

TRANSPORT MASTER PLAN

3. TRANSPORT PLANNING POLICY

(1) Planning Policy and Strategy

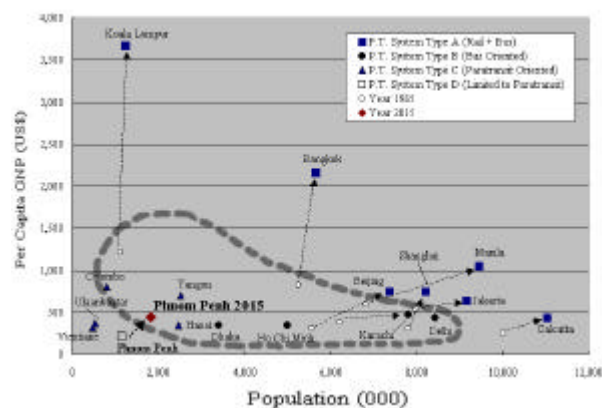
Based on the assessment of present transport issues and in line with MPP urban development policy*, the transport planning policies were established based on the discussion between Cambodian side and the Study Team. Consequently, the transport strategies were adopted through the dis-

ussion with the Cambodian side, focusing on two main themes; the restricted population growth in urbanized area and the creation of progressive region with high development potential and amenity in the suburban area.

Policy and Strategy		
MPP Urban Development Policy	Planning Policy	Development Strategy
Urbanized Area <ul style="list-style-type: none"> Easing population concentration by regulating building height. Preserving landscape, cultural heritage and environment. 	<ul style="list-style-type: none"> Spatial distribution of urban activity (restricted population growth, 1.3 times in 2015). Preservation of historic city and tourism heritage. Transport system responsive to future traffic demand. 	<ul style="list-style-type: none"> Full utilization of existing facilities. Effective traffic management system. Introduction of public transport service. Improvement of street pavement.
Suburban Area <ul style="list-style-type: none"> Achieving planned population growth. Creating progressive region with urban structure, high development potentiality and amenity. 	<ul style="list-style-type: none"> Spatial distribution of urban activities (1.9 times in 2015) Modern city with urban structure and development potentiality. Transport system responsive to future traffic demand. 	<ul style="list-style-type: none"> Integrated transport system with land use plan. Strengthening of public transport system Implementation of functional road hierarchy. Improvement of congested roads

(2) Transport System Suitable to Phnom Penh Metropolitan Area

The present transport system in the Phnom Penh Metropolitan Area is characterized as para-transit oriented mode with 84% motorcycle share. As the population increases and socioeconomic activities are developed, the transport mode will be shifted to a more comprehensive transport system such as public transport, which is developed depending on physical urban size, population scale, social characteristics, income level etc. The populated area in the urbanized area is about 27 km² (4 x 7 km). Bus system is the most flexible and suitable to short trips in a relatively small-scale urban city.



Transport Mode in Asian Countries

*Urban development plan is usually drawn up in line with higher development plans such as national development plan. In case of the Study Area, there is no higher development plan. Accordingly, urban development policy of MPP was adopted as the base for the Master Plan. The development policy is being prepared by MPP and French consultant team working under technical cooperation program of French Government.

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4. STRATEGIES AND TARGETS OF PLAN

The strategies and targets of the Plan are established in accordance with Transport Planning Policies. These strategies, as a whole, are intended to provide a smooth, safe, economic and reliable transport system as well as access to the planned development areas.

Strategy 1. Establishment of Transport Network in accordance with Land Use Plan

- Provision of access to the planned development areas
- Establishment of road network to promote desirable development in the west of present urbanized area

Strategy 2. Introduction of Modern Public Transport System

- New system responsive to future traffic demand as well as economic development as capital city of the country
- Flexible system with co-existence of paratransit
- System with affordable investment and manageable operation cost

Strategy 3. Development of Efficient, Comfortable and Safe Transport System

- Alleviation of traffic congestion on major roads

- Establishment of functional transport network

Strategy 4. Improvement of Urban and Traffic Environment

- Rehabilitation of pavement, particularly in urbanized area (on-going on major roads)
- Introduction of public transport favorable to urban environment and tourism

