility to the weakest people (children, elders and disabilities). Paratransit is the only public transport solution for people, who are living deeply in the two-wheelers accessed only areas.			Shifting of travel demand from IMV to PT will help to reduce the air pollution. However, most of paratransit vehicles in MDCs are ordinary and producing air pollution directly. An other issue is limited capacity of the paratransit vehicles.		
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⊙	1
As a part of urban public transport system, paratransit service provides public travel choice not only for the general people, but for the one who can not drive themselves or can not use public transport due to health or resident barriers.			Shifting of travel demand from IMV to PT will help to reduce the noise pollution. However, most of paratransit vehicles in MDCs are ordinary and producing noise directly.		
*1.3. To increase transport P&E***	⊙	1	*3.3. To save energy*	⊙	1
Paratransit is considered as an effective feeder service for mass transit lines, especially the trunk lines. On the other hand, the ordinary IMVs are efficiently use in paratransit service, which does not requires travellers to by their own vehicles, to pay for parking price. However, a low scale of impact is given to this measure due to its low productivity.			Shifting of travel demand from IMV to PT will help to save the energy of transportation. However, capacity of the paratransit vehicle is limited.		
1.4. To increase transport capacity	○	0	*3.4. To save urban space*	⦿	2
No new capacity is considered to provide by this measure directly.			The most advantage of paratransit vehicles in this objective is saving of urban parking area.		
Goal 2: To ensure traffic safety	⦿	**2,00**	**Goal 4: To improve economy**	⦿	**1,98**
2.1. To reduce accident frequency	⦿	2	*4.1. To reduce transport cost*	⦿	2
Good paratransit service helps to reduce number of accidents which are caused by older or immature drivers. The strangers and tourists are highly benefited in term of safety in where a good paratransit service is provided. However, only a medium scale of impact can be expected from this measure.			Paratransit provides an effective transitional transport mode for heavier public transport vehicles in the developing scattered urban area. The other positive point is that paratransit serves the two-wheelers residential areas by a relative low-cost and effective service, which allow the city to slow-down and avoid the investment for widening the access roads to these areas. However, a low scale of impact is given to this measure due to its limitation in both spatial and time		
			4.2. To improve economic P&E	⊙	1
2.2. To reduce accident severity	⦿	2	In MDCs, reduction of trip time is the most significant advantage of the paratransit, especially during peak hour. However, the scale of this impact is limited to the non-driving and relative high income groups, who can pay for taxi or motorcycle taxi for their commuting or business trip.		
In MDCs, the paratransit vehicles (taxi and motorcycle taxi) are frequently called for emergency services, including to rescue the accident victims. IN many cities, taxi drivers and MC taxi drivers are trained about rescue skills and knowledge.					
			4.3. To improve economic attractiveness	●	3
			With a low availability mass transit service, provision of a good paratransit service helps to improve the general accessibility of the city, and to improve its economic attractiveness. On the other hand, paratransit is a labour-based industry , which create a significant number of jobs in the city.		

(Cont.)

Table E-9: Detail assessment of measure PT 9: Paratransit Regulation (Cont.)

Applicability			AS = 0,71	⊙
Criteria 1: Cost of measure	⦿	**1,472**	**Criteria 3: Institutional participation**	⦿	**0,968**
1.1. Investment cost	⦿	2	3.1. Transport related institutions	⦿	2
Some additional urban space and construction cost may be required to provide waiting areas for paratransit vehicle.			Participations of operators and polices are normally required in implementing this measure.		
1.1. Operation cost	⊙	1	3.2. Political bodies	○	0
This measure creates only minor additional maintenance cost to the public road and waiting areas.			This measure principally does not require any approval of the political bodies.		
Criteria 2: Technical systems	⊙	**0,427**	**Criteria 4: Public acceptance**	○	**0**
2.1. Operation/control systems	○	0	4.1. Users	○	0
No additional operation/control system is required.			This measure is strongly supported by all public transport users.		
2.2. Information systems	⊙	1	4.2. Non-users	○	0
Some minor adjustment of information system is required for providing information about new paratransit service or new improvements.			This measure is strongly supported by the non-users.		

Non-Motorised Transport Measures

NMT1- Sidewalks and Pedestrian Crossing Facilities

- **Description**

This measure aims to ensure sufficient and safe sidewalks and crossing facilities in order to supply continuous walkways for pedestrians. Furthermore, this measure promotes a complete network of walkways and to ensure walking accessibility all land uses within the targeted urban area. Firstly, available sidewalks should be protected for pedestrians only (some cases for bicycle also if there is enough space), unregulated parking of cars or motorcycles on the sidewalks should be strictly prohibited. Secondly, plantation of trees along the sidewalk is desirable to improve the walking environment, especially in the tropical climate condition. Thirdly, sufficient and safe crossing facilities should be provided at right places. Pedestrian's signals should be considered at signalised intersections. Pedestrian bridges or tunnels are desired crossing facilities at the heavy demand crossing points or to cross over heavy traffic volume roads. Fourthly, smooth connection between sidewalks and alleys should be protected in order to encourage the peoples in the two-wheeler accessed only blocks to walk for their trip. Motorcycle traffic on the alleys must be slow down (under 15 kilometres per hour) in order to reduce accident risks for pedestrians.

- **Assessment**

This measure is one of the most effective measures (ES=2,56), especially in ensuring mobility, protecting urban environment and improving economic of the urban area.

NMT1	Sidewalks and Crossing Facilities							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X	Y	X		

Effectiveness			ES = 2,56	●
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		●
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		●
1.2. To increase modal choices	●	3.2. To reduce noise		●
1.3. To increase transport *P&E***	●	3.3. To save energy		●
1.4. To increase transport capacity	⦿	3.4. To save urban space		⦿
Goal 2: To ensure traffic safety	⦿	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	⦿	4.1. To reduce transport costs		●
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		●
		4.3. To improve economic attractiveness		●

Applicability			DS = 1,45	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	⦿	**Criteria 4: Public acceptance**		⦿
2.1. Operation/control systems	⦿	4.1. Users		⊙
2.2. Information systems	⊙	4.2. Non-users		●

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 10: Assessment of measure NMT1: Sidewalks and Crossing facilities

This measure is also appreciated by its impact on improving urban traffic safety. On the other hand, this measure faces low level of difficulty in application (DS=1,45). The most concerned barrier is opposition of the land users, who are living and doing business at the frontage of

the road. A considerable amount of investment cost is considered to pay some urban space in order to ensure the continuity of the sidewalk, for building pedestrian bridges, or for installing pedestrian traffic signals. According to the terms of selection, this measure is selected into the *first priority group* of recommended measures. Detail assessment results are presented in Table E-10.

Table E- 10: Detail assessment of measure NMT1: Sidewalks and Crossing Facilities

NMT1	Sidewalks and Crossing Facilities							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X	Y	X		

Effectiveness			ES =	2,56	●
Goal 1 : To ensure mobility	●	2,72	**Goal 3: To protect environment**	●	2,797
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	●	3
This measure ensures the right to use urban space for captive pedestrians (who can not drive by many reasons), public transport users (to access public transport stops/stations). Therefore, a highest impact on ensuring equality in using UTP is given to this measure.			Beside the pollutionless walking, this measure also encourages people to use public transport services. Therefore, highest level of impact on reducing air pollutions is given to this measure.		
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	●	3
This measure opens the primary choice for captive pedestrians, enables the availability public transport supply for passengers, connects the drivers from parking places to their activity's destination. Therefore, the highest level of impact on increasing modal choice for urban citizen is given to this measure.			Beside the noiseless, this measure also encourages people to use public transport services. Therefore, highest level of impact on reducing urban noise is given to this measure.		
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	●	3
Beside the highest effeciency (lowest infrastructure and operation costs) of walking for the short trips, this measure ensures right of way for the section between interchange and destination in most of vehicle trips in the urban areas, esepcially the public transport trips. Therefore, a high level of impact on increasing of transport productivity and efficiency is given to this measure.			Beside the fuelless walking, this measure also encourages people to use public transport services. Therefore, highest level of impact on saving energy is given to this measure.		
1.4. To increase transport capacity	⦿	2	*3.4. To save urban space*	⦿	2
Although this measure includes provision of some new sidewalks and crossing facilities, the main impact on increasing capacity of this measure is enabling the available capacity by connecting discrete sections of sidewalk, connecting sidewalks of two road sides and connecting land uses and interchanges of motorised vehicles (public transport stops/stations, parking facilities).			Walking is the only transport mode that requires no area for interchange (parking or stop). On the other hand, this measure encourages people to use public transport services. However, some additional land area are dedicated to the sidewalk. Therefore, a medium level of impact is given.		
Goal 2: To ensure traffic safety	⦿	2,00	**Goal 4: To improve economy**	●	3,00
2.1. To reduce accident frequency	⦿	2	*4.1. To reduce transport cost*	●	3
This measure significantly reduces conflicts between pedestrians and motorised vehicles, especially motorcycles.			Shifting of travel demand from IMV to NMT and PT significantly reduces urban transport costs in infrastructure, vehicle and operation. Therefore, the highest level of impact on reducing transport cost is given to this measure.		
			4.2. To improve economic P&E	●	3
2.2. To reduce accident severity	⦿	2	Walking is the only mode allow people travelling directly from in to destination. Therefore, shifting of travel demand from IMV eliminates totally the interchange time. Beside that, the extra travel distance due to operation rules of motorised vehicle traffic can also be eliminated by walking.		
This measure eliminates conflicts between pedestrians and motorised vehicles.			*4.3. To improve economic attractiveness*	●	3
			Good walking environment urban area is an attractive investment destination for service and tourism , which are normally the target economic sectors of high density cities.		

(Cont.)

Table E-10: Detail assessment of measure NMT1: Sidewalks and Crossing Facilities

Applicability				DS = 1,45	⊙
Criteria 1: Cost of measure	⊙	**1,472**	**Criteria 3: Institutional participation**	⊙	**1**
1.1. Investment cost	◉	2	3.1. Transport related institutions	⊙	1
This measure requires some new right of way to construct new sections of sidewalk or crossing facilities. Procurements of new traffic signal equipment for pedestrian crossing are also required.			This measure is implemented by transport authorities. Traffic police is the only additional institution that needs to participate in this measure.		
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙	1
Only minor increase in routine maintenance and operation cost is required.			Approval of city political bodies is required if there is need of using new urban space for provision of new side walks or pedestrians bridges or tunnels.		
Criteria 2: Technical systems	◉	**1,573**	**Criteria 4: Public acceptance**	◉	**1,751**
2.1. Operation/control systems	◉	2	4.1. Users	⊙	1
For an urban scale project, adjustments of operation/control equipments are required, especially the provision of pedestrian signal control at intersections.			This measure is strongly supported by pedestrians and public transport passengers. Some IMV drivers are unhappy with this measure because they have to find other places to park their motorcycles.		
2.2. Information systems	⊙	1	4.2. Non-users	●	3
Some minor adjustments of local information equipments are required.			A strong opposition of the frontage land users is considerable force that against this measure in the case they have to resettle or to relocate their business to give space for ensuring continuous network of sidewalks.		

NMT2- Bicycle Lanes and Facilities

- **Description**

This measure aims to ensure sufficient and safe bicycle lanes, crossing facilities and parking places for bicyclists. In MDCs, marking separation bicycle lanes are normally ineffective due to violations of driving motorcyclists and car parking. Physical separation bicycle lane is difficult to apply because the opposition of roadside land users and lack of road space. Therefore, a combination exclusive Right-of-Way for bicyclists and pedestrians is more acceptable by land users. This combination also helps to avoid and violations of IMV drivers on bicycle lanes. At the intersection, the left-turning bicycle traffic should be regulated by applying the two-step left turning rule.

In the high-density urban area as MDCS, the most difficult barrier of this measure is to reserve enough right-of-way for a continuous and integrated network of bicycle lane/way. Therefore, to reserve narrow urban roads, which is less than five meters width, for two-wheelers traffic only can be considered as a solution to reserve sufficient Right-of-Way for bicycle in the urban area of MDCs. On the other hand, smooth connection between bicycle lanes or the car-base roads and the alley network should be protected in order to encourage the peoples in the two-wheeler accessed only block to use bicycles for their trip.

- **Assessment**

This measure has a medium level of effectiveness in three of the four criteria, except economy improvement. In detail, this measure is highly appreciated in ensuring equality in using urban transport properties and increasing modal choices for urban citizen.

NMT2	Bicycle Lane and Facilities							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X	Y	X		

Effectiveness			ES = 2,33	⦿
Goal 1 : To ensure mobility	⦿	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		●
1.2. To increase modal choices	●	3.2. To reduce noise		●
1.3. To increase transport *P&E***	⦿	3.3. To save energy		●
1.4. To increase transport capacity	⊙	3.4. To save urban space		○
Goal 2: To ensure traffic safety	⦿	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	⦿	4.1. To reduce transport costs		●
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		●
		4.3. To improve economic attractiveness		●

Applicability			DS = 1,57	⦿
Criteria 1: Cost of measure	⦿	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		●
2.1. Operation/control systems	⊙	4.1. Users		●
2.2. Information systems	⊙	4.2. Non-users		⦿

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non ** UTP* = urban transport properties; *** P&E* = Productivity and Efficiency;

Figure E- 11: Assessment of measure NMT2: Bicycle Lanes and Facilities

However, this measure does not considered as a high effective solution to increase transport productivity and capacity. In the environmental aspect, this measure is highly effective in

reducing pollutions and saving energy, but it is not considered as an effective measure for saving urban space.

In term of applicability, this measure faces a medium level of difficulty in application (DS=1,57). Implementation of this measure in MDCs faces a strong opposition of motorcyclists and the land users. The public transport operators and users are also not so happy with this measure because that the bicycle lanes (next to the curbs) normally obstruct the operation of buses. Although, a considerable amount of investment cost to provide sufficient road space for bicycle lane, this measure require low operation cost and minor changes of technical systems. In principle, this measure requires only participation of traffic police and approval a city political level. According to the terms of selection, this measure is selected into the *third priority group* of recommended measures. Detail assessment results are presented in Table E-11.

Table E- 11: Detail assessment of measure NMT2: Bicycle lanes and facilities

NMT2	Bicycle Lane and Facilities							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X	Y	X		

Effectiveness			ES =	2,33	⦿
Goal 1 : To ensure mobility	⦿	2,18	**Goal 3: To protect environment**	⦿	2,392
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	●	3
This measure ensures the right to use urban space for bicyclists, who are mainly accounted for poor people, students, school children. However, the scale of impact is moderate due to lack of urban space. Therefore, a medium level of impact on ensuring equality in using UTP is given to this measure.			Bicycle is the pollutionless transport mode. However, the scale of impact is moderate, therefore a medium level is given to this measure.		
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	●	3
in MDCs, bicycles is the most effective individual transport alternative to motorcycles. This measures ensures the primary option (for a longer than 1 kilometre trip) for many people, who can not access to IMVs and public transport services by many reasons (affordability of people or availability of service). Bicycle lanes are considered as feeder service for public transport in the medium density urban areas. However, the scale of impact is moderate due to lack of urban space. Therefore, a medium level of impact on ensuring equality in using UTP is given to this measure.			Bicycle is the noiseless transport mode. However, the scale of impact is moderate, therefore a medium level is given to this measure.		
*1.3. To increase transport P&E***	⦿	2	*3.3. To save energy*	●	3
Bicycle is the highest effeciency (lowest infrastructure and operation costs) for most of urban trips among all vehicular transport modes. In term of passenger per hour, bicycle lane has higher productivity than car a lane, but lower productivity than a motorcycle lane or bus lane. Therefore a moderate level of impact on increasing transport productivity and efficiency is given to this measure.			Bicycle is the fuelless transport mode. However, the scale of impact is moderate, therefore a medium level is given to this measure.		
1.4. To increase transport capacity	⊙	1	*3.4. To save urban space*	○	0
In MDCs, provision of bicycle lanes and parking places is not considered as a good measure to increase transport capacity. However, in the new developed urban area, provision of bicycle lanes from residential area to the public transport stations enables the available public transport service to the residents.			In MDCs, provision of bicycle lanes and parking places is not considered as a measure to save urban space.		
Goal 2: To ensure traffic safety	⦿	2,00	**Goal 4: To improve economy**	●	3,00
2.1. To reduce accident frequency	⦿	2	*4.1. To reduce transport cost*	●	3
This measure significantly reduces conflicts between bicyclists and motorised vehicles, especially motorcycles. However, scale of impact is moderate.			Shifting of travel demand from IMV to NMT significantly reduces urban transport costs in infrastructure, vehicle and operation.		
			4.2. To improve economic P&E	●	3
2.2. To reduce accident severity	⦿	2	For most of the urban trips (less than 5 kilometres) in a high density urban area, cycling time is shorter than total travel time of a car driver or a bus passenger.		
This measure eliminates conflicts between NMTs and motorised vehicles.			*4.3. To improve economic attractiveness*	●	3
			Good cycling environment urban area is an attractive investment destination for service and tourism , which are normally the target economic sectors of high density cities.		

(Cont.)

Table E-11: Detail assessment of measure NMT2: Bicycle lanes and facilities

Applicability			AS = 1,57		⦿
Criteria 1: Cost of measure	⦿	**1,472**	**Criteria 3: Institutional participation**	⊙	**1**
1.1. Investment cost	⦿	2	3.1. Transport related institutions	⊙	1
This measure requires some new right of way to construct new sections of bicycle lane or parking facilities. Procurements of new traffic signal equipment for bicycle crossing are also required.			This measure is implemented by transport authorities. Traffic police is the only additional institution that needs to participate in this measure.		
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙	1
Only minor increase in routine maintenance and operation cost is required.			Approval of city political bodies is required if there is need of using new urban space for provision of new facilities.		
Criteria 2: Technical systems	⊙	**1**	**Criteria 4: Public acceptance**	●	**2,625**
2.1. Operation/control systems	⊙	1	4.1. Users	●	3
Some minor adjustments of local operation/control equipments are required.			Although this measure is strongly supported by bicyclists, IMV drivers are very unhappy if their ROW has to be reduced for providing bicycle lane. In many cases, bicycle lanes make difficulty for bus operation. Therefore, bus operators and users also oppose this measure.		
2.2. Information systems	⊙	1	4.2. Non-users	⦿	2
Some minor adjustments of local information equipments are required.			Opposition of the frontage land users is a considerable force that against this measure in the case they have to resettle or to relocate their business to give space for providing bicycle lane.		

NMT3- Non-motorised Transport Zone

- **Description**

This measure aims to protect the targeted area from the entering of any motorised transport modes. Devices for this measure range from the simple traffic signs, guide boards, signals, and physical barriers at the entries to the modification of the geometric design of the roadways. Beside that, NMT zone should be well connected with public transport services and the IMV parking places. Application of NMT zone is a considerable solution to improve traffic conditions in many two-wheeler accessed only areas of MDCs. The main difficulty in this case is the IMV traffic demands of the residents in these areas and their guests. Therefore, provision of sufficient IMV parking places on the boundary is required condition to implement this measure for the two-wheeler accessed only areas.

- **Assessment**

In urban and transport conditions of MDCs, this measure is one of the most effective measures ensuring safety and protecting environment, especially in the two-wheeler accessed only blocks. In implementation, this measure faces a low difficulty, in general. Particularly, the oppositions of IMV drivers and business and some amount of investment for parking facilities are the most concerned barriers, but they are all at medium level of difficulty. The other barriers are at low level of difficulty. According to the terms of selection, this measure is selected into the *first priority group* of recommended measures. Detail assessment results are presented in Table E-12.

NMT3	Non-motorised Transport Zone							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X	Y	Y		

Effectiveness			ES = 2,50	●
Goal 1 : To ensure mobility	⦿	**Goal 3: To protect environment**		●
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		●
1.2. To increase modal choices	⦿	3.2. To reduce noise		●
1.3. To increase transport *P&E***	●	3.3. To save energy		●
1.4. To increase transport capacity	○	3.4. To save urban space		●
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		⦿
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		●
2.2. To reduce accident severity	●	4.2. To improve economic P&E		⦿
		4.3. To improve economic attractiveness		⊙

Applicability			DS = 1,40	⊙
Criteria 1: Cost of measure	⦿	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		⦿
2.1. Operation/control systems	⊙	4.1. Users		⦿
2.2. Information systems	⊙	4.2. Non-users		⦿

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 12: Assessment of measure NMT3: Non-motorised Transport Zone

Table E- 12: Detail assessment of measure NMT3: Non-motorised Transport Zone

NMT3	Non-motorised Transport Zone							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X	Y	Y		

Effectiveness			ES =	2,50	●
Goal 1 : To ensure mobility	⦿	1,92	**Goal 3: To protect environment**	●	3
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	●	3
This measure ensures the right to use urban space for pedestrians, bicyclists and public transport users . Therefore, a highest impact on ensuring equality in using UTP is given to this measure.			Beside the pollutionless NMT, this measure also encourages people to use public transport services. Therefore, highest level of impact on reducing air pollutions is given to this measure.		
1.2. To increase modal choices	⦿	2	*3.2. To reduce noise*	●	3
This measure strongly encourages people to walk and bike within the targeted areas. Furthermore, this measure encourages travellers to use public transport services, which connects the NMT zone and other land uses in the urban area. However, this measure prohibit the use of IMVs. Therefore, only a medium level is given to this measure.			Beside the noiseless NMT, this measure also encourages people to use public transport services. Therefore, highest level of impact on reducing urban noise is given to this measure.		
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	●	3
Within a very high density city centre or in the two-wheeler accessed only area, application of NMT zone significantly increase the productivity and efficiency of the urban space.			Beside the fuelless walking, this measure also encourages people to use public transport services. Therefore, highest level of impact on saving energy is given to this measure.		
1.4. To increase transport capacity	○	0	*3.4. To save urban space*	●	3
In MDCs, NMT zone is not considered as a measure to increase transport capacity.			Some additional parking places are required for IMVs, which must be parked due to the restriction to enter the NMT zone. However, the road expansion can be avoided by this measure, and the high value land inside the targeted area can be saved from parking facilities for other purpose.		
Goal 2: To ensure traffic safety	●	3,00	**Goal 4: To improve economy**	⦿	1,96
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	●	3
This measure significantly reduces conflicts between pedestrians and motorised vehicles, especially motorcycles.			Shifting of travel demand from IMV to NMT and PT significantly reduces urban transport costs in infrastructure, vehicle and operation. Therefore, the highest level of impact on reducing transport cost is given to this measure.		
			4.2. To improve economic P&E	⦿	2
2.2. To reduce accident severity	●	3	In MDCs, NMT zone is not considered as a high n effective measure to improve economic P&E in term of, but it helps to maintain the short distance urban trips (with mixed land use and high density condition of the MDCs) by improving the liveability of the urban residential areas , especially in the two-wheelers accessed only blocks.		
This measure eliminate all type of severe traffic accidents. There fore a high level of impact is given to this measure.			*4.3. To improve economic attractiveness*	⊙	1
			In MDCs, NMT zone is not considered as a high effective measure to improve economic attractiveness. However, some positive impacts can be expected if the NMT zone concept is applied in the tourist and shopping blocks.		

