

TRANSPORT MASTER PLAN

6.3 TRAFFIC MANAGEMENT PLAN

(1) Planning Concept

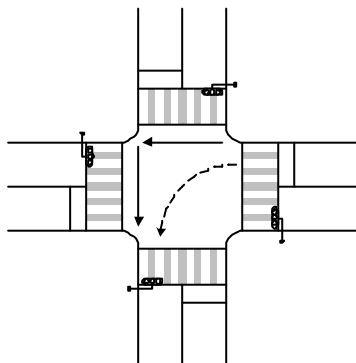
The objective of the traffic management plan is to implement a comprehensive measure and to achieve a safe, smooth and comfortable road traffic environment for road users in the city.

One of the advantages of traffic management is that it can be implemented in a relatively short-term and at low cost with various countermeasures. In particular, it is the most urgent task in Phnom Penh, to satisfy 3-E policy (Engineering, Education and Enforcement).

(2) Traffic Engineering Plan

Segregating Slow Speed Vehicles from High Speed Vehicles

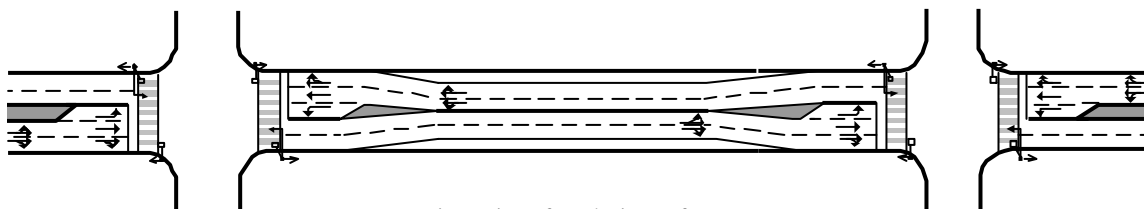
For left-turning at intersections, non-motorized vehicles (bicycles and cyclos) should be segregated from the motorized vehicles.



- ➔ Preferable turning for non-motorized vehicles
 - ⋯➔ Not preferable turning for non-motorized vehicles
- Segregation of Slow/ High-Speed Vehicles

Establishing Exclusive Left-Turn Lane and Pavement Markings

Exclusive left-turn lane is needed where demand of left-turning vehicles is large. With such lanes, the traffic capacity and safety are improved. Providing a left-turn signal phase can control left-turn vehicles.



Basic Design of Exclusive Left-turn Lane

Raised Medians

Raised medians provide a higher level of traffic safety and improve through traffic flow on multi-lane street.

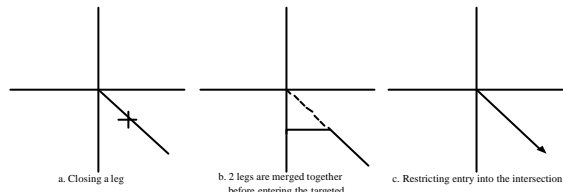


Example of Raised Medians

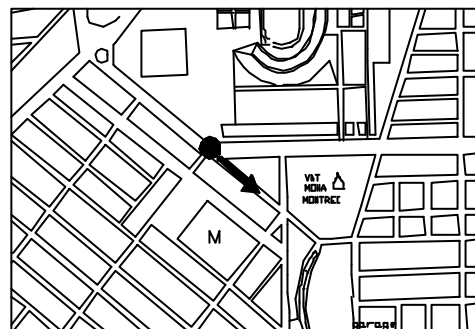
Modification of Intersections with 5 or more Legs

Possible methods for such modifications are:

- Closing one leg
- Two legs are merged together before entering the targeted intersection
- Restricting entry into the intersection (e.g. one way)



Sihanouk Blvd / St.199



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(3) Signal Control and Operation Plan

To cope with increasing traffic demands, and together with improving the road network and the facilities, the signal operation should be improved. A staged improvement plan for the traffic signal facilities is proposed as follows:

Staging Implementation Plan

Stage Time Period	Signal Control Method	Intersection Group	Number of Signalized Intersections
Stage 0 -2000	Isolated Control under Fixed Parameters	Each Intersection	21 Total 21
Stage 1 2001-2005	Isolated Control under Time-of-Day Parameters	Each Intersection	12 Total 33
Stage 2 2006-2010	Coordinated Control under Time-of-Day Parameters	Intersections along Main Route	23 Total 56
	and Isolated Control under Time-of-Day Parameters	Each Intersection	7 Total 63
Stage 3 2011-	Computerized Area Control under Detector Data and Traffic information system	Intersections in Area	54 Total 117

Stage 1: From 2001 to about 2005

- To operate signals with an isolated control according to a time schedule
- To signalize 33 intersections

Stage 2: From 2005 to about 2010

- To operate signals along main routes using a progressive control according to a time schedule
- To install 56 sets of coordinated signals and 7 sets of isolated signals
- Local signal controller may have a time clock adjusted automatically

Stage 3: From 2011 to about 2015

A traffic control center with a computerized area signal control system

- To decide signal timings by central computers based on on-line traffic data
- To centrally and remotely operate about 117 set of signals from a traffic center
- To install vehicle detectors on strategic locations.