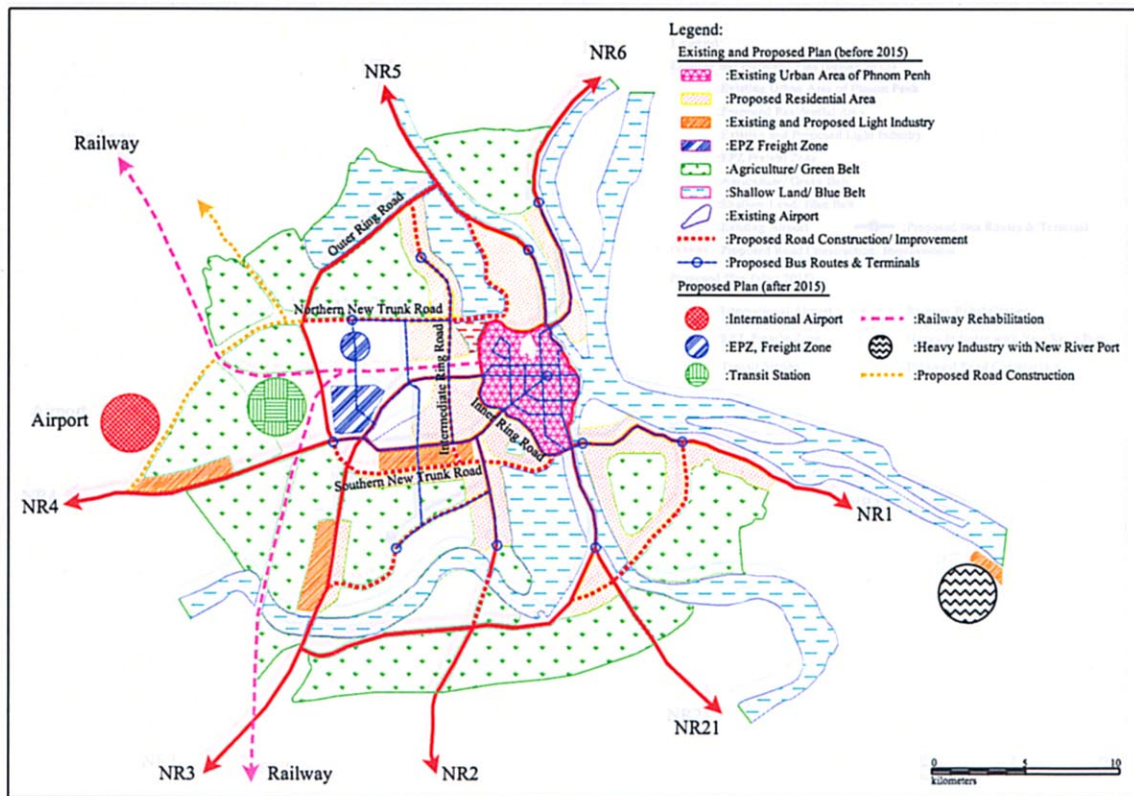
Strategy 5. Establishment of Efficient Traffic Control System

- Provision of traffic signals in urbanized area (on-going on major intersections)
- Measure to reduce traffic accidents
- Measure to alleviate traffic congestion
- Education and enforcement

Target

The realization of these strategies, which are considered to comprise the essential and minimum infrastructure, is indispensable to promote the socioeconomic development of the area, and for the rebirth of the country. The special focus is given on the introduction of new public transport, pavement rehabilitation and traffic control system as well as legislation to support them.

The transport network efficiency is evaluated in terms of level of services including average V/C ratio and travel speed.



Land Use and Transport Integrated Plan

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**5. TRANSPORT MASTER PLAN
ALTERNATIVES**

**5.1 GENERATION OF MASTER PLAN
ALTERNATIVES**

(1) Sectoral Policy and Alternatives

Transport Demand Management

The transport demand is planned to be spontaneously induced according to the land use and restricted by the building height regulation in the urbanized area.

Traffic demands are examined for the following cases:

- Do Nothing: Continuation of present pattern and road network
- Policy 1: Continuation of present transport pattern
- Policy 2: Vehicle priority policy
- Policy 3: Bus priority policy
- Policy 4: Bus favored: para-transit co-existing policy

Road Development

The land use and transport integrated plan is drawn up as the basic road network consisting of seven (7) national roads, three (3) ring roads, two (2) east-west trunk roads and supporting arterial and collector system.