(Cont.)

Table E-12: Detail assessment of measure NMT3: Non-motorised Transport Zone (Cont.)

Applicability			AS = 1,40	⊙
Criteria 1: Cost of measure	⦿	**1,472**	**Criteria 3: Institutional participation**	⊙	**1**
1.1. Investment cost	⦿	2	3.1. Transport related institutions	⊙	1
This measure requires some additional urban space to provide required parking facilities or public transport stops.			Traffic police is the only additional institution that needs to participate in this measure.		
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙	1
Only minor increase in routine maintenance and operation cost is required.			Approval of city political bodies is required.		
Criteria 2: Technical systems	⊙	**1**	**Criteria 4: Public acceptance**	⦿	**2**
2.1. Operation/control systems	⊙	1	4.1. Users	⦿	2
Some minor adjustments of local operation/control equipments are required.			This measure is strongly supported by pedestrians and public transport passengers, but IMV drivers oppose this measure, especially in the tourist and shopping blocks. The opposition is low in the case of two-wheeler accessed only area if sufficient parking places are available.		
2.2. Information systems	⊙	1	4.2. Non-users	⦿	2
Some minor adjustments of local information equipments are required.			Some oppositions of the business was counted in the case of tourist and shopping blocks, but residents normally support this measure.		

NMT4- Non-motorised Transport Information Service

- **Description**

This measure aims to provide sufficient information about the NMT's environment to the travellers. The first and most important task is to develop and publish a comprehensive map (paper and electronic) of NMT network and parking facilities in the city. The second task is to provide sufficient traffic signs, markings and guide-boards at the gates of activities centres, public places, main public transport interchanges….

In the MDCs, provision of good information about the alley network on the city map and sufficient traffic guidance at the entries and inside the two-wheeler accessed only blocks will encourage people to use the available alleys for their bicycle trips instead of combating on the road with motorcycles. The schoolchildren, low-income workers, and elders are the most important travellers groups who need to be well informed about the NMT opportunities. A website is considered as an effective tool to provide updated information of NMT.

- **Assessment**

In the unique situation of MDCs with the existence of vast urbanised areas, where only two wheeler vehicles can be operated, this measure is simply evaluated as a high effectiveness solution to ensure mobility of the people by utilising the alley network for NMT users. There is no doubt about the environmental and economical benefits of NMT. The impact on improvement of traffic safety is not high as other measure due to nature of impact of information measure on travel behaviours (educational other than enforced).

NMT4	Non-motorised Transport Information Service							IN
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X	Y			Y

Effectiveness			ES = 2,47	●
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		●
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		●
1.2. To increase modal choices	●	3.2. To reduce noise		●
1.3. To increase transport *P&E***	●	3.3. To save energy		●
1.4. To increase transport capacity	⦿	3.4. To save urban space		●
Goal 2: To ensure traffic safety	⦿	**Goal 4: To improve economy**		⦿
2.1. To reduce accident frequency	⦿	4.1. To reduce transport costs		●
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		●
		4.3. To improve economic attractiveness		⊙

Applicability			DS = 0,47	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⊙	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		○
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		○
2.1. Operation/control systems	○	4.1. Users		○
2.2. Information systems	⊙	4.2. Non-users		○

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
● = High; ⦿ = Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 13: Assessment of measure NMT4: Non-motorised transport information

In implementation, this measure requires low cost of investment and operation, simple technical and institutional requirements. Moreover, this measure is strongly supported by both users and non-users. According to the terms of selection, this measure is selected into the *first priority group.* Detail assessment results are presented in table E-13.

Table E- 13: Detail assessment of measure NMT4: Non-motorised transport information

NMT4	Non-motorised Transport Information Service							IN
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X	Y			Y

Effectiveness		ES =	2,47	●
Goal 1 : To ensure mobility	●	**2,72**	**Goal 3: To protect environment**	●	**3**
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	●	3
This measure provides information to the captive NMT users (who can not drive or ride by many reasons), NMT's lovers, IMV drivers and tourist. in addition, good information about NMT also helps public transport users, especially the strangers, to access public transport services. Therefore, a high level of impact is given to this measure in this objective.			By encouraging use of NMT, this measure effectively reduces air pollutions. In addition, good NMT information also encourages travellers to use public transport services. Therefore, highest level of impact on reducing air pollutions is given to this measure.		
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	●	3
This measure helps and encourage people to use NMT, especially the captive NMT users. In addition, it informs strange passengers/drivers about the access and availability of public transport supply, park& ride facilities and/or parking facilities. Therefore, a high level of impact is expected from this measure.			By encouraging use of NMT, this measure effectively reduces traffic noise, especially in the residential areas. In addition, good NMT information also encourages travellers to use public transport services. Therefore, highest level of impact on reducing urban noise is given to this measure.		
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	●	3
Good information firstly helps the current NMT users continuing to walk and bike for their trip. Secondly, it encourages travellers to shift from using IMVs to walking or cycling . The use of alley network for urban trips is the most important impact of this measure on increasing productivity and efficiency of the existing urban transport facilities. Therefore, one can expect a high level of impact on increasing productivity of urban transport system by this measure, especially by giving guidance to use the alley network for NMT trips.			By encouraging use of NMT, this measure effectively reduces energy consumption. In addition, good NMT information also encourages travellers to use public transport services. Therefore, highest level of impact on saving energy is given to this measure.		
1.4. To increase transport capacity	⦿	2	*3.4. To save urban space*	●	3
This measure does not increase new transport capacity, but it opens opportunity for people to use the available NMT facilities, especially the alley network.			In MDCs, the conflicts in ROW between NMT and other modes can be effectively reduced by encouraging people to use the alley network to walk and bike instead of driving.		
Goal 2: To ensure traffic safety	⦿	**2,00**	**Goal 4: To improve economy**	⦿	**2,32**
2.1. To reduce accident frequency	⦿	2	*4.1. To reduce transport cost*	●	3
The main impact in reducing accident frequency of this measure is expected from shifting of travel demand from IMV to NMT. Good information of NMT network also helps to reduce conflicts between NMV and IMV on the roads. A medium level of impact on reducing accident frequency is expected from this measure.			Shifting of travel demand from IMV to NMT and PT significantly reduces urban transport costs in infrastructure, vehicle and operation.		
			4.2. To improve economic P&E	●	3
2.2. To reduce accident severity	⦿	2	For most of the urban trips (less than 5 kilometres) in a high density urban area, cycling time is shorter than total travel time of a car driver or a bus passenger. Furthermore, good information helps NMT users to optimise their travel time and distance.		
Similarly , a medium level of impact on reducing accident frequency is expected from this measure.					
			4.3. To improve economic attractiveness	⊙	1
			This measure does not aim to attract the investors to come for creating new jobs in the targeted urban area. However, some impact on tourism can be considered in the case a good NMT information service is provided for tourists in the targeted area.		

(Cont.)

Table E-13: Detail assessment of measure NMT4: Non-motorised Transport Information (Cont.)

Applicability			DS = 0,47	⊙
Criteria 1: Cost of measure	⊙	**1**	**Criteria 3: Institutional participation**	⊙	**0,484**
1.1. Investment cost	⊙	1	3.1. Transport related institutions	⊙	1
This measure requires only some cost to study and develop the information displayers (map, signs, boards...)			This measure is implemented by transport authorities, public transport operators or NMT association.		
1.1. Operation cost	⊙	1	3.2. Political bodies	○	0
Only minor increase in routine maintenance and operation cost is required.			This measure principally does not requires official approval of political bodies.		
Criteria 2: Technical systems	⊙	**0,427**	**Criteria 4: Public acceptance**	○	**0**
2.1. Operation/control systems	○	0	4.1. Users	○	0
No adjustment of operation/control system is required.			This measure is strongly supported by NMT users and public transport passengers.		
2.2. Information systems	⊙	1	4.2. Non-users	○	0
The improvement of NMT information service requires only some local modifications of information systems of other transport modes.			This measure is strongly supported by the non-users.		

NMT5- NMT Right-of-Way Reservation Ordinance

- **Description**

Reservation of ROW for NMT as early as planning stage of urban transport infrastrcuture is an effective way to provide sidewalks and/or bicycle lane with less conflict with other transport modes. This ordinance requires transport planners to provide sufficient ROW for sidewalk, bicycle lane, and parking lots in planning for construction or expansion of any road, parking facility, and public transport station in urban area. This ordinance also requires that continuation of safe Right-of-Way for NMT must be reserved at the sites of infrastructure maintenance or construction projects. Consideration for safe crossing activities of pedestrians and bicyclists is also required. An infrastructure improvement or maintenance project could not be approved if the ROW for NMT is insufficiently considered.

- **Assessment**

In urban and transport conditions of MDCs, this measure is highly effective in ensuring traffic safety for NMT users and in protecting environment. In other aspects, it does not consider as a high effective measure, especially in improving urban economy. In implementation, this measure faces a low level of difficulty in general (DS=0,78). The most concerned barrier in implementing this measure is the cost for acquiring sufficient urban space.

NMT5	Non-motorised Transport Right-of-Way Reservation Ordinance							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X		X		

Effectiveness			ES = 1,95	⦿
Goal 1 : To ensure mobility	⦿	**Goal 3: To protect environment**		●
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		●
1.2. To increase modal choices	●	3.2. To reduce noise		●
1.3. To increase transport *P&E***	⊙	3.3. To save energy		●
1.4. To increase transport capacity	○	3.4. To save urban space		⊙
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		⊙
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		⊙
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		○
		4.3. To improve economic attractiveness		⊙

Applicability			DS = 0,78	⊙
Criteria 1: Cost of measure	⦿	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⊙	3.1. Transport related institutions		⊙
1.1. Operation cost	●	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		○
2.1. Operation/control systems	○	4.1. Users		○
2.2. Information systems	○	4.2. Non-users		○

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 14: Assessment of measure NMT5: NMT Right-of-Way Reservation Ordinance

On the other hand, this measure does not require any technical change and it faces no opposition from public. According to the terms of selection, this measure is selected into the *second priority group* of recommended measures. Detail assessment results are presented in Table E-14.

Table E- 14: Detail assessment of measure NMT5: NMT Right-of-Way Reservation Ordinance

NMT5	Non-motorised Transport Right-of-Way Reservation Ordinance							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X		X		

Effectiveness			ES = 1,95	⦿
Goal 1 : To ensure mobility	⦿	**1,65**	**Goal 3: To protect environment**	● **2,595**
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	● 3
This measure ensures that ROW is provided sufficiently and equally for NMT among the acquired urban space which is dedicated for transport infrastructure facilities. In addition, the ROW of NMT is protected at the sites of any road maintenance and expansion projects.			Beside the pollutionless NMT, this measure also encourages people to use public transport services. Therefore, highest level of impact on reducing air pollutions is given to this measure.	
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	● 3
This measure ensures the highest opportunity of having sufficient and safe ROW and facilities for NMT users.			Beside the noiseless NMT, this measure also encourages people to use public transport services. Therefore, highest level of impact on reducing urban noise is given to this measure.	
*1.3. To increase transport P&E***	⊙	1	*3.3. To save energy*	● 3
Although, increase transport P&E is not the major impact of this measure, an early stage reservation of ROW for NMT helps to minimise number of interruptions and their consequences due to conflicts between NMT and other modes during construction, maintenance and operation stage of infrastructure facilities.			Beside the fuelless NMT, this measure also encourages people to use public transport services. Therefore, highest level of impact on saving energy is given to this measure.	
1.4. To increase transport capacity	○	0	*3.4. To save urban space*	⊙ 1
Although this measure does not aims to increase transport capacity.			In principle, a sound plan optimises the use of urban space, but in practice, many bicycles lane and sidewalks are redundantly provided, especially in the new road construction projects. Therefore, this measure itself is not considered as an effective solution to save urban space.	
Goal 2: To ensure traffic safety	●	**2,43**	**Goal 4: To improve economy**	⊙ **0,94**
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	⊙ 2
Sufficiently and protected ROW is the most important condition to ensure a safe NMT.			Shifting of travel demand from IMV to NMT and PT significantly reduces urban transport costs in infrastructure, vehicle and operation. On the other hand, reserving high value urban space is very costly in some case.	
			4.2. To improve economic P&E	○ 0
2.2. To reduce accident severity	⦿	2	This measure does not create recognisable impact on improving urban economic P&E directly.	
			4.3. To improve economic attractiveness	⊙ 1
This measure reduce severe accidents, which caused by IMVs and between IMVs and NMVs.			Although, this measure does not strongly impact on creating job, some level of impact can be indirectly counted from the benefit of improvements in tourism, shopping and service in a city with safe and clean environment for walking and cycling.	

Applicability			DS = 0,78	⊙
Criteria 1: Cost of measure	⦿	**2,055**	**Criteria 3: Institutional participation**	⦿ **1**
1.1. Investment cost	⊙	1	3.1. Transport related institutions	⊙ 1
In principle, this measure requires only study cost.			This measure is implemented by transport authorities and/or city planners.	
1.1. Operation cost	●	3	3.2. Political bodies	⊙ 1
The main difficult in implementation of this measure is the required urban space, which is very costly in MDCs.			This measure principally requires official approval of the city political bodies.	
Criteria 2: Technical systems	⊙	**0**	**Criteria 4: Public acceptance**	○ **0**
2.1. Operation/control systems	○	0	4.1. Users	○ 0
No adjustment of operation/control system is required.			This measure is strongly supported by NMT and public transport users. No opposition of IMV drivers is experienced.	
2.2. Information systems	○	0	4.2. Non-users	○ 0
No adjustments of local information equipments is required.			No opposition can be the land owners or residents is experienced.	

Individual motorised vehicle measures

IMV1- Right-of-Way Reduction for Private Car

- **Description**

This measure aims to control properly the right to use road and parking space in targeted urban area or road section of private cars according to the land use patterns and time. The intended impact of this measure is to reserve road space for other transport modes by reducing and restricting the right to use urban space of IMVs. For example, parking and driving of private car traffic should be restricted from a congested road or the city centre during morning and evening peak hours. Devices for this measure are well known as car-free zone/street (similar to the NMT zone), cul-de-sac, one-way traffic for car, parking prohibition etc.

- **Assessment**

In urban and transport conditions of MDCs, this measure is highly effective in ensuring traffic safety and improving urban economy. In detail, this measure is highly effective in three of four sub-criteria in ensuring urban mobility, but it has no impact on increasing supply capacity. In protecting environment and natural resources, shifting of travel demand from private car to motorcycle and other modes is highly effective in saving energy and urban space, but the impact on reducing air pollutions is limited, and no positive impact can be expected in reducing urban noise. In implementation, this measure is considered as a low cost measure and it requires only local adjustments of control and information systems.

IMV1	Right of Way Reduction for Private Cars							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X	Y	X		

Effectiveness			ES = 2,29	⦿
Goal 1 : To ensure mobility	⦿	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⦿
1.2. To increase modal choices	●	3.2. To reduce noise		○
1.3. To increase transport *P&E***	●	3.3. To save energy		●
1.4. To increase transport capacity	○	3.4. To save urban space		●
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		●
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		●
		4.3. To improve economic attractiveness		⦿

Applicability			DS = 1,10	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⊙	3.1. Transport related institutions		⦿
1.1. Operation cost	○	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		⊙
2.1. Operation/control systems	⊙	4.1. Users		⊙
2.2. Information systems	⊙	4.2. Non-users		⦿

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
● = High; ⦿ = Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 15: Assessment of measure IMV1: Right-of-Way Reduction for Private Car

The concerned barriers are opposition of some car-based businesses in the targeted area and the participation of transport authorities and traffic police. According to the terms of selection, this measure is selected into the *second priority group* of recommended measures. Detail assessment results are presented in table E-15.

Table E- 15: Detail assessment of measure IMV1: Right-of-Way Reduction for Private Car

IMV1	Right of Way Reduction for Private Cars							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X	Y	X		

Effectiveness			ES = 2,29	⦿
Goal 1 : To ensure mobility	⦿	**2,18**	**Goal 3: To protect environment**	⦿	**1,887**
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⦿	2
This measure ensures that road space is protected from low-efficiency transport modes (private car) and provided to higher efficiency modes (public transport, NMT, MCs). This significantly increases opportunity of using road space for all social groups in the society.			In MDCs, the monocentric urban form is supportive for this measure because most of traffic generators are located in the city centre. Reduction of ROW significantly shifts travel demand from IMVs to PT, NMT and motorcycles . However, if the targeted vehicle is only private car, most of car drivers will shift to use motorcycles. In this case, a medium level of impact on reducing air pollutions is expected.		
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	○	0
Reduction of ROW for IMVs opens opportunity to assign more ROW for public transport and NMT. Without sufficient ROW, public transport prioritisation or NMT promotion measures can not be applied. Therefore, a high level of impact on increasing modal choices is given to this measure.			If the targeted vehicle is only private car, most of car drivers will shift to use motorcycles. Therefore, this measure does not create positive impact on reducing noise.		
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	●	3
This measure increases of utilisation of available road space by shifting ROW from IMVs to public transport and NMT. Therefore, a high level of impact is given to this measure.			This measure is highly effective in saving energy.		
1.4. To increase transport capacity	○	0	*3.4. To save urban space*	●	3
This measure does not aim to increase capacity of the transport supply.			This measure is highly effective in saving urban space by reducing space demand for expansion of roads and provision of parking facilities.		
Goal 2: To ensure traffic safety	●	**2,43**	**Goal 4: To improve economy**	●	**2,66**
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	●	3
This measure significantly reduces number of accident in the targeted area during targeted period.			Shifting of travel demand from using private car to motorcycle, NMT and PT significantly reduces urban transport costs in infrastructure, vehicle and operation. Therefore, the highest level of impact on reducing transport cost is given to this measure.		
			4.2. To improve economic P&E	●	3
2.2. To reduce accident severity	⦿	2	Although many drivers believe that their travel time and distance would be increased by this measure, the facts show a opposite image. This measure is highly effective in saving trip time, especially the delay in congestion and searching for parking. The extra distance due to detour by congestion and searching for parking places can also eliminated for drivers. Moreover, a big save of travel time is given for public transport passengers and NMT by alleviating of traffic congestion.		
This measure helps to reduce severe traffic accidents by eliminating the accidents, which caused by conflicts between IMVs and other vehicles in the urban areas (a relative sow speed).					
			4.3. To improve economic attractiveness	⦿	2
			At first, this measure may create some reduction of revenues of commercial activities within the targeted area. However, reserved ROW will be better utilise for other transport modes and services (public transport, taxi, motorcycles), which increase the accessibility of the urban area and improve.		

(Cont.)

Table E-15: Detail assessment of measure IMV1: Private car Right-of-Way Reduction

Applicability			DS = 1,10	⊙
Criteria 1: Cost of measure	⊙	**0,472**	**Criteria 3: Institutional participation**	⊙	**1,484**
1.1. Investment cost	⊙	1	3.1. Transport related institutions	◉	2
This measure requires cost for study and information			This measure requires participation of transport authorities and traffic polices.		
1.1. Operation cost	○	0	3.2. Political bodies	⊙	1
This measure does not requires additional operation cost.			Approval of city political bodies is required in application of this measure.		
Criteria 2: Technical systems	⊙	**1**	**Criteria 4: Public acceptance**	⊙	**1,375**
2.1. Operation/control systems	⊙	1	4.1. Users	⊙	1
Some minor adjustments of local operation/control equipments are required.			The car drivers normally against this measure but public transport passengers, NMT users and motorcyclists are happy.		
2.2. Information systems	⊙	1	4.2. Non-users	◉	2
Some minor adjustments of local information equipments are required.			The main counter force comes from commercial investors, IMV manufacturers and maintenance services.		

(Cont.)

IMV2- Separation of Motorcycle Traffic

- **Description**

This measure aims to separate Right-of-Way between motorcycles and four-wheel vehicles on the urban arterials. The main traffic impact of this measure is to reduce inflow conflicts between motorcycles and other transport modes. In application, JICA et al. (2004), JICA & HPC (2005) found that the main issues in operation of segregated motorcycle lane are conflicts between buses and motorcycles in bus's manoeuvrings at the bus stops. The other issue is conflict between right-turning movements of the middle lane vehicles and the through traffic of the outer lane at the intersection.

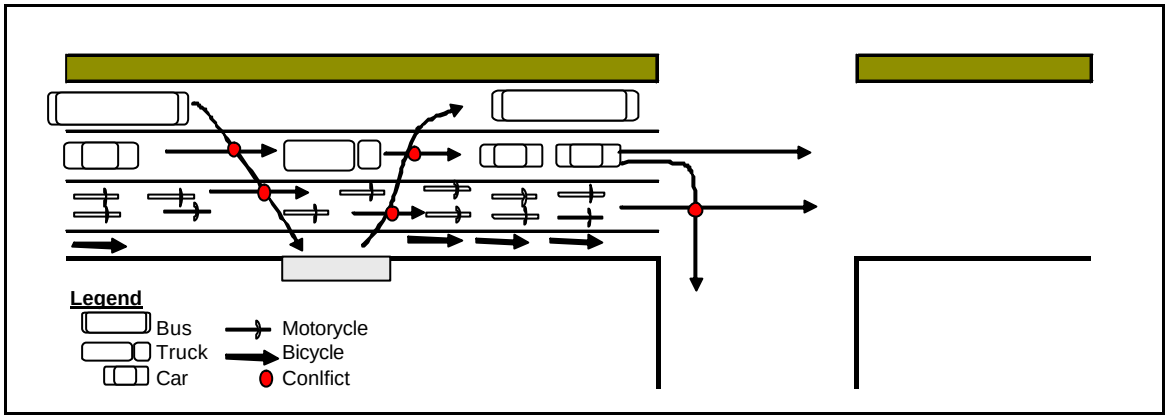


Figure E- 16: Example of Motorcycle Traffic Separation – without bus stop relocation

Therefore, relocation of bus stops would be considered as a critical part of this measure in order to eliminate bus-motorcycle conflicts. The other tactic is provision of a head-starting zone for motorcycle in order to eliminate the conflicts between right-turning movements and through traffic flow.

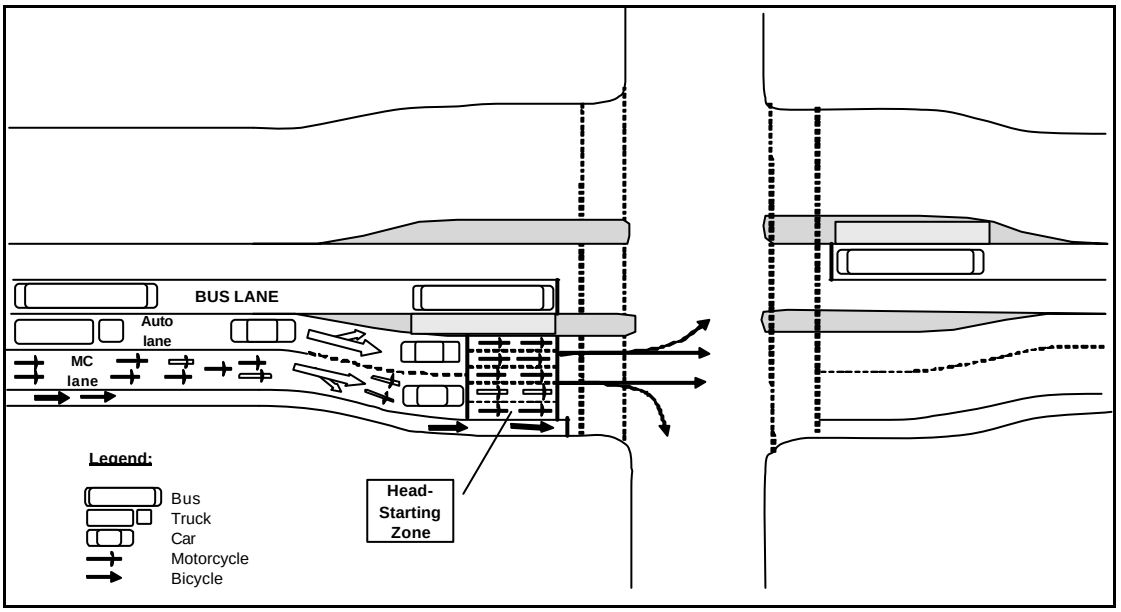


Figure E- 17: Example of Motorcycle Traffic Separation – with bus stop relocation and Head-Starting Zone for motorcycles at the intersection

Hsu, Shadullah et al. (2003) found that the starting delay of motorcycle at intersection is almost zero and the acceleration of MC is higher rate than car from stationary position. Therefore, provision of a head-starting zone for motorcycle at intersection is an effective measure to eliminate the conflict between right-turning four-wheelers and motorcycle at intersection and the delay of chaotic vehicle mix. The main issue of this head-starting zone is the increase of inter-green time (for about 0.5 to 1.0 second/approach) of the traffic signal control program at the intersection. However, the significant reduction of delay and improvement of safety are the bigger compensation for that increase (Hsu, 2004). On the other hand, the disadvantaged group in this measure is the car drivers group, who are the minorities in the traffic flow in the MDCs.

- **Assessment**

In term of effectiveness, this measure is highly effective in improving urban traffic safety but its impact is low in protecting environment and resources. The impacts in ensuring urban mobility and improving economy are at medium level.

IMV2	Separation of Motorcycle Traffic							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
						X		

Effectiveness			ES = 2,10	⦿
Goal 1 : To ensure mobility	⦿	**Goal 3: To protect environment**		⊙
1.1. To ensure equality in using *UTP**	⦿	3.1. To reduce air pollutions		⊙
1.2. To increase modal choices	⦿	3.2. To reduce noise		⊙
1.3. To increase transport *P&E***	●	3.3. To save energy		⊙
1.4. To increase transport capacity	○	3.4. To save urban space		⊙
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		⦿
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		⦿
2.2. To reduce accident severity	●	4.2. To improve economic P&E		⦿
		4.3. To improve economic attractiveness		●

Applicability			DS = 1,57	⦿
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⦿
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	⦿	**Criteria 4: Public acceptance**		⦿
2.1. Operation/control systems	⦿	4.1. Users		⊙
2.2. Information systems	⊙	4.2. Non-users		●

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non **UTP* = urban transport properties; ***P&E* = Productivity and Efficiency;

Figure E- 18: Assessment of measure IMV2: Separation of Motorcycle Traffic

In implementation, this measure faces a low level of impact (DS=1,57). In detail, this measure faces medium level of difficulty in investment cost, traffic control system (mainly at intersections) and the participation of transport authorities. The most concerned difficulty is the land users (non-users) in the case they would have to resettle or to relocate their business or properties to give space for implementing this measure. According to the terms of selection, this measure is selected into the *third priority group* of recommended measures. Detail assessment results are presented in Table E-16.

Table E- 16: Detail assessment of measure IMV2: Separation of Motorcycle Traffic

IMV2	Separation of Motorcycle Traffic							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
						X		

Effectiveness			ES = 2,10	⦿
Goal 1 : To ensure mobility	⦿	**1,71**	**Goal 3: To protect environment**	⊙	**1**
*1.1. To ensure equality in using UTP**	⦿	2	*3.1. To reduce air pollutions*	⊙	1
This measure ensure the safe and separate right of way for the main individual transport mode in MDCs. On the other hand, defined ROW for motorcycles prevents their violations to ROW of other transport mode, especially bus and bicycle.			Although concentration of air pollutions during peak period is reduced by eliminating of traffic congestions due to conflicts and undesired speed reductions on the traffic flow, this measure does not aim to reduce IMV traffic. Therefore, a low level of impact on reducing air pollution is expected from this measure.		
1.2. To increase modal choices	⦿	2	*3.2. To reduce noise*	⊙	1
Although, this measure encourage IMV drivers to use motorcycle, the separate right of way for motorcycle also helps to improve traffic environment for other transport modes, especially bicycle and bus.			Although level of noise during peak period is reduced by eliminating of traffic congestions due to conflicts and undesired speed reductions on the traffic flow, this measure does not aim to reduce IMV traffic. Therefore, a low level of impact on reducing noise is expected from this measure.		
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	⊙	1
Separation of motorcycle from four wheelers traffic considerably improves productivity of both motorcycle lane and auto lane by increasing uniformity of vehicle on the traffic flow.			Although smoother traffic flow considerably improves energy efficiency of vehicle, this measure does not aim to reduce IMV traffic. Therefore, a low level of energy saving can be expected from this measure.		
1.4. To increase transport capacity	○	0	*3.4. To save urban space*	⊙	1
This measure does not aim to increase transport capacity.			Although smoother traffic flow considerably improves efficiency of road space, this measure does not aim to reduce IMV traffic. On the other hand, better IMV traffic encourages the expansion of city. Therefore, a low level of energy saving can be expected from this measure.		
Goal 2: To ensure traffic safety	●	**3,00**	**Goal 4: To improve economy**	⦿	**2,34**
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	⦿	2
This measure significantly reduces number of accidents in the targeted area during targeted period.			Reduction of vehicle operation cost can be expected from this measure, especially for the long distance trips (5 kilometres).		
			4.2. To improve economic P&E	⦿	2
2.2. To reduce accident severity	●	3	Smoother traffic flow significantly reduces traffic congestion and saves travel time for motorcyclists, car drivers and bus passengers. However, the benefit of time saving by travelling on separate motorcycle lane may encourage some drivers to extend their trip distance.		
			4.3. To improve economic attractiveness	●	3
This measure helps to reduce severe traffic accidents by eliminating conflicts between motorcycles and heavier motorised vehicles.			Smoother traffic along the urban arterials make the city centres become more accessible and attractive for the residents who are living in the urban fingers to go for working, shopping and using other public services in the centres. On the other hand, better traffic quality along the arterials will encourage residents in the centres to move to the urban fingers for living, where housing price is cheaper and environment is better.		

(Cont.)

Table E-16: Detail assessment of measure IMV2: Separation of Motorcycle Traffic (Cont.)

Applicability			DS = 1,57		⦿
Criteria 1: Cost of measure	⊙	**1,472**	**Criteria 3: Institutional participation**	⊙	**1,484**
1.1. Investment cost	⦿	2	3.1. Transport related institutions	⦿	2
A considerable amount of investment is required in implementation of this measure in the case it needs some additional urban space to provide sufficient right of way for motorcycle lanes and modification of intersection and bus stops.			This measure requires participation of traffic polices.		
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙	1
This measure requires only minor additional operation cost.			Approval of city political bodies is required in application of this measure.		
Criteria 2: Technical systems	⦿	**1,573**	**Criteria 4: Public acceptance**	⦿	**1,751**
2.1. Operation/control systems	⦿	2	4.1. Users	⊙	1
For an urban scale project, this measure requires a significant changes on operation/control system, especially the traffic signal controls.			The IMVs drivers, bus passengers and NMT users are happy with this measure.		
2.2. Information systems	⊙	1	4.2. Non-users	●	3
Only some local adjustments of information system for IMV are required.			Acceptance of land users is very difficult to achieve if they would have to resettle or relocate their property/business.		

IMV3- Vehicle Taxes and Duties

- **Description**

This measures aims to increase costs of purchasing and using individual motorised vehicles (PC and MC) in order to make them become less attractive for the travellers. In addition, this measure is aims to collect revenue for financing other traffic management measures. The taxes and duties can be implemented in the fixed or variable form. The first is imposed by a fixed rate at a specific time (registering or disposal) or for a specific period (e.g. per 1 year) and do not consider to the level of using that vehicle (e.g. import tax, special consumption tax, registration fee…). The variable tax and duties are charged for vehicles according to the use of them (vehicle kilometres). The most popular device in this form is the fuel tax, but it requires certain tax refund or tax reduction mechanisms for public transport vehicles.

- **Assessment**

In urban and transport conditions of MDCs, this measure is one of the most effective measures, especially on improving traffic safety and protecting environment. In term of applicability, the most difficult barrier for implementation of this measure is the requirement for national level decisions (e.g. a decision of the general assembly), a single city, or region cannot apply this measure.

IMV3	Vehicle Taxes and Duties							ECO
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X			Y	

Effectiveness			ES = 2,45	●
Goal 1 : To ensure mobility	⦿	**Goal 3: To protect environment**		●
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		●
1.2. To increase modal choices	⦿	3.2. To reduce noise		●
1.3. To increase transport *P&E***	●	3.3. To save energy		●
1.4. To increase transport capacity	○	3.4. To save urban space		●
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		●
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		⦿
		4.3. To improve economic attractiveness		●

Applicability			DS = 1,26	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⦿
1.1. Investment cost	⊙	3.1. Transport related institutions		○
1.1. Operation cost	○	3.2. Political institutions		●
Criteria 2: Technical systems	○	**Criteria 4: Public acceptance**		●
2.1. Operation/control systems	○	4.1. Users		●
2.2. Information systems	○	4.2. Non-users		⦿

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non ** UTP* = urban transport properties; *** P&E* = Productivity and Efficiency;

Figure E- 19: Assessment of measure IMV3: Vehicle taxes and Duties

In addition, this measure is strongly opposed by IMV drivers, manufacturers, and maintenance businesses in the targeted area. In contrast, this measure is considered as a low-cost measure and it requires neither any change of technical systems nor transport related institutions. According to the terms of selection, this measure is selected into the *first priority group* of recommended measures. Detail assessment results are presented in Table E-17.

Table E- 17: Detail assessment of measure IMV3: Vehicle taxes and Duties

IMV3	Vehicle Taxes and Duties for IMVs							ECO
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X			Y	

Effectiveness — ES = 2,45 ●

Goal 1 : To ensure mobility — ⦿ 1,92

*1.1. To ensure equality in using UTP** — ● 3

This measure firstly reduce the affordability of IMVs, thus, it reduces the use of IMV efficiently. Furthermore, this measure collects revenues for funding other traffic management measures, especially to subsidy public transport service.

1.2. To increase modal choices — ⦿ 2

On one side, this measure increases the difficulty to afford IMVs, and forces low income IMVs to use public transport and NMT, even for long distance trips or with low quality service. However, these trips can be served by taxi or motorcycle taxi. On the other side, the received taxes and duties can be provided for improving quality of public transport service. It can also use to provide incentives for public transport users. In many cases, the fund helps to provide additional sidewalks, bicycle lanes, and support facilities. From the social view point, a high level of impact on increasing modal choices.

*1.3. To increase transport P&E*** — ● 3

This measure avoid the use of IMVs and reserves urab road space for public transport services, which are much higher capacity and efficiency than IMVs. On the other hand, this measure encourage travellers to use public transport and NMT service by reducing their affordability of owning and travelling by IMVs.

1.4. To increase transport capacity — ○ 0

This measure does not aim to increase transport capacity.

Goal 2: To ensure traffic safety — ● 2,43

2.1. To reduce accident frequency — ● 3

Experiences show that high vehicle purchasing cost is the main barrier to prevent people to drive, especially in MDCs. On the other hand, this measure protect the market for public transport and NMT. Therefore, this measure helps to avoid traffic accidents.

2.2. To reduce accident severity — ⦿ 2

This measure helps to reduce severe traffic accidents by eliminating the accidents, which caused by conflicts between IMVs and other vehicles.

Goal 3: To protect environment — ● 3

3.1. To reduce air pollutions — ● 3

By preventing MV traffic, this measure significantly reduces air pollutions in the urban area.

3.2. To reduce noise — ● 3

By preventing MV traffic, this measure significantly reduces noise in the urban area.

3.3. To save energy — ● 3

By preventing MV traffic, this measure significantly saves energy in the urban area.

3.4. To save urban space — ● 3

By preventing MV traffic, this measure significantly saves urban space.

Goal 4: To improve economy — ● 2,64

4.1. To reduce transport cost — ● 3

This measure on one side saves investment in IMV infrastructure and control equipment and also avoids gasoline consumption. On the other side it encourages people to use public transport and NMT.

4.2. To improve economic P&E — ⦿ 2

By preventing the extreme use of IMV, this measure significantly reduces traffic congestion in the urban area. Therefore, it helps to save travel time in general. However, for some long distance trips, travelling by public transport and NMT normally requires more travel time than driving IMV.

4.3. To improve economic attractiveness — ● 3

High vehicle taxes and duties discourage domestic IMV industry and after sale services. However, the scale of IMV industry in many developing countries is still small (e.g. Vietnam, Bangladesh, Pakistan) and it is no more a high profit sector today and in the future (e.g. Thailand, Malaysia). Therefore, the barrier on investment in IMV industry may be the opportunity to appeal investment capital in the other sectors, which would have brighter future in these developing countries. In some other developing countries, the IMV industry is a key economic sector. Therefore, the implementation of IMV will force the manufacturers to increase the share of export in order to remain their productivity (e.g. India, China, Indonesia).Therefore, a positive impact on this objective is still accounted for this measure.

(Cont.)

Table E-17: Detail assessment of measure IMV3: Vehicle taxes and Duties (Cont.)

Applicability			DS = 1,26	⊙
Criteria 1: Cost of measure	⊙	**0,472**	**Criteria 3: Institutional participation**	◉	**1,55**
1.1. Investment cost	⊙	1	3.1. Transport related institutions	○	0
Only study cost is required.			No transport related institution is required.		
1.1. Operation cost	○	0	3.2. Political bodies	●	3
This measure requires only minor additional operation cost by increasing some employees and office equipments in the ministry of finance. However, the revenue from taxes and duties is simply cover these expenses.			Approval of national political bodies is required in application of this measure.		
Criteria 2: Technical systems	○	**0**	**Criteria 4: Public acceptance**	●	**2,62**
2.1. Operation/control systems	○	0	4.1. Users	●	3
No additional operation and control system is required.			The IMVs drivers are unhappy, but public transport passengers and NMT users are happy. However, if the tax for motorcycles is increased, the counter force is significant.		
2.2. Information systems	○	0	4.2. Non-users	◉	2
No additional information system is required.			IMV manufacturers, IMV service providers, high income people definitely oppose this measure, but the IMV industry in developing countries is not a major economic sector in term of profit and number of jobs. On the other hand, no land owner is suffered by this measure . Therefore, a medium level of difficulty is counted for this barrier.		

IMV4- Road Pricing for Private Car

- **Description**

This measure aims to reduce motorised vehicle traffic by imposing certain amounts of charge to the road users during a specific period (e.g. peak hours) and at certain road section a part or overall road network or in certain sections, for certain transport mode (e.g. car). On the other hand, this measure is an effective tool to balance the transport subsidies between all transport modes. For freight transport vehicles, Road Pricing is also used as a tool for collecting the infrastructure cost of the truck traffic, but it is normally applied on the expressways and rural highways (e.g. German truck tolling system). A toll rate can be applied for truck but its impact focuses on getting revenue rather than traffic management.

With the mono-centric urban form of MDCs, cordon pricing is more suitable for the congested city centre. The targeted vehicle should be **private car** only. In the technological aspect, a manual tolling system is affordable, but traffic congestion at the tollgates is the main reason for many failures of Road Pricing in MDCs (e.g. Hanoi and Hochiminh City). An electronic tolling system is a proper application to avoid the tollgate congestion, but the heavy investment is the main barrier to achieve this high-tech application. Another difficulty is rising during decision-making process. In many MDCs, a national-level decision must be required for such measure as Road Pricing.

- **Assessment**

In urban and transport conditions of MDCs, Road Pricing is appreciated as a highly effective measure, especially on ensuring urban mobility and improving economy. In improvement of urban traffic safety and environment, its impacts are also considerable. In application, this measure does not face crucial difficulties as the case in developed cities (DS=1,37). The most difficult barrier is the high level of institutional participation.

IMV4	Road Pricing for Private Car							ECO
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
		Y	X	X	Y			

Effectiveness			ES = 2,09	⦿
Goal 1 : To ensure mobility	⦿	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⊙
1.2. To increase modal choices	●	3.2. To reduce noise		○
1.3. To increase transport *P&E***	●	3.3. To save energy		●
1.4. To increase transport capacity	○	3.4. To save urban space		●
Goal 2: To ensure traffic safety	⦿	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	⦿	4.1. To reduce transport costs		●
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		●
		4.3. To improve economic attractiveness		⦿

Applicability			DS = 1,27	⦿
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		●
1.1. Investment cost	⦿	3.1. Transport related institutions		⦿
1.1. Operation cost	○	3.2. Political institutions		●
Criteria 2: Technical systems	○	**Criteria 4: Public acceptance**		⊙
2.1. Operation/control systems	○	4.1. Users		⊙
2.2. Information systems	⊙	4.2. Non-users		⊙

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 20: Assessment of measure IMV4: Road Pricing for Private Car

Secondly, considerable amount of investment cost for electronic tolling system is also required. The opposition of car drivers and car manufacturers is existent but its impact is low. According to the terms of selection, this measure is selected into the *second priority group* of recommended measures. Detail assessment results are presented in Table E-18.