These systems are considered as the basic transport infrastructure. Therefore, no alternatives are considered.

Public Transport

The present para-transit orientated mode is planned to be changed to a modern transport system of bus system with due consideration on various factors such as population scale, magnitude of urban activity, degree of population concentration as well as level of economic development and social activities.

The measures required for attracting bus passengers shall be established.

Transport Control Management

The disorderly traffic flow of cars and para-transit shall be improved with traffic control measures such as education and enforcement, and installation of traffic signals at congested intersections.

Transport Legislation

Transport related legislation, including vehicle registration system, driver license system and private investment law, shall be established

Human Resource Development

Organizational and human resource capacity development is the vital key in developing the urban transport system.

The development plan, covering budget, management, database, computer operation technique, etc. shall be prepared

(2) Generation of Master Plan Alternatives

To generate the transport master plan alternatives, the sectorial policy and alternatives are combined.

The focus is given on examination of bus introduction policy, and the traffic control management. Transport legislation and human resource development are considered as the fixed component to be implemented in any case.

Master Plan Alternatives

	Transport Demand Management				Road * Develop-ment		Public ** Transport	
	Policy				Network		Pre- sent	Bus
	1	2	3	4	Ex- isting	Basic		
Do Nothing	<input type="radio"/>				<input type="radio"/>		<input type="radio"/>	
Alternative 1 Present Pat- tern	<input type="radio"/>					<input type="radio"/>	<input type="radio"/>	
Alternative 2 Vehicle Pri- ority		<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	
Alternative 3 Bus Priority			<input type="radio"/>			<input type="radio"/>		<input type="radio"/>
Alternative 4 Bus Favored/ Development				<input type="radio"/>		<input type="radio"/>		<input type="radio"/>

* "Basic Network" refers to the Basic Road Network shown in page 26.
** "Present" refers to the "para-transit oriented mode" while "Bus" refers to "Bus Favored" or "Bus Priority" type of public transport.

The basic aspects of these alternatives are schematically illustrated in the following table.

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Alternatives	Urbanized Area	Suburban Area
<p>Alternative 1: Present Pattern</p> <ul style="list-style-type: none"> - Present pattern is assumed to be continued in the future without transport regulation. - Modal share of future transport is assumed to be remained the same as present except the change due to the economic growth. 		
<p>Alternative 2: Vehicle Priority Policy</p> <ul style="list-style-type: none"> - Vehicle are assumed to be increased by encouraging usage of 4-wheel vehicles. - Policy in favor of 4-wheel vehicles is enforced. 		
<p>Alternative 3: Bus Priority Policy</p> <ul style="list-style-type: none"> - Bus services are assumed to be operated on arterials by implementation of bus priority policy. - Operating of 2-wheel vehicles is regulated on arterials, thus suppressing 2-wheel vehicles. 		
<p>Alternative 4: Bus Favored Policy (Para-Transit Coexistence Policy)</p> <ul style="list-style-type: none"> - Bus operation with co-existence of 2-wheel vehicles are assumed to be encouraged by bus promotion policy. - Passage of 2-wheel vehicles is regulated on principal arterials. 		

Schematic Illustration of Master Plan Alternatives

5.2 COMPARATIVE EVALUATION OF ALTERNATIVES

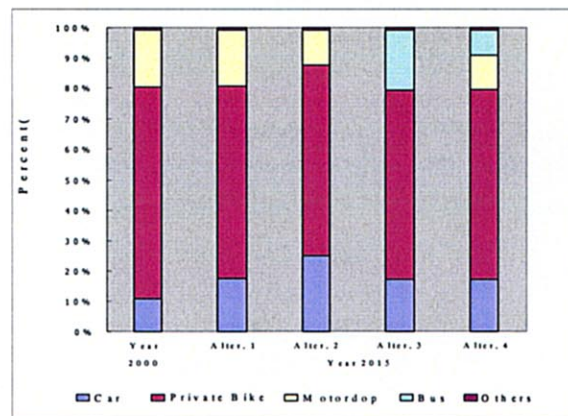
To select the optimum plan, the above four (4) alternatives are evaluated with traffic analysis, economic evaluation, environmental assessment as well as social acceptance. The modal share is determined based on bus operation experiment.