Table E- 18: Detail assessment of measure IMV4: Road Pricing for Private Car

IMV4	Road Pricing for Private Car							ECO
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
		Y	X	X	Y			

Effectiveness			ES = 2,09	⦿
Goal 1 : To ensure mobility	⦿	**2,18**	**Goal 3: To protect environment**	⦿ **1,568**
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⊙ 1
This measure firstly increase the cost of using IMVs, thus, it reduces the use of IMV efficiently. Furthermore, this measure collects revenues for funding other traffic management measures, especially to subsidy public transport service.			By reducing car traffic, this measure reduces air pollutions in the urban area. A medium level of impact is given to this measure according to the level of preventing car traffic.	
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	○ 0
On one side, this measure increases the difficulty to drive car and forces car drivers to use public transport, NMT or sharing mode, esepcially for long distance trips. On the other side, the revenue can be provided for improving quality and affordability of public transport service and NMT facilities.			If the targeted vehicle is only private car, most of car drivers will shift to use motorcycles. Therefore, this measure does not create positive impact on reducing noise.	
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	● 3
The main impact of this measure is to alleviate traffic congestion in the targeted urban area by reducing IMV traffic. Experiences show that, a slight reduction of IMV traffic during peak period significantly improve traffic quality (speed) in the city centre. Therefore, a high level of impact on increase transport productivity and efficiency is given to this measure.			By reducing car traffic, this measure effectively helps to save energy in the urban area.	
1.4. To increase transport capacity	○	0	*3.4. To save urban space*	● 3
This measure does not aim to increase transport capacity.			By preventing car traffic, this measure significantly saves urban space.	
Goal 2: To ensure traffic safety	⦿	**2,00**	**Goal 4: To improve economy**	● **2,66**
2.1. To reduce accident frequency	⦿	2	*4.1. To reduce transport cost*	● 3
The reduction of car traffic along the urban roads helps to effectively reduce the conflicts between cars and other vehicles on the links and at intersections.			This measure on one side increase the cost of car traffic and on the other side it saves investment in car-based infrastrcuture and control equipment and also avoids gasoline consumption.	
			4.2. To improve economic P&E	● 3
2.2. To reduce accident severity	⦿	2	By preventing the extreme use of car, this measure helps to reduces traffic congestion in the urban area, especially during applied period. Therefore, it helps to save travel time in general. The shift of travellers from cars to motorcycles can also help to save travel time, esepcially for urban trips.	
This measure helps to reduce severe traffic accidents by eliminating the accidents, which caused by conflicts between cars and other vehicles.			*4.3. To improve economic attractiveness*	⦿ 2
			Although road pricing may discourage some commercial activities at the beginning, for the long time with improvements of public transport and commercial transport services, the attractiveness of city centre will be better. Furthermore, reducing of traffic congestion makes the city become more attractive for the investors.	

(Cont.)

Table E-18: Detail assessment of measure IMV4: Road Pricing for Private Car (Cont.)

Applicability			DS = 1,27		⦿
Criteria 1: Cost of measure	⊙	**0,945**	**Criteria 3: Institutional participation**	●	**2,516**
1.1. Investment cost	⦿	2	3.1. Transport related institutions	⦿	2
Road pricing in a high density and lacking road as MDCs needs high-tech application in order to avoid traffic congestion at the toll gates. Therefore, a considerable amount of investment on electronic tolling system and on-board units is required.			Transport authorities and traffic policies are required to implement this measures.		
1.1. Operation cost	○	0	3.2. Political bodies	●	3
This measure requires considerable additional operation cost of the technical equipments. However, the operation cost of this measure is easily compensated by revenue from toll fee.			In some cases, an approval of city political bodies is enough, but normally, approvals of national political bodies is required in application of this measure.		
Criteria 2: Technical systems	○	**0,427**	**Criteria 4: Public acceptance**	⊙	**1**
2.1. Operation/control systems	○	0	4.1. Users	⊙	1
Normally, road pricing has its own control and monitoring system, there fore no additional operation and control system is required.			The car drivers are very unhappy, especially if the but public transport passengers, NMT users and motorcyclists are very happy.		
2.2. Information systems	⊙	1	4.2. Non-users	⊙	1
Some adjustment of information system is required.			Car manufacturers, after-sale service providers, high income people definitely oppose this measure but the car industry in developing countries is not a major economic sector in term of profit and number of jobs. On the other hand, no land owner is suffered by this measure . Therefore, a medium level of difficulty is counted for this barrier.		

IMV5- Parking Pricing

- **Description**

This measure aims to increase cost of using IMVs in order to reduce the attractiveness of the targeted mode in the targeted area. The central part of this measure is a gradual Parking Pricing system for private motorised and commercial vehicles according to the land use patterns of targeted urban area or by time. The targeted urban area can be classified into different categories (A, B, C) according to the levels of private motorised vehicle discouragement. The highest parking price would be applied in the most discouraged private motorised vehicle category, in the most congestion sensitive area and time.

- **Assessment**

In urban and transport conditions of MDCs, Parking Pricing can be considered as a medium effective measure (ES=2,05). In detail, this measure is highly effective in ensuring equality, increasing modal choice and transport productivity and efficiency but no additional capacity is increased, while it got a medium level for all other criteria and sub-criteria.

IMV5	Parking Pricing							ECO
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
		Y	Y	X	X			

Effectiveness			ES = 2,05	⦿
Goal 1 : To ensure mobility	⦿	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⦿
1.2. To increase modal choices	●	3.2. To reduce noise		⦿
1.3. To increase transport *P&E***	●	3.3. To save energy		⦿
1.4. To increase transport capacity	○	3.4. To save urban space		⦿
Goal 2: To ensure traffic safety	⦿	**Goal 4: To improve economy**		⦿
2.1. To reduce accident frequency	⦿	4.1. To reduce transport costs		⦿
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		⦿
		4.3. To improve economic attractiveness		⦿

Applicability			DS = 0,95	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⊙	3.1. Transport related institutions		⦿
1.1. Operation cost	○	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		⦿
2.1. Operation/control systems	○	4.1. Users		⦿
2.2. Information systems	⊙	4.2. Non-users		⊙

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 21:Assessment of measure IMV5: Parking Pricing

In term of applicability, this measure faces considerable difficulties from institutional participation (transport related institutions) and users' acceptance. However, the cost of measure is low and only minor change of information system is required. According to the terms of selection, this measure is selected into the *second priority group* of recommended measures. Detail assessment results are presented in Table E-19.

Table E- 19: Detail assessment of measure IMV5: Parking Pricing

IMV5	Parking Pricing							ECO
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
		Y	Y	X	X			

Effectiveness			ES = 2,05	⦿
Goal 1 : To ensure mobility	⦿	2,18	**Goal 3: To protect environment**	⦿ 2
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⦿ 2
This measure firstly increase the cost of using IMVs, thus, it reduces the use of IMV efficiently. Furthermore, this measure collects revenues for funding other traffic management measures, especially to subsidy public transport service.			By reducing IMV traffic, this measure reduces air pollutions in the urban area. A medium level of impact is given to this measure according to the level of preventing IMV traffic.	
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⦿ 2
On one side, this measure increases the difficulty to drive IMVs, and forces IMV drivers to use public transport, NMT or sharing mode, esepcially for long distance trips. On the other side, the revenue can be provided for improving quality and affordability of public transport service and NMT facilities.			By reducing IMV traffic, this measure reduces noise in the urban area. A medium level of impact is given to this measure according to the level of preventing IMV traffic.	
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	⦿ 2
The main impact of this measure is to alleviate traffic congestion in the targeted urban area by reducing IMV traffic. Experiences show that, a slight reduction of IMV traffic during peak period significantly improve traffic quality (speed) an productivity of urban road. For parking facilities, the fee encourage drivers to reduce their parking time and frequency significantly. Therefore, a high level of impact on increase transport productivity and efficiency is given to this measure.			By reducing IMV traffic, this measure helps to save energy in the urban area. A medium level of impact is given to this measure according to the level of preventing IMV traffic.	
1.4. To increase transport capacity	○	0	*3.4. To save urban space*	⦿ 2
This measure does not aim to increase transport capacity.			By preventing MV traffic, this measure considerably saves urban space.	
Goal 2: To ensure traffic safety	⦿	2,00	**Goal 4: To improve economy**	⦿ 2,00
2.1. To reduce accident frequency	⦿	2	*4.1. To reduce transport cost*	⦿ 2
The reduction of IMV traffic along the urban roads helps to effectively reduce the conflicts between IMV and other vehicles on the links and at intersections.			This measure on one side increase the cost of IMV traffic and on the other side it saves investment in IMV infrastructure and control equipment and also avoids gasoline consumption. The most important impact on this objective is to shift travel demand from using IMVs to public transport and NMT.	
			4.2. To improve economic P&E	⦿ 2
2.2. To reduce accident severity	⦿	2	By preventing the extreme use of IMV, this measure helps to reduces traffic congestion in the urban area, especially during applied period. Therefore, it helps to save travel time in general. In addition, the higher driving cost of IMVs encourage the commercial transport and logistic services.	
This measure helps to reduce severe traffic accidents by eliminating the accidents, which caused by conflicts between IMVs and other vehicles.				
			4.3. To improve economic attractiveness	⦿ 2
			Although parking pricing may discourage some economic activities at the beginning, for the long time with improvements of public transport and commercial transport services, the attractiveness of city centre will be better. Furthermore, reducing of traffic congestion makes the city become more attractive for the investors.	

(Cont.)

Table E-19: Detail assessment of measure IMV5: Parking Pricing (Cont.)

Applicability			DS = 0,95	⊙
Criteria 1: Cost of measure	⊙	**0,472**	**Criteria 3: Institutional participation**	⊙	**1,484**
1.1. Investment cost	⊙	1	3.1. Transport related institutions	◉	2
This measure requires only small investment for manual systems or simple automatic parking meters.			Transport authorities and traffic policies are required to implement this measures.		
1.1. Operation cost	○	0	3.2. Political bodies	⊙	1
This measure requires minor additional operation cost for automatic parking meters and some employees. However, the operation cost of this measure is easily compensated by revenue from parking fee.			In most of the cases, an approval of city political bodies is required in application of this measure.		
Criteria 2: Technical systems	⊙	**0,427**	**Criteria 4: Public acceptance**	◉	**1,625**
2.1. Operation/control systems	○	0	4.1. Users	◉	2
Normally, road pricing has its own control and monitoring system, there fore no additional operation and control system is required.			The IMVs drivers are unhappy, but public transport passengers and NMT users area happy. However, if parking price for motorcycles is increased, the counter force is considerable. Experiences show that this measure is easier to be accepted than the road pricing.		
2.2. Information systems	⊙	1	4.2. Non-users	⊙	1
Some adjustment of information system is required.			IMV manufacturers, high income people definitely oppose this measure. However, no land owners are suffered and the IMV industry in developing countries is not a major economic sector. Therefore, a medium low of difficulty is counted for this barrier.		

IMV6- Parking Information Service

- **Description**

This measure aims to provide to IMV drivers sufficient information about the location, access direction, planned and real-time availability of the parking places. In MDCs, bicycle parking slots are usually provided at public parking places. Therefore, bicyclists are also benefited form this measure. In developed cities, the Parking Information Service is integrated as a part of in the urban traffic information system (OECD 2002). However, in most of the cities, especially in developing countries, the Parking Information Service is still poor or absent.

High cost is the main barrier to have real-time Parking Information Service for overall parking places in the MDCs, but the fixed time information still can be provided by the conventional traffic signs and guide boards. In some cases, real-time Parking Information Service can be applied in certain parking places whose parking price is high enough to recover system cost, especially for car parking places in the city centres.

- **Assessment**

In general, this measure can create only a low level of effectiveness because its small scale of impact, except a medium level on ensuring urban mobility. In contrast, this measure is one of the most applicable measures with low level of difficulty in most of the barriers, except the need to adjust the IMV traffic information system in overall scale of project.

IMV6	Parking Information Service							IN
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
		Y	Y	Y	Y			X

Effectiveness			ES = 1,14	⊙
Goal 1 : To ensure mobility	⦿	**Goal 3: To protect environment**		⊙
1.1. To ensure equality in using *UTP**	⦿	3.1. To reduce air pollutions		⊙
1.2. To increase modal choices	⦿	3.2. To reduce noise		⊙
1.3. To increase transport *P&E***	⦿	3.3. To save energy		⊙
1.4. To increase transport capacity	⊙	3.4. To save urban space		⊙
Goal 2: To ensure traffic safety	⊙	**Goal 4: To improve economy**		⊙
2.1. To reduce accident frequency	⊙	4.1. To reduce transport costs		O
2.2. To reduce accident severity	⊙	4.2. To improve economic P&E		⊙
		4.3. To improve economic attractiveness		⊙

Applicability			DS = 0,55	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⊙	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		O
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		O
2.1. Operation/control systems	O	4.1. Users		O
2.2. Information systems	⦿	4.2. Non-users		O

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; O= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 22: Assessment of measure IMV6: Parking Information Service

Moreover, this measure normally highly appreciated by both users and non-users. According to the terms of selection, this measure is not recommended as a main traffic management measure in MDCs. However, it can be applied as a Supportive Measure due to its easiness in implementation. Detail assessment results are presented in Table E-20.

Table E- 20: Detail assessment of measure IMV6: Parking Information Service

IMV6	Parking Information Service							IN
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
		Y	Y	Y	Y			X

Effectiveness			ES = 1,14	⊙
Goal 1 : To ensure mobility	⦿	1,72	**Goal 3: To protect environment**	⊙	1
*1.1. To ensure equality in using UTP**	⦿	2	*3.1. To reduce air pollutions*	⊙	1
This measure helps IMV drivers to find the right parking place for their trip with optimal access distance and time. It supports directly the major traveller group (including motorcyclists and bicyclists), while public transport passengers and pedestrians have no direct benefit. Therefore, a medium level of impact is given to this measure.			On one side, this measure helps to reduce parking search traffic, on the other side, the convenient by good parking information encourage IMV drivers to stay with their IMV rather than to shift to public transport. Therefore, a low impact on reducing air pollution is given to this measure.		
1.2. To increase modal choices	⦿	2	*3.2. To reduce noise*	⊙	1
This measure make encourage the major group (motorcyclists and bicyclists) to drive be providing good parking information to them. In contrast, a better information service also encourages car use. For longer term, the application of real time parking information is more suitable for IMV drivers than other modes. Therefore, a medium level of impact on increasing modal choice in expected from this measure.			On one side, this measure helps to reduce parking search traffic, on the other side, the convenient by good parking information encourage IMV drivers to stay with their IMV rather than to shift to public transport. Therefore, a low impact on reducing noise is given to this measure.		
*1.3. To increase transport P&E***	⦿	2	*3.3. To save energy*	⊙	1
A good parking information system helps drivers to optimise distance and access time to the proper parking places. A significant reduction of traffic for searching parking place can be reduced. Therefore a medium level of impact on increasing transport productivity and efficiency is given to this measure.			On one side, this measure helps to reduce parking search traffic, on the other side, the convenient by good parking information encourage IMV drivers to stay with their IMV rather than to shift to public transport. Therefore, a low impact on saving energy is given to this measure.		
1.4. To increase transport capacity	⊙	1	*3.4. To save urban space*	⊙	1
This measure enable some available parking place for drivers.			On one side, this measure helps to reduce parking search traffic, on the other side, the convenient by good parking information encourage IMV drivers to stay with their IMV rather than to shift to public transport. Therefore, a low impact on saving urban space is given to this measure.		
Goal 2: To ensure traffic safety	⊙	1,00	**Goal 4: To improve economy**	⊙	0,70
2.1. To reduce accident frequency	⊙	1	*4.1. To reduce transport cost*	○	0
Reduction of parking search traffic can help to reduce traffic conflicts, especially for strange drivers. However, a low level of impact can only expected from this measure. Because that parking search traffic is normally not considered as high conflict potential traffic.			By encouraging IMV to stay with their vehicle, this measure does not help to reduce transport cost.		
			4.2. To improve economic P&E	⊙	1
2.2. To reduce accident severity	⊙	1	This measure helps to save travel time and distance (parking search traffic). However, scale of impact is limited, therefore a low level of impact is given to this measure.		
By limited scale of impact, a low level of reducing accident severity is expected by this measure.			*4.3. To improve economic attractiveness*	⊙	1
			This measure improve significantly the economic attractiveness of the city centre. However, scale of impact is limited, therefore a low level of impact is given to this measure.		

(Cont.)

Table E-20: Detail assessment of measure IMV6: Parking Information Service (Cont.)

Applicability			AS = 0,55	⊙
Criteria 1: Cost of measure	⊙	**1**	**Criteria 3: Institutional participation**	⊙	**0,484**
1.1. Investment cost	⊙	1	3.1. Transport related institutions	⊙	1
This measure requires only small investment for a fixed time information system.			Apart from parking operators, transport authorities are required to implement this measures.		
1.1. Operation cost	⊙	1	3.2. Political bodies	○	0
This measure requires minor additional operation cost.			A fixed time information system does not require the approval of the political bodies.		
Criteria 2: Technical systems	⊙	**0,854**	**Criteria 4: Public acceptance**	○	**0**
2.1. Operation/control systems	○	0	4.1. Users	○	0
Normally, road pricing has its own control and monitoring system, there fore no additional operation and control system is required.			Users are happy by this measure.		
2.2. Information systems	◉	2	4.2. Non-users	○	0
Some adjustment of information system is required.			No opposition is accounted for this measure.		

IMV7- Motorcycle Sharing

- **Description**

This measure aims to encourage students and workers sharing motorcycle for their school or working trips. The motorcycle sharing is currently practicing in many universities and industrial zones in Vietnam among the students or workers who are living in the same areas (e.g. student dormitories). This measure is supported effectively by motorcycle taxi for mid-day returning trips. Motorcycle-for-rent service is also a part of this measure.

- **Assessment**

In general, this measure creates a low level of effectiveness only because its small scale of impact. However, this measure is one of the high applicable measures with low level of difficulty in most of the barriers, except a considerable attempt in seeking the participation of IMV drivers. According to the terms of selection, this measure is not recommended as a main traffic management measure. Detail assessment results are presented in Table E-21.

IMV7	Motorcycle Sharing							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X	Y			

Effectiveness			ES = 1,14	⊙
Goal 1 : To ensure mobility	⊙	**Goal 3: To protect environment**		⊙
1.1. To ensure equality in using *UTP**	⊙	3.1. To reduce air pollutions		⊙
1.2. To increase modal choices	⊙	3.2. To reduce noise		⊙
1.3. To increase transport *P&E***	⊙	3.3. To save energy		⊙
1.4. To increase transport capacity	⊙	3.4. To save urban space		⊙
Goal 2: To ensure traffic safety	◉	**Goal 4: To improve economy**		⊙
2.1. To reduce accident frequency	◉	4.1. To reduce transport costs		⊙
2.2. To reduce accident severity	⊙	4.2. To improve economic P&E		⊙
		4.3. To improve economic attractiveness		⊙

Applicability			DS = 0,82	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⊙	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		○
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		⊙
2.1. Operation/control systems	○	4.1. Users		◉
2.2. Information systems	⊙	4.2. Non-users		○

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
● = High; ◉= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 23: Assessment of measure IMV7: Motorcycle Sharing

Table E- 21: Detail assessment of measure IMV7: Motorcycle Sharing

IMV7	Motorcycle Sharing							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	X	Y			

Effectiveness			ES = 1,14	⊙
Goal 1 : To ensure mobility	⊙	**1,00**	**Goal 3: To protect environment**	⊙	**1**
*1.1. To ensure equality in using UTP**	⊙	1	*3.1. To reduce air pollutions*	⊙	1
This measure firstly aims to optimise utilisation of motorcycle, and to save road and parking space for the use of public transport and NMT. Secondly, it provides motorcycles and required information people, who wants to drive motorcycle for their urban trip. However, the main targeted groups are students, workers tourists and visitors.			This measure absolutely reduces air pollution by shared driving. However, air pollution is producing from motorcycle for rent service. Therefore, a low level of impact is given to this measure.		
1.2. To increase modal choices	⊙	1	*3.2. To reduce noise*	⊙	1
In principle, this measure opens a new choice for travellers, esepcially who have a quite stable travel patterns (origin, destination and time). The middle and low workers and students are the main beneficiaries of this measure. In addition, it provides a very effective transport mode for visitors and tourists.			This measure absolutely reduces noise n by shared driving. However, noise is producing from motorcycle for rent service. Therefore, a medium level of impact is given to this measure.		
*1.3. To increase transport P&E***	⊙	1	*3.3. To save energy*	⊙	1
This measure effectively increases productivity and efficiency of motorcycle traffic . It saves road and parking space (at the origin and destination). However, the scale of impact is low.			This measure can be considered as a very effective tool to save energy. However, a low level of impact is given to this measure in comparison with public transport and NMT measure.		
1.4. To increase transport capacity	⊙	1	*3.4. To save urban space*	⊙	1
This measure enables new transport service in the urban area, called motorcycle for rent. However, scale of impact is small.			This measure can be considered as a very effective tool to save urban space. However, a low level of impact is given to this measure in comparison with public transport and NMT measures.		
Goal 2: To ensure traffic safety	◉	**1,43**	**Goal 4: To improve economy**	⊙	**1,00**
2.1. To reduce accident frequency	◉	2	*4.1. To reduce transport cost*	⊙	1
Experiences show that, motorcycle sharing strongly helps to reduce number of traffic accidents. A medium level of impact is given to this measure due to its scale of impact on reduction IMV traffic.			This measure significantly reduces transport cost from saving of vehicle operation cost, road and parking space. However, a low level of impact is given to this measure in comparison with public transport and NMT measure.		
			4.2. To improve economic P&E	⊙	1
2.2. To reduce accident severity	⊙	1	In term of travel time, motorcycle is the most effective transport mode in MDCs. Experiences show that many students and workers are using the shared motorcycle with their colleagues instead of cycling or riding public transport because they wants to save travel time, especially for relative long distance trips.		
Studies' results showed that, drivers tends to drive slower while they carry a trip partners. Therefore, this measure helps also to reduce severity of accident.			*4.3. To improve economic attractiveness*	⊙	1
			Firstly, this measure improve mobility and traffic quality of the urban areas, especially on the main commuter corridors. Secondly, this encourage tourisms by having quite effective transport mode for visitors and tourists. Thirdly, this measure ensures a cheap transport mode for long distance urban trips (from 5 to 15 kilometres).		

Applicability			DS = 0,82	⊙
Criteria 1: Cost of measure	⊙	**1**	**Criteria 3: Institutional participation**	⊙	**0,484**
1.1. Investment cost	⊙	1	3.1. Transport related institutions	⊙	1
For public, no investment is required. For motorcycle for rent operators, the main cost is to purchase motorcycles.			In principle, no transport institution is required to participate on this measure. However, participation of public transport authorities is required if any incentive is given to travellers,		
1.1. Operation cost	⊙	1	3.2. Political bodies	○	0
No cost additional cost is required for public infrastrcuture operation or maintenance. The maintenance cost of motorcycle is low.			This measure principally does not requires official approval of political bodies.		
Criteria 2: Technical systems	⊙	**0,427**	**Criteria 4: Public acceptance**	⊙	**1,249**
2.1. Operation/control systems	○	0	4.1. Users	◉	2
No adjustment of operation/control system is required.			This measure requires a considerable effort of campaigning to get the acceptance of users.		
2.2. Information systems	⊙	1	4.2. Non-users	○	0
Some minor adjustments of local information equipments are required.			This measure is strongly supported by the non-users.		

IMV8- Vehicle Registration Control

- **Description**

This measure aims to control the registration of incoming and outgoing vehicles according to engine capacity, vehicle ownership (PCO, MCO), and vehicle emission rates. For controlling engine capacity, a maximum engine capacity is imposed for individual use of motorcycle or private car. For controlling vehicle ownerships, this measure can implement via a registration quota system that give a specific number of new cars that can register in the city within the next year. The registration prohibition would be applied only when there is no other option. For controlling vehicle emission rates, this measure can impose a progressive vehicle emission standard (or limitations of engine for motorcycle, car and truck) in the city or country. For example, since 01.07.2006, Vietnam started to apply EURO II emission standards for all vehicles operating in this country. Therefore, lower than EURO II standard vehicles will have to improve their exhaust gas controller or to stop operating.

- **Assessment**

In the developing cities, Vehicle Registration Control is recognised as a high effective measure in all considering aspects, esepcially in protecting environment and safety. However, the applicability is at medium level only due to considerable barriers on acquiring institutional participation and public acceptance.

IMV8	Vehicle Registration Control							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X			X	Y

Effectiveness			ES = 2,45	●
Goal 1 : To ensure mobility	⦿	**Goal 3: To protect environment**		●
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		●
1.2. To increase modal choices	⦿	3.2. To reduce noise		●
1.3. To increase transport *P&E***	●	3.3. To save energy		●
1.4. To increase transport capacity	○	3.4. To save urban space		●
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		●
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		⦿
		4.3. To improve economic attractiveness		●

Applicability			DS = 1,50	⊙
Criteria 1: Cost of measure	⦿	**Criteria 3: Institutional participation**		●
1.1. Investment cost	⊙	3.1. Transport related institutions		⦿
1.1. Operation cost	⦿	3.2. Political institutions		●
Criteria 2: Technical systems	○	**Criteria 4: Public acceptance**		⦿
2.1. Operation/control systems	○	4.1. Users		⦿
2.2. Information systems	○	4.2. Non-users		⊙

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 24: Assessment of measure IMV8: Vehicle Registration Control

This measure does not require any addition control or information systems, but a national level decision, because that implementation of this measure in only one city or region does not effective. In addition, implementation of this measure is also asking for sufficient operation cost and participation of transport institutions in monitoring and enforcement.

According to the terms of selection, this measure is selected into the *first priority group* of recommended measures. Detail assessment results are presented in Table E-22.

Table E- 22: Detail assessment of measure IMV8: Vehicle Registration Control

IMV8	Vehicle Registration Control							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
				X			X	Y

Effectiveness			ES = 2,45	●
Goal 1 : To ensure mobility	⦿	1,92	**Goal 3: To protect environment**	● 3
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	● 3
In general, this measure avoids the over usage of IMVs, which may affect the right to use UTP of public transport and NMT. This measure creates an absolute barrier to access certain IMVs, whose usage would destroy the equality in using UTP of public transport passengers, NMT users and also of other IMV drivers. Therefore, this measure is given the high rate of impact on this objective.			This measure is the key measure to reduce air pollutions from IMV traffic. Moreover, the protection of market for public transport and NMT helps to avoid a significant quantity of air pollutions.	
1.2. To increase modal choices	⦿	2	*3.2. To reduce noise*	● 3
By restraints of IMVs, this measure encourages most of people to use public transport and NMT. Some IMV drivers are unhappy because this measure absolutely forces them to use alternative modes.			This measure is the key measure to reduce noise from IMV traffic. Moreover, the protection of market for public transport and NMT helps to avoid potential noise sources.	
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	● 3
This measure is considered as the most effective traffic management measure in reducing traffic congestion in developing cities in general and in MDCs.			This measure is the key measure to save energy from IMV traffic. Moreover, the protection of market for public transport and NMT helps to avoid potential energy consumption	
1.4. To increase transport capacity	○	0	*3.4. To save urban space*	● 3
			By preventing MV traffic, this measure significantly saves urban space.	
Goal 2: To ensure traffic safety	●	2,43	**Goal 4: To improve economy**	● 2,64
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	● 3
Experiences show that, the absolute barrier to prevent people to drive strongly helps to reduce IMVs traffic accidents. On the other hand, this measure protect the market for public transport and NMT. Therefore, this measure helps to avoid traffic accidents.			This measure on one side saves investment in IMV infrastructure and control equipment and also avoids gasoline consumption. On the other side it encourages people to use public transport and NMT.	
			4.2. To improve economic P&E	⦿ 2
			By preventing the extreme use of IMV, this measure significantly reduces traffic congestion in the urban area. Therefore, it helps to save travel time in general. However, for long distance trips, the public transport and NMT normally requires more travel time than driving IMV.	
2.2. To reduce accident severity	⦿	2	*4.3. To improve economic attractiveness*	● 3
The controlling of engine capacity is also considered as an important factor to reduce severity of traffic accident in MDCs.			Although strict control of vehicle ownerships and duties may discourage the domestic IMV industry and maintenance service as a whole, this does not create much negative impact on the high density urban area where good public transport service and NMT environment are provided. The monitoring service is also attractive for investors. In addition, less congestion, clean environment increase the economic attractiveness of the city.	

(Cont.)

Table E-22: Detail assessment of measure IMV8: Vehicle Registration Control (Cont.)

Applicability			DS = 1,50	⊙
Criteria 1: Cost of measure	⦿	**1,528**	**Criteria 3: Institutional participation**	●	**2,516**
1.1. Investment cost	⊙	1	3.1. Transport related institutions	⦿	2
This measure requires only study cost.			This measure requires participation of all transport authorities and traffic polices.		
1.1. Operation cost	⦿	2	3.2. Political bodies	●	3
This measure requires some increase of budget for monitoring and enforcement.			Approval of national political bodies is required in application of this measure.		
Criteria 2: Technical systems	○	**0**	**Criteria 4: Public acceptance**	⦿	**1,625**
2.1. Operation/control systems	○	0	4.1. Users	⦿	2
			The IMVs drivers are unhappy, but public transport passengers and NMT users area happy. However, if the tax for motorcycles is increased, the counter force is significant.		
2.2. Information systems	○	0	4.2. Non-users	⊙	1
			IMV manufacturers, high income people definitely oppose this measure. However, no land owners are suffered and the IMV industry in developing countries is not a major economic sector. Therefore, a low level of difficulty is counted for this barrier.		

Multimodal and intermodal measures

MIM1- Ringroad System

- **Description**

This measure is to establish a system of ring roads in order to avoid the entering of undesired through traffic in the city centres, specific urban areas, road sections or points in the city all day long or during specific periods. This measure also plays a very important role in implementation of the NMT zone, where the motorised traffic is considered as the undesired element. The Ringroad System in traffic management focuses in utilising the existing urban roads. Modifications and adjustments of road links and intersections in order to establish the ring road are considered as part of this measure, but construction of any new road section will be excluded from this measure.

- **Assessment**

In urban and transport conditions of MDCs, Ringroad System is highly effective in ensuring mobility and in improving urban traffic safety, especially in reducing severity of traffic accident. However, it is not highly appreciated as effective measure in protecting environment and improving economy.

MIM1	Ringroad System							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
					Y	X		

Effectiveness			ES = 2,25	⦿
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		⊙
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⊙
1.2. To increase modal choices	●	3.2. To reduce noise		⊙
1.3. To increase transport *P&E***	●	3.3. To save energy		⊙
1.4. To increase transport capacity	⊙	3.4. To save urban space		●
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		⦿
2.1. To reduce accident frequency	⦿	4.1. To reduce transport costs		⦿
2.2. To reduce accident severity	●	4.2. To improve economic P&E		⦿
		4.3. To improve economic attractiveness		●

Applicability			DS = 0,94	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		⊙
2.1. Operation/control systems	⊙	4.1. Users		○
2.2. Information systems	⊙	4.2. Non-users		⊙

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 25: Assessment of measure MIM1: Ringroad System

In implementation, this measure is very popular in MDCs by facing low level of difficulties in most of application's barriers, except considerable cost could be required if some physical bottlenecks must be eliminated. According to the terms of selection, this measure is selected into the *second priority group* of recommended measures. Detail assessment results are presented in Table E-23.

Table E- 23: Detail assessment of measure MIM1: Ringroad System

MIM1	Ringroad System							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
					Y	X		

Effectiveness			ES = 2,25	⊙
Goal 1 : To ensure mobility	●	**2,45**	**Goal 3: To protect environment**	⊙	**1,405**
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⊙	1
This measure optimise the use of urban road space. It generally protected the inner road space for inner traffic demand or short urban trips. Therefore, it increases opportunity to preserve more urban road space for public transport and NMT. In addition, quality of IMV traffic in the targeted urban area is also improved.			On one side, this measure significantly reduces air pollution in the targeted urban area. On the other side, this increases air pollution along the ring road. Therefore, a low level of impact is given to this measure.		
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⊙	1
By avoiding the though traffic, this measure reserves urban road space for all transport modes, especially public transport and NMT. Therefore, a high level of impact on increasing modal choice is expected.			On one side, this measure significantly reduces noise in the targeted urban area. On the other side, this increases noise level along the ring road. Therefore, a low level of impact is given to this measure.		
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	⊙	1
This measure is highly appreciated in MDCs as the most effective and popular tool to avoid traffic congestion at the urban gates and along main urban arterials by significantly reducing heavy vehicle traffic to the city centre. Thus, a high level of impact is given to this measure.			On one side, this measure significantly saves energy by reducing traffic congestion in the targeted urban area. On the other side, this increases travel distance of the through trips, which have to use the ringroad to bypass the protected area. Therefore, a low level of impact is given to this measure.		
1.4. To increase transport capacity	⊙	1	*3.4. To save urban space*	●	3
This measure does not aim to increase transport capacity. However, in most of the cases, some capacity is added by eliminating of bottlenecks on the ringroad.			In some cases, establishing a ringroad helps to save urban road for providing bus lanes on the urban arterials or to reserve a urban quarter for NMT only without new additional urban area. In the other cases, ringroads encourage IMV traffic in the urban area by reserving more area for on-street parking.		
Goal 2: To ensure traffic safety	●	**2,57**	**Goal 4: To improve economy**	⦿	**2,34**
2.1. To reduce accident frequency	⦿	2	*4.1. To reduce transport cost*	⦿	2
This measure significantly reduces traffic accidents within the urban areas, especially during off-peak period and night time. However, experiences show that number of accidents increased on the ring roads, where insufficient safety schemes are considered.			This measure encourage travellers to use public transport and NMT inside the targeted areas. However, it encourages IMV drivers to drive for their long distance urban trips, which must use the ringroad. Therefore, a medium level of impact on reducing transport cost is expected from this measure.		
			4.2. To improve economic P&E	⦿	2
2.2. To reduce accident severity	●	3	Most of MDCs are appreciated by this measure in reducing travel time for both long distance and urban trips. Some increase of travel distance for the ringroad trips, but drivers are happy with the reduction of travel time. Therefore, a medium level of impact on improving economic productivity and efficiency is given to this measure.		
Experiences shows that the accidents with long-distance traffic (especially the heavy truck traffic) are among the most severe traffic accidents in the urban area in MDCs. Therefore, ringroad appreciated as an effective solution to reduce severity of accident in the urban area. However, increase of severe accidents on the ring road is the negative impact of this measure on reducing accident severity.			*4.3. To improve economic attractiveness*	●	3
			By reducing traffic congestion in the city centre, this measure significantly improve economic attractiveness of this area by every aspect. Although negative impacts on the land use along ringroad are considerable, especially for the residents, auto-based economic activities along the ringroad are benefited, for example wholesale shopping centres, logistic centres.		

(Cont.)

Table E-23: Detail assessment of measure MIM1: Ringroad System (Cont.)

Applicability			DS = 0,94		⊙
Criteria 1: Cost of measure	⊙	**1,472**	**Criteria 3: Institutional participation**	⊙	**1**
1.1. Investment cost	◉	2	3.1. Transport related institutions	⊙	1
Some additional investment may required to eliminate bottlenecks on the ringroad.			This measure requires participation of traffic polices.		
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙	1
This measure requires additional maintenance cost for the ringroad, but it saves the amount of maintenance cost on the urban roads.			Approval of city political bodies is required in application of this measure.		
Criteria 2: Technical systems	⊙	**1**	**Criteria 4: Public acceptance**	⊙	**0,375**
2.1. Operation/control systems	⊙	1	4.1. Users	○	0
Some minor adjustments of local operation/control equipments are required.			All traffic users are happy with this measure.		
2.2. Information systems	⊙	1	4.2. Non-users	⊙	1
Some minor adjustments of local information equipments are required.			Opposition of residents along the ringroad is considerable if there is no consideration on resettlement or changing of land use purpose. However, this barrier is normally not so high in MDCs.		

MIM2- Road Capacity Adjustments

- **Description**

This measure aims to ensure sufficient road capacity according to traffic demand patterns by three main approaches:

- The first is to eliminate physical bottlenecks that may appear as narrow cross sections, difficult vertical or horizontal curves, potholes, or some other road damages.
- The second is to reduce temporarily or permanently capacity of some road sections in order to avoid negative impacts of shock waves on urban traffic flow.
- The third approach is flexible use of road space (tidal flow, reversible lane, emergency lane, etc.) and one-way traffic scheme.

- **Assessment**

In urban and transport conditions of MDCs, road capacity adjustments is one of the main measures to ensure the urban mobility in general and to provide sufficient road space for other traffic management measures, for example public transport ROW prioritisation or bicycle lanes is considered as a highly effective measure. This measure is also highly appreciated in improving urban economy, although the impact on traffic safety is at medium and the impact on protecting environment and natural resources is at low level only.

MIM2	Road Capacity Adjustments							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
						X		

Effectiveness			ES = 2,10	⦿
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		⊙
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⊙
1.2. To increase modal choices	●	3.2. To reduce noise		○
1.3. To increase transport *P&E***	●	3.3. To save energy		⊙
1.4. To increase transport capacity	⦿	3.4. To save urban space		●
Goal 2: To ensure traffic safety	⦿	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	⦿	4.1. To reduce transport costs		⊙
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		●
		4.3. To improve economic attractiveness		●

Applicability			DS = 1,15	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		⊙
2.1. Operation/control systems	⊙	4.1. Users		○
2.2. Information systems	⊙	4.2. Non-users		●

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 26: Assessment of measure MIM2: Road Capacity Adjustments

In term of applicability, this measure faces significant difficulties on financing the investment cost and esepcially on seeking the support of the landowners, who have to resettle their home or to replace their business. In contrast, this measure does not require major changes of technical systems or high level of institutional participation. According to the terms of selection, this measure is selected into the *second priority group* of recommended measures. Detail assessment results are presented in Table E-24.

Table E- 24: Detail assessment of measure MIM2: Road Capacity Adjustments

MIM2	Road Capacity Adjustments							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
						X		

Effectiveness			ES = 2,10	⦿
Goal 1 : To ensure mobility	●	2,72	**Goal 3: To protect environment**	⊙	1,141
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⊙	1
This measure optimise the use of urban road space. It generally provided additional road space for all transport modes. In some cases, capacity adjustment ensure sufficient road capacity for operation of public transport service or provision of NMT facilities.			On one side, reducing traffic congestion helps to reduce the concentration of air pollutions during peak hours in in urban areas. On the other side, higher road capacity may encourage IMV traffic and increase quantity of air pollution. As best, this measure can achieve medium level of impact on reducing air pollution in urban area.		
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	○	0
This measure reserves urban road space for all transport modes, especially public transport and NMT. Although in some cases, capacity adjustments (increases) are implemented to provide more road space for IMV traffic (motorcycle lane, on-street parking places), it is considered as an important measure to ensures sufficient ROW for public transport and NMT .			On one side, reducing traffic congestion encourages IMV traffic speed and increases noise level in the urban area. On the other side, reduction of capacity in some section helps to calmer down the traffic and reduce noise level, but this case is seldom in MDCs. Therefore, one can consider that no impact on reducing noise is resulted from this measure.		
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	⊙	1
This measure is highly appreciated in MDCs as a popular tool to reduce traffic congestion along main urban arterials by significantly eliminating bottlenecks. Although in some cases, this measure could strongly encourage IMV traffic, it is considered as an important measure to ensures sufficient ROW for public transport and NMT .			This measure can save energy by reducing traffic congestion in the targeted urban area, but the impact is low (in many cases even worse) because the increase of IMV traffic.		
1.4. To increase transport capacity	⦿	2	*3.4. To save urban space*	●	3
This measure does not aim to increase transport capacity. However, in most of the cases, this measure significant increase the uniform capacity of the network.			The elimination of bottlenecks helps to utilise the disable capacity. Therefore, this measure is considered as an effective measure to save urban traffic.		
Goal 2: To ensure traffic safety	⦿	2,00	**Goal 4: To improve economy**	●	2,40
2.1. To reduce accident frequency	⦿	2	*4.1. To reduce transport cost*	⊙	1
On one side, widening road may cause some increases of accident. On the other side, the reduction of capacity in some road section is a popular measure to reduce traffic speed and number of accidents. The eliminations of shockwave also helps to reduce traffic accidents. Therefore, by assumption of traffic safety devices are well provided in cases of road widening, a medium of impact on reducing accident frequency is expected from this measure.			Indirectly, this measure encourage travellers to use public transport and NMT. However, it also encourage IMV drivers to drive fro their urban trip. Therefore, a low level of impact on reducing transport cost is expected from this measure.		
			4.2. To improve economic P&E	●	3
			Most of MDCs are appreciated this measure in reducing travel time of urban trips.		
2.2. To reduce accident severity	⦿	2			
By assumption of traffic safety devices are well provided in cases of road widening, the reducing of t traffic speed in the cases of capacity reduction helps to reduce severity of accident.			*4.3. To improve economic attractiveness*	●	3
			By reducing traffic congestion in the city centre, this measure significantly improve economic attractiveness of this area by every aspect.		

Applicability			AS = 1,15	⊙
Criteria 1: Cost of measure	⊙	1,472	**Criteria 3: Institutional participation**	⊙	1
1.1. Investment cost	⦿	2	3.1. Transport related institutions	⊙	1
Additional investments are required to eliminate bottlenecks on the network.			This measure requires participation of traffic polices.		
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙	1
This measure requires additional maintenance cost for the ringroad, but it saves the amount of maintenance cost on the urban roads.			Approval of city political bodies is required in application of this measure.		
Criteria 2: Technical systems	⊙	1	**Criteria 4: Public acceptance**	⊙	1,126
2.1. Operation/control systems	⊙	1	4.1. Users	○	0
Some minor adjustments of local operation/control equipments are required.			All traffic users are happy with this measure.		
2.2. Information systems	⊙	1	4.2. Non-users	●	3
Some minor adjustments of local information equipments are required.			Opposition of residents, who must be resettled for elimination of bottlenecks is considerable.		

MIM3- Signalisation of Intersection Control

- **Description**

This measure aims to provide and improve traffic signal control equipments at intersections. Additional provision of turning lanes, traffic islands, traffic signs, road markings in order to support the signalisation are also included as parts of this measure. Moreover, Right-of-Way priority at intersections should be given to the public transport vehicles and sufficient considerations for pedestrians and bicycles are part of technical requirements. As the uniqueness of traffic flow in MDCs, improvements of traffic signal control should consider motorcycle as the main individual motorised vehicle in the traffic flow. Therefore, special designs and control mechanisms for motorcycle traffic should be considered as the main improvement for IMV traffic at the targeted intersections.

- **Assessment**

In urban and transport conditions of MDCs, traffic signal control improvement is the major measure to ensure urban mobility and safety. It is also an important tool to protect environment and to support economic development.

MIM3	Signalisation of Intersection Control							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
						X		

Effectiveness			ES = 2,70	●
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⦿
1.2. To increase modal choices	●	3.2. To reduce noise		⦿
1.3. To increase transport *P&E***	●	3.3. To save energy		⦿
1.4. To increase transport capacity	⦿	3.4. To save urban space		●
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		⦿
2.2. To reduce accident severity	●	4.2. To improve economic P&E		●
		4.3. To improve economic attractiveness		●

Applicability			DS = 0,72	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		○
2.1. Operation/control systems	○	4.1. Users		○
2.2. Information systems	⊙	4.2. Non-users		○

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 27: Assessment of measure MIM3: Signalisation of Intersection Control

This measure is also highly applicable in MDCs although a moderate investment cost is required to provide some new equipments and requirements of changing overall traffic signal control system in the targeted area. According to the terms of selection, this measure is selected into the *first priority group* of recommended measures. Detail assessment results are presented in Table E-25.