(1) Assumed Modal Share

The total person trip excluding walking is 3.95 million per day in 2015, which are split into the modal shares assumed for the Alternatives. Alternative 3 has a 20% share for bus and 0% for motodop and Alternative 4 has a 8.4% share for bus and 11.4% for motodop.

These assumptions were made based on the opinion survey on introduction of city bus operation from the person trip survey and policies to encourage bus service.

The 8.4% bus share of Alternative 4 is the basic figure estimated by such method. The car ratio is basically followed the ratio of present pattern, except Alternative 2. (The car ratio is expected to increase to 17.2% due to economic growth.)



Assumed Modal Share for Alternatives

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(2) Traffic Analysis of Alternatives

Traffic assignment and analysis of four (4) alternatives were made on the proposed road network in Year 2015 for comparative evaluation of traffic efficiency in terms of travel length, travel time, volume capacity ratio (VCR), average speed and traffic cost.

Comparison of Traffic Parameters (whole area)

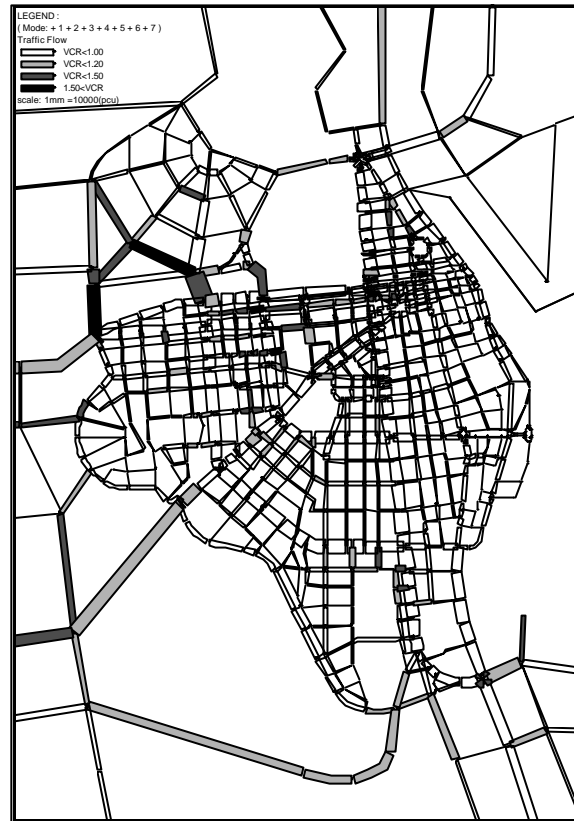
Alternative	VCR	Travel Speed (km/h)	Traffic Cost (\$)
Alternative 1	0.34	33.9	423,854
Alternative 2	0.34	33.8	421,755
Alternative 3	0.32	34.8	402,444
Alternative 4	0.33	34.2	403,878

Alternative 1 (Continuation of Present Pattern) shows the second lowest average speed of 33.9 km/h, and highest VCR of 0.34 with travel cost of US\$ 423,854, which is ranked as 4 (lowest) in the view of traffic efficiency. Moreover, due to non-controlled increase of para-transit vehicles, the traffic pollution, nuisance and accidents will become worse than tolerable, thus hampering the image of a modern city on heritage.