Table E- 25: Detail assessment of measure MIM3: Signalisation of Intersection Control

MIM3	Signalisation of Intersection Control							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
						X		

Effectiveness			ES = 2,70	●
Goal 1 : To ensure mobility	●	2,72	**Goal 3: To protect environment**	⦿ 2,203
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⦿ 2
This measure ensures that all transport modes have proper right of way in travelling through the intersections. Furthermore, public transport priority and sufficient considerations for NMT preserve the ROW for travellers of all social groups.			In general, this measure helps to reduce the concentration of air pollutions during peak hours in in urban areas. Moreover, with public transport prioritisation and NMT solution at intersection, this measure encourage travellers to shift from using IMV to these two environmental friendly modes. However, the later benefit depends on implementation of other measures. Therefore, a medium level of impact of this measure on reducing air pollutions is given to this measure.	
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⦿ 2
The emphasis on public transport vehicles and NMT significantly increases opportunity for improving quality of these transport modes. However, the impact of this measure can only be realised if it implement together with prioritisation of public transport and provision NMT facilities. Therefore, a medium level impact is expected from this measure.			This measure significantly reduces noise in the urban area by ensuring a smooth traffic flow for IMV, truck and public transport vehicle. However, the trade off between priority for public transport vehicles and other motorised vehicles at intersections does not allow the impact on reducing noise achieve high level.	
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	⦿ 2
This measure is the most effective measure to eliminate most of potential interruptions of traffic at intersections. Therefore, it is high appreciated as the major measure to reduce traffic congestion ad delay in urban area of MDCs.			In general, this measure helps to save energy during peak hours in in urban areas. Moreover, with public transport prioritisation and NMT solution at intersection, this measure encourage travellers to shift from using IMV to these two energy saving modes. However, the later benefit depends on implementation of other measures. Therefore, a medium level of impact of this measure on saving energy is given to this measure.	
1.4. To increase transport capacity	⦿	2	*3.4. To save urban space*	● 3
Service capacity of certain road and all network is significantly improved by signalising of intersection control. Without signal control of at grade intersections, a significant part of road capacity is disable.			Saving urban space is the main reason that make signalisation of intersection control becomes the most popular solution for urban intersections.	
Goal 2: To ensure traffic safety	●	3,00	**Goal 4: To improve economy**	● 2,70
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	⦿ 2
Improvement of traffic signal control is the most important control measure to reduce traffic accident in the urban area.			Saving energy, encouraging IMV drivers to shift to public transport and NMT, this measure helps to reduce transport cost in some extent.	
			4.2. To improve economic P&E	● 3
2.2. To reduce accident severity	●	3	Most of MDCs are appreciated this measure in reducing travel time of urban trips.	
By signalisation, most of severe conflicts at intersections are eliminated.			*4.3. To improve economic attractiveness*	● 3
			By reducing traffic congestion and accident in the city centre, this measure significantly improve economic attractiveness of this area by every aspect.	

(Cont.)

Table E-25: Detail assessment of measure MIM3: Signalisation of Intersection Control

Applicability			DS = 0,72	⊙
Criteria 1: Cost of measure	⊙	**1,472**	**Criteria 3: Institutional participation**	⊙	**1**
1.1. Investment cost	◉	2	3.1. Transport related institutions	⊙	1
In MDCs, this measure normally requires considerable amount of investment to provide new traffic signals and controller.			This measure requires participation of traffic polices.		
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙	1
This measure requires minor additional maintenance cost.			Approval of city political bodies is required in application of this measure in a city scale project.		
Criteria 2: Technical systems	⊙	**0,427**	**Criteria 4: Public acceptance**	○	**0**
2.1. Operation/control systems	○	0	4.1. Users	○	0
An urban scale project of intersection control signalisation improvements in MDCs is normally includes all improvements for required intersection controls for public transport, IMVs and NMTs.			All traffic users are happy with this measure.		
2.2. Information systems	⊙	1	4.2. Non-users	○	0
Some minor adjustments of local information equipments are required.			In principle, no opposition is expected against this measure.		

MIM4- Improvement of Non-signalised Intersection Control

- **Description**

This measure aims to improve geometrical design and traffic control at the non-signalised intersections. Provisions of roundabouts, turning lanes, traffic islands, traffic signs, mirrors, and road markings… are the expected improvements of many intersections in the MDCs. In the other cases, elimination of obstacles is required, for example unplanned electricity poles, trees, or house corners. This measure is very important tool to deal with traffic conflicts at intersections in the alley-network and between an alley and a car-based road, where no traffic control devices are provided so far.

- **Assessment**

In urban and transport conditions of MDCs, non-signalised intersection improvement is the major measure to ensure urban mobility and traffic safety, especially in the two-wheelers accessed only areas. The impacts on other aspects are also highly appreciated, but their scale is at moderate level only in comparing with signalisation.

MIM4	Improvement of Non-signalised Intersection Control							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
						X		

Effectiveness			ES = 2,12	⦿
Goal 1 : To ensure mobility	⦿	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⦿
1.2. To increase modal choices	⦿	3.2. To reduce noise		⦿
1.3. To increase transport *P&E***	⦿	3.3. To save energy		⦿
1.4. To increase transport capacity	⊙	3.4. To save urban space		⦿
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		⦿
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		⦿
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		⦿
		4.3. To improve economic attractiveness		⦿

Applicability			DS = 0,81	⊙
Criteria 1: Cost of measure	⦿	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		○
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		⊙
2.1. Operation/control systems	⊙	4.1. Users		○
2.2. Information systems	⊙	4.2. Non-users		⊙

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 28: Assessment of measure MIM4: Improvement of Non-signalised Intersection Control

In application, although considerable amount of investment is required to acquire sufficient urban space, it is considered as a highly applicable measure because the low difficulties of other barriers. According to the terms of selection, this measure is selected into the *second priority group* of recommended measures. Detail assessment results are presented in Table E-26.

Table E- 26: Detail assessment of measure MIM4: Improvement of Non-signalised Intersection Control

MIM4	Improvement of Non-signalised Intersection Control							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
						X		

Effectiveness			ES = 2,12	⦿
Goal 1 : To ensure mobility	⦿	**1,93**	**Goal 3: To protect environment**	⦿	**2**
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⦿	2
This measure ensures that all transport modes have proper right of way in travelling through the intersections. However, prioritisation for public transport vehicles and considerations for NMT are very limited by this measure.			In general, this measure helps to reduce the concentration of air pollutions during peak hours in the urban areas. In addition this measure encourage people to use NMT by ensuring the safe traffic control on the alley network. Therefore, a medium level of impact on reducing air pollution can be expected from this measure.		
1.2. To increase modal choices	⦿	2	*3.2. To reduce noise*	⦿	2
Without sequencing procedure in controlling traffic, this measure can not ensure that public transport vehicle and NMT have proper right of way in travelling through the intersection on car-based road. However, this measure ensure safety and encourage NMT traffic within the two-wheeler accessed only area.			In general, this measure helps to reduce the concentration of air pollutions during peak hours in the urban areas. n addition this measure encourage people to use NMT by ensuring the safe traffic control on the alley network. Therefore, a medium level of impact on reducing noise can be expected from this measure.		
*1.3. To increase transport P&E***	⦿	2	*3.3. To save energy*	⦿	2
This measure helps to reduce the potential interruptions of traffic at intersections. Although it is not appreciated as a tool to reduce traffic congestion ad delay at car-based intersections, this measure is a very important measure to improve the utilisation of alley network for NMT traffic in the MDCs.			In general, this measure helps to reduce the concentration of air pollutions during peak hours in the urban areas. n addition this measure encourage people to use NMT by ensuring the safe traffic control on the alley network. Therefore, a medium level of impact on saving energy can be expected from this measure.		
1.4. To increase transport capacity	⊙	1	*3.4. To save urban space*	⦿	2
Service capacity of certain road and all network is improved by modifying of intersection control. Although, impact of this measure on increasing transport capacity is low on the car based road network, this measure enable huge capacity of alley network for NMT traffic.			In comparison with signalisation of intersection control, this measure has only low impact on saving urban space in the four-wheeler accessed area. On the other hand, it is one of the key solutions to utilise the alleys for NMT traffic without asking for additional urban space to expand the roads.		
Goal 2: To ensure traffic safety	●	**2,43**	**Goal 4: To improve economy**	⦿	**2,00**
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	⦿	2
This measure may not be highly appreciated on the urban arterials, but it is the only solution to reduce conflicts at intersections within the two-wheeler accessed only area and between alley and car based road.			By medium level of impact on saving energy and shifting demand to efficient modes, a medium level of impact on reducing transport cost is given to this measure.		
			4.2. To improve economic P&E	⦿	2
2.2. To reduce accident severity	⦿	2	Travel t time and distance can be reduced considerable for travellers if they use the alley network for the NMT trips. Therefore, a medium level of economic improvement is expected from this measure.		
For people who are living in the two-wheeler accessed only areas, application of this measure is the key measure to eliminate severe accidents.			*4.3. To improve economic attractiveness*	⦿	2
			By reducing environmental pollutions and accident in the city centre, this measure significantly improve economic attractiveness of the city centre. More over, by improving liveability of the two-wheeler accessed only areas, the four-wheeler land is reserved for non-residential activities.		

Applicability			DS = 0,81	⊙
Criteria 1: Cost of measure	⦿	**1,472**	**Criteria 3: Institutional participation**	⊙	**0,484**
1.1. Investment cost	⦿	2	3.1. Transport related institutions	⊙	1
In MDCs, this measure normally requires some investment to acquires additional urban space for modifying the geometrical design of the intersection.			This measure requires participation of traffic polices.		
1.1. Operation cost	⊙	1	3.2. Political bodies	○	0
This measure requires minor additional maintenance cost.			No approval of the political bodies is required in application of this measure.		
Criteria 2: Technical systems	⊙	**1**	**Criteria 4: Public acceptance**	⊙	**0,375**
2.1. Operation/control systems	⊙	1	4.1. Users	○	0
Only minor changes of systems are required.			All traffic users are happy with this measure.		
2.2. Information systems	⊙	1	4.2. Non-users	⊙	1
Some minor adjustments of local information equipments are required.			Opposition of residents, who must be resettled for elimination of bottlenecks is accounted, but at low level.		

MIM5- Traffic Calming and Speed Reduction

- **Description**

This measure aims to reduce speed of motorised vehicles in a targeted urban area or a road section in order to reduce frequency and severity of conflicts between vehicles, between motorised vehicles and NMV, and to maintain the smoothness of the traffic flow. The traffic calming is also aiming to reduce the noise, air pollutions, and the fuel consumption of vehicle. On the other hand, traffic calming directly attacks the advantage of IMV traffic in order to encourage people to use public transport services and NMT. The term “traffic calming” is normally used for this measure when it is applied in an areas and the term “speed reduction” is using when it is applied on the road section.

- **Assessment**

In urban and transport conditions of MDCs, Traffic Calming and Speed Reduction is one of the most effective measures to ensure urban traffic safety and to protect urban environment and natural in overall city and in the two-wheelers accessed only areas. The high level of impact is also recognised on ensuring urban mobility and improving urban economy.

MIM5	Traffic Calming and Speed Reduction							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	Y	Y	X		

Effectiveness			ES = 2,78	●
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		●
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		●
1.2. To increase modal choices	●	3.2. To reduce noise		●
1.3. To increase transport *P&E***	●	3.3. To save energy		●
1.4. To increase transport capacity	⊙	3.4. To save urban space		●
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		●
2.2. To reduce accident severity	●	4.2. To improve economic P&E		⦿
		4.3. To improve economic attractiveness		●

Applicability			DS = 1,21	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⊙	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	⦿	**Criteria 4: Public acceptance**		⊙
2.1. Operation/control systems	⦿	4.1. Users		⊙
2.2. Information systems	⦿	4.2. Non-users		⊙

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; O= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 29: Assessment of measure MIM5: Traffic Calming and Speed Reduction

In application, although major changes on road traffic control and information systems are required, this measure is highly applicable because the low difficulties of other barriers. According to the terms of selection, this measure is selected into the *first priority group* of recommended measures. Detail assessment results are presented in Table E-27.

Table E- 27: Detail Assessment of measure MIM5: Traffic Calming and Speed Reduction

MIM5	Traffic Calming and Speed Reduction							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	Y	Y	X		

Effectiveness			ES = 2,78	●
Goal 1 : To ensure mobility	●	**2,45**	**Goal 3: To protect environment**	●	**3**
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	●	3
Although this measure reduces speed advantage of IMVs, it ensures that all transport modes have an equal right and opportunity to travel in a safe condition. Moreover, traffic calming ensures that the right of using UTP of all social groups are taken place in a harmonise manner.			The reduction of IMV traffic speed is not the key factor of reducing air pollution, but the shift to using NMT and public transport service in the targeted area is much more considerable. Especially, this measure strongly encourage people to use NMT by ensuring the safe traffic control on the alley network. Therefore, a high level of impact on reducing air pollution can be expected from this measure.		
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	●	3
Firstly, traffic calming ensures that IMVs are not restricted but they should drive without negative effect to the others. Therefore, this measure encourage many travellers and force (slightly) some of them (IMV drivers) to use public transport and NMT because the speed advantage of IMV is already eliminated.			This measure is one of the major tools to reduce noise level in the targeted areas.		
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	●	3
In the city centre of MDCs, traffic calming ensure a smooth traffic flow , especially during peak periods, in order to avoid the interruptions by different of technologies an operational regimes. In the two-wheeler accessed areas, speed reduction ensures the smoothness of a mix traffic flow between NMT and motorcycles. Along the arterials, speed reduction reduce interruptions by minimising traffic conflicts.			The reduction of IMV traffic speed is not the key factor of saving energy (fuel), but the shift to using NMT and public transport service in the targeted area is much more considerable. Especially, this measure strongly encourage people to use NMT by ensuring the safe traffic control on the alley network. Therefore, a high level of impact on saving energy can be expected from this measure.		
1.4. To increase transport capacity	⊙	1	*3.4. To save urban space*	●	3
Some increase of uniform capacity can be accounted for this measure because the reduction of interruptions in the network.			On one hand, this measure allow urban road to handle a higher traffic volume by smooth traffic. On the other hand, this measure is the most important scheme to ensure the safe traffic condition in the alley network in order to encourage people to use NMT.		
Goal 2: To ensure traffic safety	●	**3,00**	**Goal 4: To improve economy**	●	**2,64**
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	●	3
The main impact of this measure is to reduce accident frequency and severity.			By high level of impact on saving energy and shifting demand to efficient modes, a high level of impact on reducing transport cost is given to this measure.		
			4.2. To improve economic P&E	⦿	2
2.2. To reduce accident severity	●	3	Significant time and distance can be reduced for travellers if they use the alley network for the NMT trips. Therefore, a medium level of economic improvement is expected from this measure.		
			4.3. To improve economic attractiveness	●	3
The main impact of this measure is to reduce accident frequency and severity.			By reducing environmental pollutions and accident in the city centre, this measure significantly improve economic attractiveness of this area by every aspect. More over, by improving liveability of the two-wheeler accessed only areas, the four-wheeler land is reserved for non-residential activities.		

(Cont.)

Table E-27: Detail Assessment of measure MIM5: Traffic Calming and Speed Reduction

Applicability			AS = 1,21	⊙
Criteria 1: Cost of measure	⊙	**1**	**Criteria 3: Institutional participation**	⊙	**1**
1.1. Investment cost	⊙	1	3.1. Transport related institutions	⊙	1
This measure requires only study cost and some minor investment of provision of speed reduction device.			This measure requires participation traffic polices.		
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙	1
Increase on enforcement cost (police service) can be compensated by reduction of road maintenance cost.			Approval of city political bodies is required in application of this measure.		
Criteria 2: Technical systems	◉	**2**	**Criteria 4: Public acceptance**	⊙	**1**
2.1. Operation/control systems	◉	2	4.1. Users	⊙	1
Changes of urban road traffic control system are required.			IMV drivers are normally unhappy with this measure, but a low counter force is expected because that the traffic speed in high density urban area is already low.		
2.2. Information systems	◉	2	4.2. Non-users	⊙	1
Adjustments of urban information equipments are required.			In principle, the main opposition to this measure comes from IMV manufacturers and sales, but the land users can also be accounted as a source of counter force.		

(Cont.)

MIM6- Urban Traffic Information Service

- **Description**

In the MDCs, transport infrastructure construction and maintenance, culture, sport, exhibition activities are taken place almost every day, and then traffic operation and control activities need to be changed accordingly. In addition, MDCs are main destinations for visitors, tourists, and immigrants in their countries. Therefore, a general traffic information service is very important. This measure is to provide travellers sufficient planned and/or real-time information on general traffic conditions, route and mode options. The information can be received at home, at work or en-route via a variety of communication media (OECD 2002). In MDCs, provision of real-time traffic information is limited due to low level of application of information technology in urban transport system (for data collection, processing and dissemination). Therefore, provisions of planned traffic information through conventional pubic media (radio, TV, newspapers) and traffic-guiding devices (traffic map, warning and guiding boards, traffic control signals and signs…) are suitable for the condition of the MDCs and other developing cities. For example, changes of traffic operation and control due to a sport events, road/railway construction or maintenance projects, new traffic management measure… can be provided to people in affected area via daily newspapers, television or radio before and during affected period. At the sites of projects, traffic control and guiding devices should be rightly installed in order to help travellers finding proper alternative routes.

- **Assessment**

In urban and transport conditions of MDCs, urban traffic information service is considered as a highly effective measure in ensuring urban mobility and economy, while the level of impact is at medium level in the other aspects of effectiveness.

MIM6	Urban Traffic Information Service							IN
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	Y	Y	Y		X

Effectiveness			ES = 2,47	⦿
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⦿
1.2. To increase modal choices	●	3.2. To reduce noise		⦿
1.3. To increase transport *P&E***	●	3.3. To save energy		⦿
1.4. To increase transport capacity	⦿	3.4. To save urban space		⦿
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		⦿
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		●
		4.3. To improve economic attractiveness		●

Applicability			DS = 1,01	⊙
Criteria 1: Cost of measure	⦿	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⦿
1.1. Operation cost	⦿	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		○
2.1. Operation/control systems	⊙	4.1. Users		○
2.2. Information systems	○	4.2. Non-users		○

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 30: Assessment of measure MIM6: Urban Traffic Information Service

For all travellers, a good traffic information service can be very effective in saving travel time and distance for the travellers. In application, this measure means a full-scale improvement of urban transport information systems. Therefore, no additional information system is required. In addition, active participations of two major transport related institutions, authorities and polices. On the other hand, this measure normally achieves a full support of public and requires low costs of both investment and maintenance. According to the terms of selection, this measure is selected into the *first priority group* of recommended measures. Detail assessment results are presented in Table E-28.

Table E- 28: Detail assessment of measure MIM6: Urban Traffic Information Service

MIM6	Urban Traffic Information Service							IN
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			Y	Y	Y	Y		X

Effectiveness			ES = 2,47	⦿
Goal 1 : To ensure mobility	●	**2,72**	**Goal 3: To protect environment**	⦿ **2**
*1.1. To ensure equality in using UTP**	● 3		*3.1. To reduce air pollutions*	⦿ 2
In principle, planned traffic information service via TV, radio, or newspapers can provide information for all people, who live within the targeted are. The same level of equality can be expected by traffic maps, warning and guiding boards at the sites. Therefore, this measure is given a high level of impact on ensuring equality in using UTP.			The main impact on reducing air pollutions of this measure is gained via reduction of traffic congestion. The impact via shifting travel demand from IMV to public transport and NMT is not specified. Therefore, a medium level of impact on this objective is given to this measure.	
1.2. To increase modal choices	● 3		*3.2. To reduce noise*	⦿ 2
In principle, this measure does not only aims to encourage public transport or NMT, but for all other modes. A good information service helps travellers to select most suitable transport mode for their trip under certain traffic condition.			The main impact on reducing noise of this measure is gained via reduction of traffic congestion. The impact via shifting travel demand from IMV to public transport and NMT is not specified. Therefore, a medium level of impact on this objective is given to this measure.	
*1.3. To increase transport P&E***	● 3		*3.3. To save energy*	⦿ 2
In general, good information helps to travellers to select the optimal route for their trip. In cases of having changes of traffic operation in certain area or road section , good traffic information helps to avoid traffic congestion and other problems at the activities location and surrounding areas. Therefore, a high level of impact on increasing transport P&E is given to this measure.			The main impact on saving energy consumption of this measure is gained via reduction of traffic congestion. The impact via shifting travel demand from IMV to public transport and NMT is not specified. Therefore, a medium level of impact on this objective is given to this measure.	
1.4. To increase transport capacity	⦿ 2		*3.4. To save urban space*	⦿ 2
This measure does not aims to increase transport capacity, but good information enable idling service capacity for many travellers, especially the strangers. Therefore, impact on increasing capacity is given to this measure.			The main impact on saving urban space of this measure is gained via guiding and controlling traffic behaviours. The impact via shifting travel demand from IMV to public transport and NMT is limited. Therefore, a medium level of impact on this objective is given to this measure.	
Goal 2: To ensure traffic safety	●	**2,43**	**Goal 4: To improve economy**	● **2,70**
2.1. To reduce accident frequency	● 3		*4.1. To reduce transport cost*	⦿ 2
In general, good traffic information also helps to reduce traffic accident frequency, especially for strangers. In cases of having road construction sites good information helps also help to avoid traffic accident at the sites, especially during night time. In cases of sport and cultural events, good information helps to reduce traffic accidents at the locations and surrounding areas by guiding the participants to select to right modes, routes and interchanges and also guiding the non-participants to avoid the locations.			The main impact on reducing cost of this measure is gained via improvement of transport productivity and efficiency by reducing congestion. The impact via shifting travel demand from IMV to public transport and NMTis not specified. Therefore, a medium level of impact on this objective is given to this measure.	
			4.2. To improve economic P&E	● 3
			This measure significantly helps to reduce trip distance and travel time for all travellers on the targeted network. Therefore, a high level of impact is given to this measure on improving economic productivity and efficiency.	
2.2. To reduce accident severity	⦿ 2			
In general, the accidents at construction sites or accidents on the sport and cultural events are severer than the one on the normal day, esepcially accidents during night time or with drinking drivers. Therefore, impact on reducing severity of accident can be accounted for this measure.				
			4.3. To improve economic attractiveness	● 3
			Good information provide investors, employees and residents a clear image about traffic condition in the city. In most of the cases, this measure helps to improve the economic attractiveness of the city and region. In some cases, good information show a bad traffic condition that definitely disappointed the investors, employees and residents.	