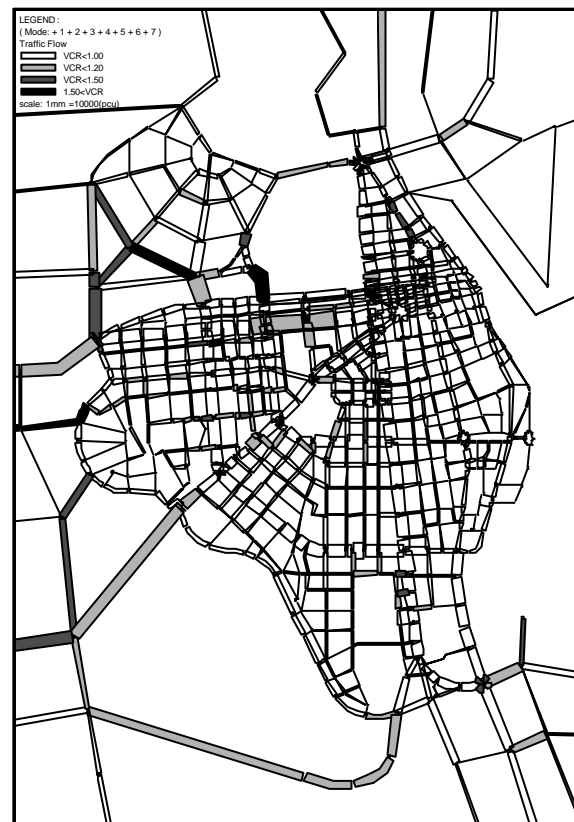
Alternative 2 (Vehicle Priority Policy) indicates almost the same figures as Alternative 1, and ranked as 3. In addition, the intentional encouragement of vehicle may increase traffic pollution and accidents.

Alternative 3 (Bus Priority Policy) has the most favorable traffic parameters, the highest average speed of 34.8 km/h, VCR of 0.32 and lowest travel cost of US\$ 402,444, which is ranked as the best among 4 alternatives. However, due to bus priority policy, utilization of motodop will be suppressed or prohibited, and this will be very inconvenient to the local traffic service, and therefore will not be accepted by public.

Alternative 4 (Bus Favored: Para-transit Co-existing Policy) shows almost the same parameters as Alternative 3, average speed of 34.2 km/h, VCR of 0.33, and traffic cost of US\$ 403,878, and was ranked as No.2 in terms of traffic efficiency. Moreover, co-existence of bus and motodop operations can create a transport system with a hierarchical and functional modal split in accordance with their transport characteristics, thus will be accepted by public.



Alternative 1 Urbanized Area, Year 2015



Alternative 4 Urbanized Area, Year 2015

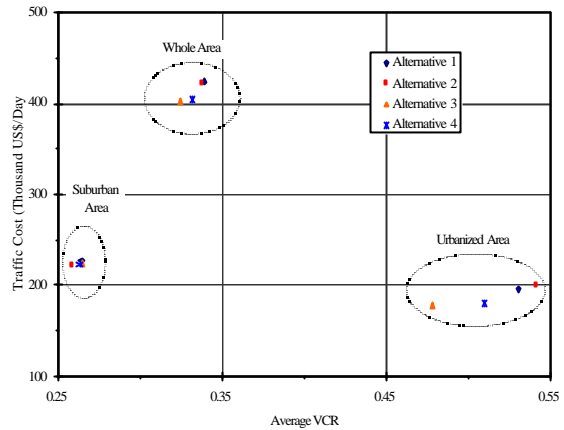
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Alternative 1, Suburban Area, Year 2015



Alternative 4, Suburban Areas, Year 2015



Comparison of Traffic Efficiency by Area

As can be seen in the figure above, there is a substantial difference in traffic efficiency between the urbanized area and suburban area, reflecting the difference in the characteristics of these areas such as land use. There are little differences in the traffic efficiencies of the alternatives in the suburban area. Contrarily, there are evident differences in the traffic efficiencies in the urbanized area, and it is clearly seen that Alternative 3 is most efficient.

(3) Overall Evaluation of Alternatives

Comparison of Economic Indications

	B/C	EIRR (%)	NPV (US\$ mil.)
Alternative 1	1.59	16.07	104.73
Alternative 2	1.64	16.29	111.69
Alternative 3	1.73	24.82	146.86
Alternative 4	1.73	24.64	126.17

Overall Evaluation of Transport Master Plan Alternatives

	Traffic Condition	System Efficiency	Environmental Impact	Social Acceptance	Economic Evaluation	Overall Evaluation
Alternative 1		X	X	X	EIRR=16.1% B/C=1.59	4
Alternative 2		X	X	X	EIRR=16.3% B/C=1.64	3
Alternative 3			○	XX	EIRR=24.8% B/C=1.73	2
Alternative 4		○	○		EIRR=24.6% B/C=1.73	1

As shown in the above, Alternative 4 is selected as the Optimum Alternative. Alternative 3 is slightly better in “System Efficiency” and “Economic Evaluation” than Alternative 4. However, Alternative 3 needs suppression/prohibition of motodop operation and is judged to be socially unacceptable.