(Cont.)

Table E-28: Detail assessment of measure MIM6: Urban Traffic Information Service

Applicability			AS = 1,01	⊙
Criteria 1: Cost of measure	◉	**2**	**Criteria 3: Institutional participation**	⊙	**1,484**
1.1. Investment cost	◉	2	3.1. Transport related institutions	◉	2
This measure requires considerable investment of provision of additional facilities and equipments to collect and disseminate traffic information.			This measure requires participation of transport operators and traffic polices.		
1.1. Operation cost	◉	2	3.2. Political bodies	⊙	1
This measure requires considerable additional office, employees and equipments for collecting, processing and disseminating of information.			Approval of city political bodies is required in application of this measure.		
Criteria 2: Technical systems	⊙	**0,573**	**Criteria 4: Public acceptance**	○	**0**
2.1. Operation/control systems	⊙	1	4.1. Users	○	0
Only minor changes of systems are required.			In principle, no opposition is expected against this measure.		
2.2. Information systems	○	0	4.2. Non-users	○	0
An urban scale project ask for a total changes of all information systems of different modes. Therefore, no additional system is required.			In principle, no opposition is expected against this measure.		

(Cont.)

MIM7- Land Use Change

- **Description**

In the framework of traffic management concept, the measure *Land Use Change* is defined as *a short-term version* of the integrated land use and transport plan. This appears as a plan under a legal decree or an administrative ordinance, which defines and regulates desired land use patterns of the already fill-up areas in the city (e.g. city centre, university campus). The main impact of this measure is to reduce travel demand absolutely by combining different human purposes in a designated area. In MDCs, the applications of this measure can be establishment of series small supermarkets, medical clinics or kindergarten at the boundary or inside the two-wheeler accessed only areas; establishment shopping centre/street/quarter within coverage area of public transport nodes (e.g. main interchanges), provision of accommodations and groceries for students in a walking radius from the universities, improvement of education capacity for local primary and secondary school etc.

- **Assessment**

In MDCs, land use change is considered as the most effective measure in all aspect because its large scale of impact. In application, this measure also faces a general low level of difficulty (DS=1,46), although it faces a big challenge in getting acceptance from the land users, who would have to changes their activities or even to relocate their home or properties for the new land uses. Beside the high difficult in getting acceptance of the land users, considerable amount of investment and operation cost and active participations of transport authorities and operators are required. The other barriers are at low level of difficulty.

MIM7	Land Use Change							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
X			Y	Y	X			

Effectiveness			ES = 2,85	●
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		●
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		●
1.2. To increase modal choices	●	3.2. To reduce noise		●
1.3. To increase transport *P&E***	●	3.3. To save energy		●
1.4. To increase transport capacity	⊙	3.4. To save urban space		●
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		●
2.2. To reduce accident severity	●	4.2. To improve economic P&E		●
		4.3. To improve economic attractiveness		●

Applicability			DS = 1,41	⊙
Criteria 1: Cost of measure	◉	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	◉	3.1. Transport related institutions		◉
1.1. Operation cost	◉	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		⊙
2.1. Operation/control systems	⊙	4.1. Users		○
2.2. Information systems	⊙	4.2. Non-users		●

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ◉= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 31: Assessment of measure MIM7: Land Use Change

According to the terms of selection, this measure is selected into the *first priority group* of recommended measures. Detail assessment results are presented in Table E-29.

Table E- 29: Detail assessment of measure MIM7: Land Use Change

MIM7	Land Use Change							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
X			Y	X	X			

Effectiveness			ES = 2,85	●
Goal 1 : To ensure mobility	●	2,45	**Goal 3: To protect environment**	●	3
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	●	3
On one hand, this measure preserve road space for the transport modes of major and weak traveller groups. On the there hand, it enables the available capacity of public transport for travellers by modifying land use patterns.			By reducing number and distance of trips, this measure absolutely reduces average air pollution per trip. By reducing number of IMV trips, it reduces the most polluted type of trips. A highest level of impact on reducing air pollution is given to this measure.		
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	●	3
Reducing travel distance and shifting activities next to public transport interchanges strongly encourage travellers to use NMT and public transport services.			By reducing number and distance of trips, this measure absolutely reduces average noise per trip. By reducing number of IMV trips, it reduces the most noisy type of trips. A highest level of impact on reducing noise is given to this measure.		
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	●	3
Firstly, this measure manage to handle the same demand of activities but less number of trips. Secondly, this measure manage to handle the trips with shorter distance. Thirdly, this measure build a rich market for the available public transport services and NMT.			By reducing number and distance of trips, this measure absolutely reduces average energy consumption per trip. By reducing number of IMV trips, it reduces the most energy consumption type of trips. A highest level of impact on saving energy is given to this measure.		
1.4. To increase transport capacity	⊙	1	*3.4. To save urban space*	●	3
This measure does not aims to increase capacity, but it enables some available capacity for travellers.			By reducing number and distance of trips, this measure absolutely reduces average urban road per trip . By reducing number of IMV trips, it reduces the most space consumption type of trips. A highest level of impact on saving urban space is given to this measure.		
Goal 2: To ensure traffic safety	●	3,00	**Goal 4: To improve economy**	●	3,00
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	●	3
By reducing number and distance of trips, this measure absolutely reduces accident risks. By reducing number of IMV trips, it reduces the most risky type of trips. A highest level of impact on reducing accident frequency is given to this measure.			First, this measure absolutely reduces number of trip. Secondly, this measure reduce energy, time, road space consumption per trip by reducing of trip distance and shifting travel demand from IMVs to public transport and NMT. Therefore, a high level of impact on reducing transport cost is given to this measure.		
			4.2. To improve economic P&E	●	3
			This measure reduces both travel time and average distance of trips. Therefore, a high level of impact on improving economic P&E is given to this measure.		
2.2. To reduce accident severity	●	3			
By significant reduction of IMV conflicts, which are the most severe type of conflict, this measure is given a high level of impact on reducing accident severity.			*4.3. To improve economic attractiveness*	●	3
			Land use change programs alone can be considered as quite attractive economic activity for investors, who would be able to gain profit by investment on the designed activities of the programs. Moreover, a high accessibility urban area is simply preferred by other investors, visitors, and tourists.		

(Cont.)

Table E-29: Detail assessment of measure MIM7: Land Use Change (Cont.)

Applicability			AS = 1,41	⊙
Criteria 1: Cost of measure	⦿	**2**	**Criteria 3: Institutional participation**	⊙	**1,484**
1.1. Investment cost	⦿	2	3.1. Transport related institutions	⦿	2
This measure requires study cost and some public investment to provides and modifies some additional parking facilities, public transport stops, kindergartens. Investments for improvements of buildings or houses for fitting with new land use patterns are also required.			This measure requires participation of transport authorities and operators.		
1.1. Operation cost	⦿	2	3.2. Political bodies	⊙	1
In principle, this measure requires only minor additional employees, equipments, and coordination effort. In the case applying some tax exemption, a considerable operation cost must be counted.			Normally, approvals of city political bodies is required in application of this measure.		
Criteria 2: Technical systems	⊙	**1**	**Criteria 4: Public acceptance**	⊙	**1,126**
2.1. Operation/control systems	⊙	1	4.1. Users	○	
Only minor changes of systems are required.			In principle, no opposition is expected against this measure.		
2.2. Information systems	⊙	1	4.2. Non-users	●	3
Only minor changes of systems are required.			Strong opposition from land users is expected if they have to relocated their land use. In addition, land users are suffered from generated environmental impacts due to the new activities.		

MIM8- Flexible Working and School Hour

- **Description**

This measure is to modify the working and school schedule in order to reduce travel demand during peak periods of the day or in the peak day of the week. Earlier school and later working begin, working-at-home, 4.5 working days for 40 working hours per week (or 4/40, 3/36) are the most popular applications. The main impact of this measure is to shift the traffic demand from the peak hour to off-peak periods.

- **Assessment**

In MDCs, flexible working and schooling hour is recognised a relatively low effective measure, except its high level of impact on ensuring urban mobility. However, this measure is rated low effectiveness in improving traffic safety and protecting environment.

MIM8	Flexible Working and Schooling Hour							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			X					Y

Effectiveness			ES = 1,25	⊙
Goal 1 : To ensure mobility	◉	**Goal 3: To protect environment**		⊙
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⊙
1.2. To increase modal choices	●	3.2. To reduce noise		⊙
1.3. To increase transport *P&E***	●	3.3. To save energy		⊙
1.4. To increase transport capacity	○	3.4. To save urban space		◉
Goal 2: To ensure traffic safety	⊙	**Goal 4: To improve economy**		⊙
2.1. To reduce accident frequency	⊙	4.1. To reduce transport costs		⊙
2.2. To reduce accident severity	○	4.2. To improve economic P&E		◉
		4.3. To improve economic attractiveness		⊙

Applicability			DS = 1,27	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⊙	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		◉
2.1. Operation/control systems	○	4.1. Users		⊙
2.2. Information systems	●	4.2. Non-users		●

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ◉= Medium; ⊙=Low; ○= Non **UTP* = urban transport properties; ***P&E* = Productivity and Efficiency;

Figure E- 32: Assessment of measure MIM8: Flexible Working and School Hour

In contrast, this measure is highly applicable with low requirements on finance, technical systems and institutional participation. The most difficult issue of this measure is the acceptance of land users (e.g. employers) and the urban scale modifications of information systems for all transport modes. According to the terms of selection, this measure is not recommended as the main traffic management measure in MDCs. Detail assessment results are presented in Table E-30.

Table E- 30: Detail assessment of measure MIM8: Flexible Working and School Hour

MIM8	Flexible Working and Schooling Hour							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			X					Y

Effectiveness			ES = 1,25	⊙
Goal 1 : To ensure mobility	⦿	**2,18**	**Goal 3: To protect environment**	⊙	**1,203**
1.1. To ensure equality in using UTP	●	3	*3.1. To reduce air pollutions*	⊙	1
This measures ensures that all social groups have equal right of use UTP at the right time. Therefore, a high level of impact is given to this measure.			The concentration of air pollution is significantly reduced during peak period. However, the IMV traffic demand is remaining. Therefore, a low level of impact is expected from this measure.		
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⊙	1
Reduction of travel demand during peak hour opens chances for travellers of all modes, especially the passengers of public transport services and NMT users. Therefore, a high level of impact is given to this measure.			The level of noise is significantly reduced during peak period. However, the IMV traffic demand is remaining. Therefore, a low level of impact is expected from this measure.		
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	⊙	1
This objective can be considered as the core impact of this measure. With the same service capacity, urban transport system is efficiently handling all travel demand with much lower risk of congestion.			Reduction of traffic congestion helps to save energy consumption during peak period. However, the IMV traffic demand is remaining. Therefore, a low level of impact is expected from this measure.		
1.4. To increase transport capacity	○	0	*3.4. To save urban space*	⦿	2
This measure does not aim to increase service capacity.			In principle, this measure is considered as one of the most effective measure in saving urban space. In fact, a low level of shifting IMV drivers to public transport reduces the level of impact on saving urban space of this measure.		
Goal 2: To ensure traffic safety	⊙	**0,43**	**Goal 4: To improve economy**	⊙	**1,36**
2.1. To reduce accident frequency	⊙	1	*4.1. To reduce transport cost*	⊙	1
Although some conflicts may be reduced by this measure, one can not expect a considerable reduction of accident frequency if this measure is applied alone.			The main impact on reducing cost of this measure is gained via reducing congestion. The impact via shifting travel demand from IMV to public transport and NMT is limited. Therefore, a low level of impact on this objective is given to this measure.		
			4.2. To improve economic P&E	⦿	2
			This measure helps to reduce travel time of trips via avoiding traffic congestion. Therefore, a medium level of improving economic P&E is expected.		
2.2. To reduce accident severity	○	0	*4.3. To improve economic attractivene*	⊙	1
This measure does not aim to reduce accident severity.			As most, this measure can eliminate all traffic congestion during peak hour in the targeted area. This significantly improve the economic attractiveness of the city. However, the different of working time may results some disturbance for manufacturers, whose products or services require intercity production or distribution process.		

(Cont.)

Table E-30: Detail assessment of measure MIM8: Flexible Working and School Hour

Applicability			DS = 1,27	⊙
Criteria 1: Cost of measure	⊙	**1**	**Criteria 3: Institutional participat**	⊙	**1**
1.1. Investment cost	⊙	1	3.1. Transport related institutions	⊙	1
This measure requires only study cost			This measure requires participation of public transport operators for adjusting their operation schedule.		
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙	1
This measure requires only minor additional operation cost of transport service.			In the case of schooling and city administration working hour changes, approval of city political bodies is required in application of this measure.		
Criteria 2: Technical systems	⊙	**1,281**	**Criteria 4: Public acceptance**	⦿	**1,751**
2.1. Operation/control systems	○	0	4.1. Users	⊙	1
Only minor changes of systems are required.			Some changes on travel habit are the main concerns.		
2.2. Information systems	●	3	4.2. Non-users	●	3
An urban scale project ask for a total changes of all information systems of different modes.			For flexible working hours, employers (land users) do not simple accept the proposal due to considerable changes of production chain schedule. For schooling hours, the school administration and parents of school children some time do not want to change.		

(Cont.)

MIM9- Road Safety Audit

- **Description**

According to AUSROADS (1994) road safety audit "is a formal examination of an existing or future road or traffic project, or any project which interacts with road users, in which an independent, qualified examiner looks at the project's accident potential and safety performance"(Hildebrand and Wilson, 1999). In the framework of a traffic management program, Road Safety Audit is firstly applied for the planned infrastrcuture projects and all phases of the other traffic management measures, which will be implemented during time horizon of traffic management program. Secondly, it can be applied individually for any existing road section or facility (in-service facility).

- **Assessment**

In MDCs, Road Safety Audit is considered as the most effective measure to correct the safety mistakes in planning, design, construction, and maintenance of roads and other transport infrastructure facilities. The main safety impact of this measure is to reduce severity of accidents, which cause by the errors of roads. Reduction of accident frequency is also an important impact, but its scale is limited on comparing with the other safety solutions, which create impact on human behaviours. However, the impacts on other aspects of effectiveness are at low level. In implementation, this measure faces low level of difficulty in all aspects. In detail, this measure requires only low cost, no change on technical systems and it normally

MIM9	Road Safety Audit							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
						X		

Effectiveness			ES = 1,63	⦿
Goal 1 : To ensure mobility	⊙	**Goal 3: To protect environment**		⊙
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⊙
1.2. To increase modal choices	○	3.2. To reduce noise		⊙
1.3. To increase transport *P&E***	⊙	3.3. To save energy		⊙
1.4. To increase transport capacity	○	3.4. To save urban space		○
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		⊙
2.1. To reduce accident frequency	●	4.1. To reduce transport costs		⊙
2.2. To reduce accident severity	●	4.2. To improve economic P&E		⊙
		4.3. To improve economic attractiveness		⦿

Applicability			DS = 0,51	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⊙	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	○	**Criteria 4: Public acceptance**		○
2.1. Operation/control systems	○	4.1. Users		○
2.2. Information systems	○	4.2. Non-users		○

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

gets a strong support from public.

Figure E- 33: Assessment of measure MIM9: Road Safety Audit

According to the terms of selection, this measure is selected into the *second priority group* of recommended measures. Detail assessment results are presented in Table E-31.

Table E- 31: Detail assessment of measure MIM9: Road Safety Audit

MIM9	Road Safety Audit							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
						X		

Effectiveness			ES = 1,63	⦿
Goal 1 : To ensure mobility	⊙	**0,87**	**Goal 3: To protect environment**	⊙ **0,797**
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⊙ 1
This measure ensures safe infrastructure conditions for all road transport modes, intersections between road and railway are also included.			The concentration of air pollution is reduced by avoiding of traffic congestions , which causes by accidents. However, the IMV traffic demand is remaining. Therefore, a low level of impact is expected from this measure.	
1.2. To increase modal choices	○	0	*3.2. To reduce noise*	⊙ 1
This measure does not aim to increase modal choices.			Level of noise is reduced by avoiding of traffic congestions , which causes by accidents. However, the IMV traffic demand is remaining. Therefore, a low level of impact is expected from this measure.	
*1.3. To increase transport P&E***	⊙	1	*3.3. To save energy*	⊙ 1
In principle, this measure reduces number of interruptions, which caused by unsafe road, to achieve smooth traffic flow. Therefore, a low level of impact is given to this measure.			This measure helps to save energy consumption by avoiding of traffic congestions , which causes by accidents. However, the IMV traffic demand is remaining. Therefore, a low level of impact is expected from this measure.	
1.4. To increase transport capacity	○	0	*3.4. To save urban space*	○ 0
This measure does not aim to increase transport capacity			This measure does not aim to save urban space.	
Goal 2: To ensure traffic safety	●	**3,00**	**Goal 4: To improve economy**	⊙ **1,34**
2.1. To reduce accident frequency	●	3	*4.1. To reduce transport cost*	⊙ 1
The main impact of this measure is to eliminate the traffic accidents, which caused by unsafe road condition. This measure is the best effort that can be done by traffic engineers to safe urban lives. Therefore, a high level of impact on reduction of accident frequency is given to this measure.			The main impact on reducing cost of this measure is gained via reducing accidents. The impact via shifting travel demand from IMV to public transport and NMT is limited. Therefore, a low level of impact on this objective is given to this measure.	
			4.2. To improve economic P&E	⊙ 1
			This measure helps to reduce travel time of trips via avoiding traffic interruptions. Therefore, a low level of improving economic P&E is expected.	
2.2. To reduce accident severity	●	3	*4.3. To improve economic attractiveness*	⦿ 2
Although driver behaviour is the most important cause of accident and its severity, safe road designs helps to avoid a major part of severest accidents, which are not caused by human factors.			A safe road network is a key factor to attract investors to invest in the transport and logistic services. On the other hand, safe and smooth transport system make the city and region become attractive for commerce, tourisms, insurances and other economic activities.	

Applicability			AS = 0,51	⊙
Criteria 1: Cost of measure	⊙	**1**	**Criteria 3: Institutional participation**	⊙ **1**
1.1. Investment cost	⊙	1	3.1. Transport related institutions	⊙ 1
This measure requires only study cost.			This measure requires participation of traffic polices.	
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙ 1
This measure requires only minor additional employees and equipments.			In most of the cases, approval of city political bodies is required in application of this measure.	
Criteria 2: Technical systems	○	**0**	**Criteria 4: Public acceptance**	○ **0**
2.1. Operation/control systems	○	0	4.1. Users	○ 0
No operation and control system is required.			All traffic users are happy with this measure.	
2.2. Information systems	○	0	4.2. Non-users	○ 0
No information system is required.			All people are happy with this measure.	

Freight Transport Improvement Measures

FR1- Urban Truck Traffic Control

- **Description**

The measure aims to control Right-of-Way for truck traffic in the targeted urban area or road section. This measure consists a plan of truck prohibition roads or areas and the corresponded prohibition period (flexible or fixed). In MDCs, application of this measure is that operation of heavy trucks is prohibited during daytime overall city centre. The main impact of this measure is to reduce heavy truck traffic in the city centre in order to reduce number of conflicts between trucks and other vehicles in using limited road space in the city centre during main traffic hours (daytime).

- **Assessment**

In MDCs, urban truck traffic control is considered as an effective measure to reduce traffic congestion in the city centre. The impacts on ensuring traffic safety and protecting environment are also highly appreciated but only during daytime. During night-time, it creates negative impacts on traffic safety and environment.

FR1	Urban Truck Traffic Control							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			X	Y		X		

Effectiveness			ES = 1,80	⦿
Goal 1 : To ensure mobility	⦿	**Goal 3: To protect environment**		⦿
1.1. To ensure equality in using *UTP**	⦿	3.1. To reduce air pollutions		⦿
1.2. To increase modal choices	●	3.2. To reduce noise		⦿
1.3. To increase transport *P&E***	⦿	3.3. To save energy		⦿
1.4. To increase transport capacity	○	3.4. To save urban space		⦿
Goal 2: To ensure traffic safety	⦿	**Goal 4: To improve economy**		⊙
2.1. To reduce accident frequency	⦿	4.1. To reduce transport costs		○
2.2. To reduce accident severity	⦿	4.2. To improve economic P&E		⦿
		4.3. To improve economic attractiveness		⦿

Applicability			DS = 1,21	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⊙	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		⦿
2.1. Operation/control systems	⊙	4.1. Users		⊙
2.2. Information systems	⊙	4.2. Non-users		●

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 34: Assessment of measure FR1: Urban Truck Traffic Control

Fortunately, it is one of the very high applicable measures by facing only low level of difficulty in all barriers. The most difficult barrier is opposition of freight carriers, industries, and shopping business. In contrast, the travellers are happy with this measure. According to the

terms of selection, this measure is selected into the *second priority group* of recommended measures. Detail assessment results are presented in Table E-32.

Table E- 32: Detail assessment of measure FR1: Urban Truck Traffic Control

FR1	Urban Truck Traffic Control							TE
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
			X	Y		X		

Effectiveness			ES = 1,80	⦿
Goal 1 : To ensure mobility	⦿	**1,71**	**Goal 3: To protect environment**	⦿	**2**
*1.1. To ensure equality in using UTP**	⦿	2	*3.1. To reduce air pollutions*	⦿	2
This measure reserves urban road space for passenger transport modes and smaller freight transport vehicles during the prohibition period or all day long. Therefore, this measure encourages public and lower cost transport services, which can serve freight transport demands of all social groups in the urban area.			By eliminating heavy truck traffic , this measure significantly reduce air pollution along urban arterials during prohibition period. However, this measure only does not significantly reduce truck traffic, but only shift their operation time from day to night.		
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⦿	2
By prohibiting the heavy truck, this measure encourages the urban freight transport services by smaller vehicles, especially motorcycles and NMVs.			By eliminating heavy truck traffic, this measure significantly reduce noise in the urban area during prohibition . However, increasing of motorcycle traffic creates additional noise in the urban area. In addition, the increase of truck traffic during night time creates the most disturbance type of noise for urban life. Therefore, a medium level of impact on this measure is expected.		
*1.3. To increase transport P&E***	⦿	2	*3.3. To save energy*	⦿	2
This measure significantly increases productivity and efficiency of general urban transport by reducing traffic interruptions by conflicts between heavy trucks and smaller vehicles. However, transport productivity and efficiency can be reduced in cases of mass transport demand. Therefore, a medium impact is given to this measure.			In general, this measure saves energy consumption by reducing urban traffic congestion during prohibition period. However, this measure only does not significantly reduce truck traffic, but only shift their operation time from day to night.		
1.4. To increase transport capacity	○	0	*3.4. To save urban space*	⦿	2
This measure does not aim to increase transport capacity.			This measure reduces needs of urban space for large parking spaces or widening roads (for heavy truck traffic).		
Goal 2: To ensure traffic safety	⦿	**2,00**	**Goal 4: To improve economy**	⊙	**1,40**
2.1. To reduce accident frequency	⦿	2	*4.1. To reduce transport cost*	○	0
On one side, this measure significantly reduce the technological conflicts between heavy trucks and smaller vehicles in the traffic flow. On the other side, this measure creates some truck racing in urban area during allowed operation time (night). Experiences show that number of truck related accidents is higher during nigh time in the cities, where this measure is applied. Therefore, a medium level of impact is given to this measure.			This measure alone does not help to reduce transport cost.		
			4.2. To improve economic P&E	⦿	2
			On one side, this measure reduce travel time for general urban traffic by reducing traffic congestion during prohibition period. On the other side, this measure creates disturbance for truck operators and business by forcing them to reschedule their production and distribution process.		
2.2. To reduce accident severity	⦿	2			
Experiences shows that the truck related accidents are accounted as the most deadly accident in MDCs. Reduction of heavy truck traffic in the urban area significantly reduces risks of having severe urban traffic accidents but the risk of night accident is considerable. Therefore, a medium level of impact is given to this measure.			*4.3. To improve economic attractiveness*	⦿	2
			On one side, this measure improve the attractiveness of low transport demand economic sectors. On the other side, this measure discourages the manufactured industries. Fortunately, the portion of these sector is small in the urban area.		

(Cont.)

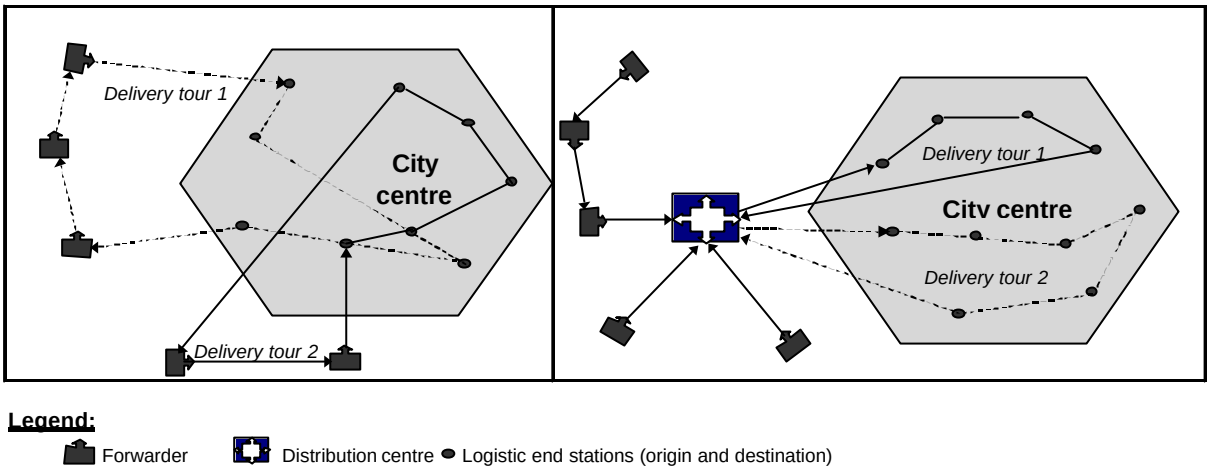
Table E-32: Detail assessment of measure FR1: Urban Truck Traffic Control (Cont.)

Applicability			AS = 1,21	⊙
Criteria 1: Cost of measure	⊙	**1**	**Criteria 3: Institutional participation**	⊙	**1**
1.1. Investment cost	⊙	1	3.1. Transport related institutions	⊙	1
Some minor of investments are required to carry out the study, and to provide traffic signs and guiding boards.			This measure requires participation of traffic polices.		
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙	1
Some minor increases of man power and equipments for enforcement.			Approval of city political bodies is required in application of this measure.		
Criteria 2: Technical systems	⊙	**1**	**Criteria 4: Public acceptance**	◉	**1,75**
2.1. Operation/control systems	⊙	1	4.1. Users	⊙	1
Minor adjustments of local control systems are required.			Truck drivers normally oppose this measure, but other travellers are happy.		
2.2. Information systems	⊙	1	4.2. Non-users	●	3
This measure requires adjustments of urban traffic information system.			Businesses, freight carriers, industries strongly oppose this measure, but the high transport demand industries are normally located outside the city centres. In contrast, residents and shopping businesses are happy.		

FR2- City Logistic Management System

- **Description**

In principle, this measure is providing a coordination service for different freight transport origins and destinations by coordinated delivering tours either to linking different forwarders or via city delivering centres (see Figure E- 35).



[Source: adapted from (Boltze, 2003)]

Figure E- 35: Example of City Logistic Management System

In MDCs, this measure focuses also on provision a multimodal distribution service, which operates by light trucks, pickups, and motorcycles. Main impacts of this measure are to improve freight transport productivity and efficiency and to eliminate (reduce) heavy truck traffic in the city centre, especially the empty returning truck. In the delivering tour, the medium and light truck is normally using.

Although, this application can make some increases in light truck traffic in the city centre, the reduction of heavy truck is much a bigger compensation by significant reduction of air-pollution, noise, severity accident (between trucks and motorcycles), traffic delay (by slow acceleration of heavy truck), and the maintenance cost of urban road and parking facilities.

- **Assessment**

In MDCs, city logistic management system is considered as one the most effective measures to ensure urban mobility, traffic safety and to support economic development of the city (see Figure E- 36). In term of applicability, this measure faces only low level of difficulty in general although considerable investment cost is required. The opposition of land users in the surrounding areas of distribution centres is also considerably difficult. In contrast, this measure requires only minor changes of information system while it gains a strong support of urban travellers. According to the terms of selection, this measure is selected into the *first priority group* of recommended measures. Detail assessment results are presented in Table E-33.

FR2	City Logistic Management System							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
X		Y	Y	Y	Y			

Effectiveness			ES = 2,40	●
Goal 1 : To ensure mobility	●	**Goal 3: To protect environment**		⊙
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⊙
1.2. To increase modal choices	●	3.2. To reduce noise		⊙
1.3. To increase transport *P&E***	●	3.3. To save energy		◉
1.4. To increase transport capacity	◉	3.4. To save urban space		◉
Goal 2: To ensure traffic safety	●	**Goal 4: To improve economy**		●
2.1. To reduce accident frequency	◉	4.1. To reduce transport costs		◉
2.2. To reduce accident severity	●	4.2. To improve economic P&E		●
		4.3. To improve economic attractiveness		●

Applicability			DS = 0,79	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	◉	3.1. Transport related institutions		⊙
1.1. Operation cost	⊙	3.2. Political institutions		○
Criteria 2: Technical systems	○	**Criteria 4: Public acceptance**		⊙
2.1. Operation/control systems	○	4.1. Users		○
2.2. Information systems	⊙	4.2. Non-users		◉

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ◉= Medium; ⊙=Low; ○= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 36: Assessment of measure FR2: City Logistic Management System

Table E- 33: Detail assessment of measure FR2: City Logistic Management System

FR2	City Logistic Management System							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
X		Y		X	Y			

Effectiveness			ES = 2,40	●
Goal 1 : To ensure mobility	●	2,72	**Goal 3: To protect environment**	⊙ 1,42
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⊙ 1
This measure establishes a public transport service for urban goods. With this service, good transport demands of different land uses, which are located at different accessibility condition locations, have a same opportunity to use transport supply.			By eliminating heavy truck traffic, this measure significantly reduce air pollution along urban arterials. In addition, by multimodal distribution service, most of small packages (less than 1 mx1mx1m dimension) are collected and distributed by motorcycle, which also help to reduce air pollution in the urban area. However, this measure increases air pollution in the surrounding area of the distribution centres.	
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⊙ 1
Multimodal distribution centres offer multi choices for urban good transport demands.			By eliminating heavy truck traffic, this measure significantly reduce noise in the urban area. However, increasing of motorcycle traffic creates additional noise in the urban area. In addition, this measure increase noise level in the surrounding area of this distribution centres. Therefore a low level of impact on reducing noise is given to this measure.	
*1.3. To increase transport P&E***	●	3	*3.3. To save energy*	⦿ 2
This measure significantly increases productivity and efficiency of freight transport in the urban area by reducing empty trips of vehicle. Secondly, this measure reducing traffic interruptions and congestions in the city centre by eliminating heavy trucks in urban traffic.			By eliminating empty vehicle, this measure significantly increase energy efficiency of freight transport. In addition, by multimodal distribution service, most of small packages (less than 1 mx1mx1m dimension) are collected and distributed by motorcycle, which is the most energy efficient motorised vehicle in the urban traffic.	
1.4. To increase transport capacity	⦿	2	*3.4. To save urban space*	⦿ 2
This measure does not aim to increase transport capacity by having many new vehicles but it increases transport capacity by coordinates the available vehicles in formulating a new form of service.			Although new urban land areas are required for distribution centres, this measure ensures that most of good transport demands in the city centre can be transported without need of providing large parking spaces or widening roads (for heavy truck traffic).	
Goal 2: To ensure traffic safety	●	2,57	**Goal 4: To improve economy**	● 2,70
2.1. To reduce accident frequency	⦿	2	*4.1. To reduce transport cost*	⦿ 2
On one side, this measure significantly reduce the technological conflicts between heavy trucks and smaller vehicles in the traffic flow. On the other side, the increase of small distribution vehicle traffic is a potential reason for increasing of accident frequency. Fortunately, experiences show that professional distribution vehicles are the most seldom participated vehicles in urban traffic accidents. Therefore, a medium level of impact is given to this measure.			This measure significantly reduce transport cost, especially vehicle purchasing and operation cost. The increase in number of small vehicles asks for increase of man powers, although which cost is relatively low in MDCs and other developing cities. Therefore, a medium level of impact on reducing transport cost is given to this measure.	
			4.2. To improve economic P&E	● 3
			Firstly, the coordination of freight trips significantly reduces travel distance and time. Secondly, reducing of empty vehicle trips makes the service more efficient. Thirdly, using of motorcycles for distribution service helps to reduce travel distance and time by its flexibility and ability to access every city corners by shortest routes.	
2.2. To reduce accident severity	●	3		
Experiences shows that the truck related accidents are accounted as the most deadly accident in MDCs. Therefore, reduction of heavy truck traffic in the urban area significantly reduces risks of having severe urban traffic accidents.			*4.3. To improve economic attractiveness*	● 3
			This measure itself is a good service to invest. Moreover, having a good quality and low cost freight transport and distribution service, the urban area becomes very attractive for investors to invest in different economic sectors.	

(Cont.)

Table E-33: Detail assessment of measure FR2: City Logistic Management System

Applicability			DS = 0,79	⊙
Criteria 1: Cost of measure	⊙	**1,472**	**Criteria 3: Institutional participation**	⊙	**0,48**
1.1. Investment cost	◉	2	3.1. Transport related institutions	⊙	1
The most considerable investment in this measure is the land, building and equipments for distribution centre.			For changing information system, this measure requires participation of transport authorities.		
1.1. Operation cost	⊙	1	3.2. Political bodies	○	0
Only minor additional cost for operation and maintenance is required.			No approval of political bodies is required in application of this measure.		
Criteria 2: Technical systems	○	**0,427**	**Criteria 4: Public acceptance**	⊙	**0,75**
2.1. Operation/control systems	○	0	4.1. Users	○	0
This measure does not require any additional transport operation and control system.			Users are happy with this measure.		
2.2. Information systems	⊙	1	4.2. Non-users	◉	2
This measure requires some minor adjustments in local information system.			This measure may face counter force of people, who live in the surrounding area of the distribution centres, due to negative environmental impacts.		

(Cont.)

FR3- Freight Taxi Service Improvement

- **Description**

In many MDCs, this service is considered as the main transport supply for serving household freight and service transport demands. It is considered as an effective alternative to private car use in serving household freight transport demand. Moreover, this service operates as the complementary measure of the city logistic management systems. This measure firstly aims to regularise and standardise the available freight taxi service, which provides professional freight transport in urban area by operating light trucks, pickups, motorcycles, and tricycles in some area. On one hand, certain requirements on vehicle standards (colour, design, communication device), service insurance, taxes, and duties are imposed from city authorities in order to distinguish the taxis and individual use vehicles. On the other hand, these vehicles have right to use waiting places and parking facilities, which are provided for passenger taxis, in front of shopping centres or next to the residential areas. In some cases, this measure introduces a business model, which coordinates individual operators into a freight taxi company, cooperative, or a self-management unit.

- **Assessment**

In MDCs, this measure is considered as an effective measure to ensure urban mobility, but the impacts on other aspects are relatively low in comparing with other freight traffic measures. In term of applicability, this measure is highly applicable although considerable investment costs and participation of transport institutions are required. Moreover, this measure requires only some minor changes of information system, while it normally gains strong supports of the public.

FR3	Freight Taxi Service Improvement							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
		X		X				

Effectiveness			ES = 1,60	⦿
Goal 1 : To ensure mobility	⦿	**Goal 3: To protect environment**		⊙
1.1. To ensure equality in using *UTP**	●	3.1. To reduce air pollutions		⊙
1.2. To increase modal choices	●	3.2. To reduce noise		⊙
1.3. To increase transport *P&E***	⦿	3.3. To save energy		⊙
1.4. To increase transport capacity	⊙	3.4. To save urban space		⊙
Goal 2: To ensure traffic safety	⊙	**Goal 4: To improve economy**		⦿
2.1. To reduce accident frequency	⦿	4.1. To reduce transport costs		⊙
2.2. To reduce accident severity	⊙	4.2. To improve economic P&E		⊙
		4.3. To improve economic attractiveness		●

Applicability			DS = 0,85	⊙
Criteria 1: Cost of measure	⊙	**Criteria 3: Institutional participation**		⊙
1.1. Investment cost	⦿	3.1. Transport related institutions		⦿
1.1. Operation cost	⊙	3.2. Political institutions		⊙
Criteria 2: Technical systems	⊙	**Criteria 4: Public acceptance**		O
2.1. Operation/control systems	O	4.1. Users		O
2.2. Information systems	⊙	4.2. Non-users		O

Note: X = primary impact; Y = secondary impact; Blank cell = No impact
●= High; ⦿= Medium; ⊙=Low; O= Non * *UTP* = urban transport properties; ** *P&E* = Productivity and Efficiency;

Figure E- 37: Assessment of measure FR2: Freight Taxi Service Improvement

According to the terms of selection, this measure is selected into the *second priority group* of recommended measures. Detail assessment results are presented in Table E-34.

Table E- 34: Detail assessment of measure FR2: Freight Taxi Service Improvement

FR3	Freight Taxi Service Improvement							A-O
AT1	AT2	AT3	ST1	ST2	ST3	CT1	CT2	CT3
		X		X				

Effectiveness			ES = 1,60	⦿
Goal 1 : To ensure mobility	⦿	**2,18**	**Goal 3: To protect environment**	⊙ **1**
*1.1. To ensure equality in using UTP**	●	3	*3.1. To reduce air pollutions*	⊙ 1
This measure encourages the use of a public transport service for household good transport demands. With this service, small good transport demands of different land uses, which are located at different accessibility condition locations, have a same opportunity to use transport supply.			By reducing heavy truck traffic, this measure helps to reduce air pollution in urban area. However, this measure alone can create only low level of impact on reducing heavy truck traffic. On the other hand, this measure simply shift use of individual use motorised small vehicle to a public use small vehicle. Therefore a low level of impact on reducing air pollution is given to this measure.	
1.2. To increase modal choices	●	3	*3.2. To reduce noise*	⊙ 1
This measure encourages a most convenient and accessible transport service for households in MDCs.			By reducing heavy truck traffic, this measure helps to reduce noise in urban area. However, this measure alone can create only low level of impact on reducing heavy truck traffic. On the other hand, this measure simply shift use of individual use motorised small vehicle to a public use small vehicle. Therefore a low level of impact on reducing noise is given to this measure.	
*1.3. To increase transport P&E***	⦿	2	*3.3. To save energy*	⊙ 1
Experiences show that the distinguish freight taxi vehicles have much higher productivity and revenue that the others. Moreover, the average income of individual operators/vehicles is much lower than the one who have been joined a cooperative or a company. In addition, this measure helps to reduce the use of normal IMVs and heavy trucks for transporting household goods. Therefore, a medium level of impact on increasing transport productivity and efficiency is given to this measure.			By reducing heavy truck traffic, this measure helps to save energy in urban area. However, this measure alone can create only low level of impact on reducing heavy truck traffic. On the other hand, this measure simply shift use of individual use motorised small vehicle to a public use small vehicle. Therefore a low level of impact on saving energy is given to this measure.	
1.4. To increase transport capacity	⊙	1	*3.4. To save urban space*	⊙ 1
This measure does not aim to increase transport capacity by having many new vehicles but it mainly coordinates the available vehicles in formulating a new form of service. Additional area for waiting and parking places is also provided. Therefore, a low impact on increasing capacity is expected from this measure.			Although new urban land areas are required for waiting and parking places, this measure ensures that most of good transport demands in the city centre can be transported without need of providing large parking spaces or widening roads (for heavy truck traffic). However, scale of impact is small.	
Goal 2: To ensure traffic safety	⊙	**1,43**	**Goal 4: To improve economy**	⦿ **1,68**
2.1. To reduce accident frequency	⦿	2	*4.1. To reduce transport cost*	⊙ 1
Experiences show that professional freight taxis are seldom participate on traffic accident in comparing with the IMVs. The reasons are that the taxi vehicles are designed properly for freight transport and the drivers have better skills and experiences on transporting goods, especially by motorcycles. The provision of light truck and pickup taxis also helps to reduce the risks of transporting everything by motorcycles. Therefore, a medium impact on reducing accident frequency is given to this measure.			The increase in number of small vehicles asks for increase of man powers, which cost is relatively low in MDCs and other developing cities. Therefore, a low level of impact on reducing transport cost is given to this measure.	
			4.2. To improve economic P&E	⊙ 1
			The use of demand responsive service helps to reduce time of waiting or interchange for household good transport. Smaller vehicles are much more flexible and higher mobility than the conventional trucks. However, the mass production can not be achieved by this service.	
2.2. To reduce accident severity	⊙	1		
By reducing of accidents, which caused by motorcycles those transported goods are over weighted or oversized , this measure reduces accident severity in MDCs.				
			4.3. To improve economic attractiveness	● 3
			This measure itself is a good service to invest. Moreover, having a high mobility and low cost freight transport and distribution service, the urban area becomes very attractive for investors to invest in different economic sectors.	

(Cont.)

Table E-34: Detail assessment of measure FR2: Freight Taxi Service Improvement

Applicability				AS = 0,85	⊙
Criteria 1: Cost of measure	⊙	**1,472**	**Criteria 3: Institutional participation**	⊙	**1,484**
1.1. Investment cost	◉	2	3.1. Transport related institutions	◉	2
The study cost and additional area for waiting and parking places are the main public investment for this measure.			This measure requires the participation of individual operators and traffic police.		
1.1. Operation cost	⊙	1	3.2. Political bodies	⊙	1
Only minor additional cost for operation and maintenance is required.			Approval of city political bodies is required in application of this measure.		
Criteria 2: Technical systems	⊙	**0,427**	**Criteria 4: Public acceptance**	○	**0**
2.1. Operation/control systems	○	0	4.1. Users	○	0
This measure does not require any additional transport operation and control system.			Users are happy with this measure.		
2.2. Information systems	⊙	1	4.2. Non-users	○	0
This measure require minor adjustment in local information system.			People are happy with this measure.		

(Cont.)

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