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(4) Evaluation of Optimum Master Plan Alternative

The traffic system performance of the Plan is assessed with analysis of traffic parameters such as gross travel length, gross travel time, average travel speed, volume-capacity ratio (VCR) and gross traffic cost to examine the optimum investment timing. With Master Plan, average travel speed will increase by 1.47 times and traffic cost will decrease to 0.70 times, comparing with “without case” in 2015.

Comparison of “Without” and “With”

Year	Average Speed (km/h)			Traffic Cost (US\$ M.)		
	WO	W	W/WO	WO	W	W/WO
2005	29.3	33.0	1.13	347.9	265.4	0.76
2010	26.5	33.8	1.28	443.3	323.1	0.73
2015	23.0	34.2	1.47	579.9	403.9	0.70

Note: WO: Without, W: With

(5) Effect of Master Plan

The proposed Master Plan is designed to provide reliable, efficient and economical means for people’s movement and commodity transport and evaluated from the following viewpoints.

Target Realization

The Master Plan meet the requirement of the Objectives and Targets.

- **Establishment of transport network in accordance with Land Use Plan:** The Master Plan provides access the planned development areas.
- **Introduction of modern public transport system:** The Master Plan introduces bus system as main public transport mode.
- **Development of efficient, comfortable and safe transport system:** This objective is achieved by introduction of bus services proposed in the Master Plan.
- **Improvement of urban and traffic environment:** The Master Plan proposes pavement improvement of urban streets. Introduction of bus is expected to improve environment through reducing air pollution caused by congestion, as well as to promote tourism by providing transport for tourist.
- **Establishment of traffic control system:** The Master Plan is to introduce improved traffic control including installation of modern traffic signals and implementation of traffic education and enforcement.

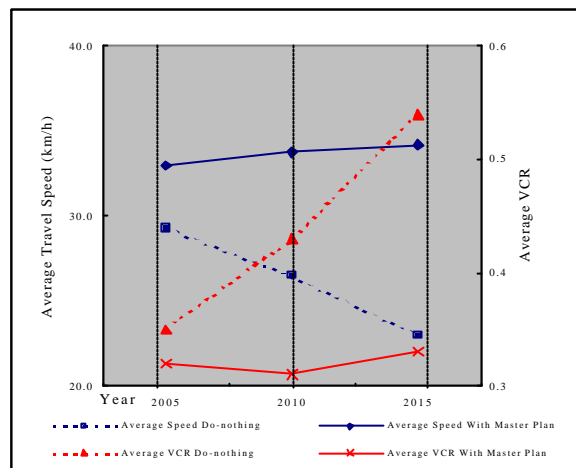
Traffic Efficiency Improvement

The Plan satisfactorily caters the future traffic demand maintaining acceptable traffic efficiency as evaluated in the network efficiency analysis.

Economic Benefits

The Plan yields the economic benefit in ten (10) years after its completion in year 2015.

- NPV = US\$114.4 million
- B/C = 1.62
- EIRR = 22.02%



Comparison of Traffic Parameter

Indirect Benefits

The Plan is also expected to generate the indirect benefits given below.

Economic Development

- Promotion of economic/industrial activities through improved transport.
- Promotion of poverty reduction through provision of access to markets and work places.

Urban Environment Development

- Fulfilling basic human needs through providing transportation to/from the remote area and/or the area with limited access. Improved access/transportation will allow the people living in such areas better access to schools, hospitals and other facilities of public services.

Feasibility

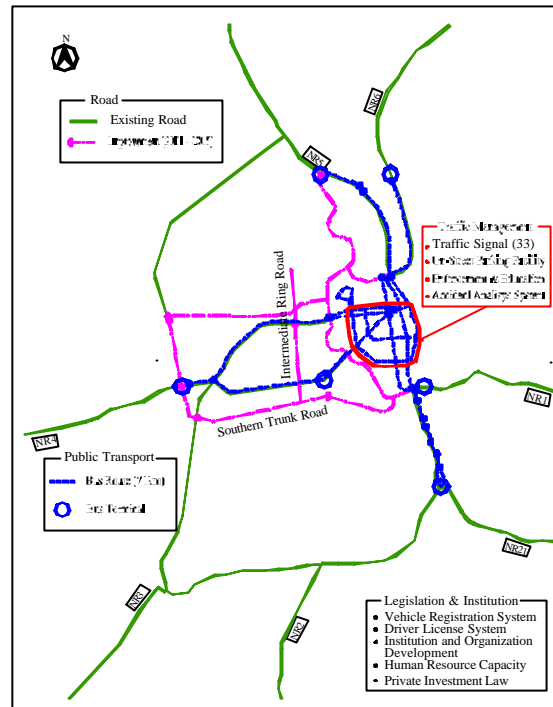
The Plan is feasible with regard to institution and fund, as shown in Chapter 8 and 9, respectively.

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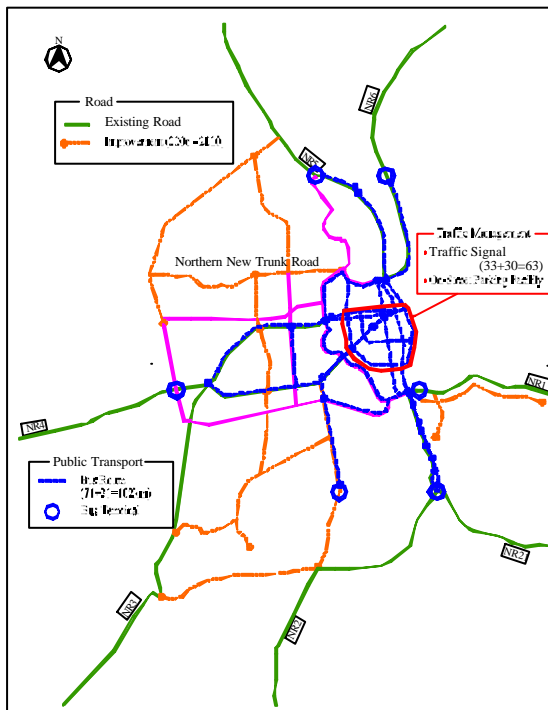
(6) Major Components of Recommended Master Plan

The sectorial development plans propose various projects and measures. The Master Plan is engineered to encompass those plans to be integrated in such a way that they can complement and support each other.

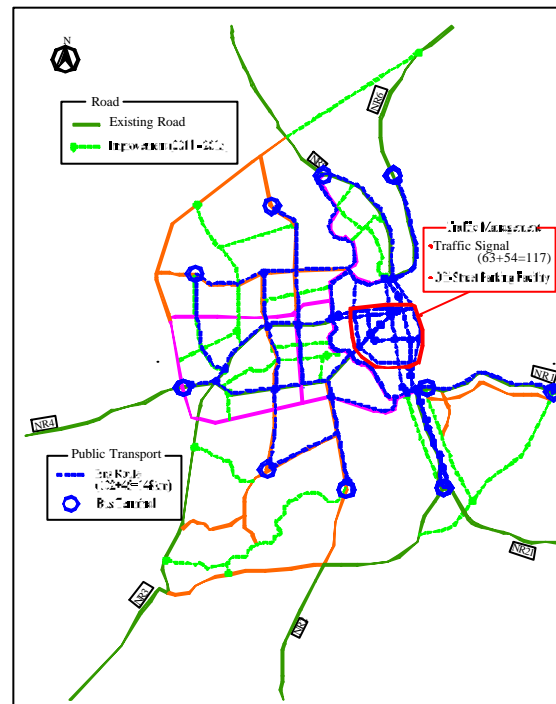
- Road Improvement Plan
 - Pavement improvement
 - Development of road network
- Public Transport Plan
 - Bus operation
 - Provision of bus facility and terminal
- Traffic Management Plan
 - Installation of traffic signal
 - On-street parking facility
 - Enforcement and education
 - Accident analysis system
- Traffic Legislation and Institutional Development
 - Vehicle registration system
 - Driver license system
 - Institutional and organizational development
 - Human resource capacity development



Proposed Projects and Measures, 2005



Proposed Projects and Measures, 2010



Proposed Projects and Measures, 2015