Traffic information system for road users

- Changeable message signboard
- Radio and TV broadcast and others

(4) System for Traffic Accident Data Base and Analysis

At present, traffic accident statistics are collected manually. However these data alone are not enough for the traffic engineering analyses in formulating remedial measures for accidents.

Therefore, it is necessary to establish a computerized database in a uniform format that can be readily used for analysis to identify the remedial measures.

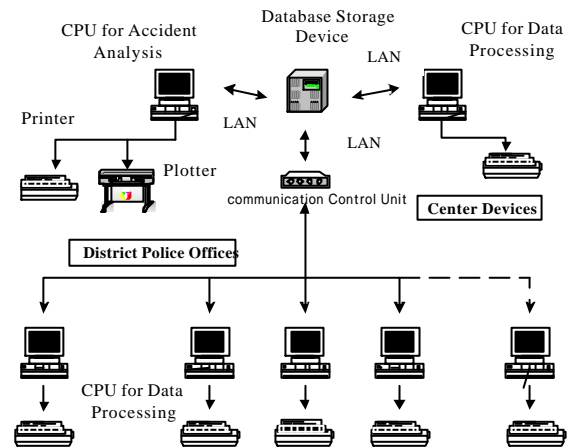
Objective

The proposed system aims at decreasing traffic accidents effectively in short term by identifying appropriate measures applicable at high accident locations and giving priorities to them.

Functions

- Setting up database on traffic accidents
- Identifying high accident locations
- Analyzing high accident locations
- Examining the remedial measures

Equipment Configuration of the System



Effects

The introduction of this kind of advantageous system would enhance the benefits of road improvements and traffic control measures, based on the analysis of the various traffic accident factors, and the identification of remedial measures. Traffic accident statistics are largely being ignored at present.

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(5) Parking Facility Plan

Parking facilities in the CBD area by Year 2015 are discussed. (Bounded by Sihanouk / Nerhu Blvds, Doun Penh Avenue and Bassac River)

Estimating Existing Parking Supply

Existing potential parking on both on-street parking and off-street parking is estimated:

- 10,177 lots under parking prohibition
- 11,875 lots without it



Parking Situations on both on-street and Sidewalk

Forecasting Parking Demand in 2015

- Parking Demand per Day
---- Approx. 131,000
- Traffic Demands during Peak Hours
---- 7.2 % of daily demand

The zone facing shortage of parking spaces in 2015 will be:

[13][14] Phsar Thmei I, II [28] Monourom:	580
[15] Phsar Thmei III [16] Boeng Reang:	200
[17] [20] Phsar Kandal I, II [21] Phsar Chase:	395
[24][25][26][27] Ou Ruessei:	365

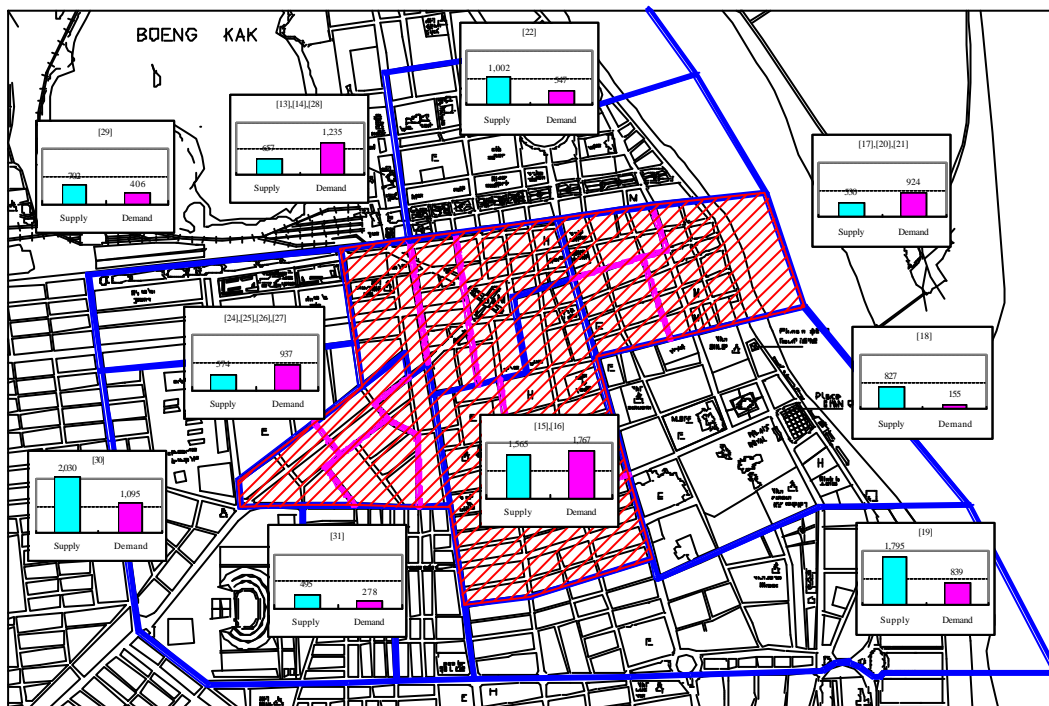
Examination of Need for Off-Street Parking Facilities

The existing supply of parking in the entire Study Area is larger than the demands in 2000 as well as in 2015, if on-road parking is still allowed in the future. However, several sub-districts (traffic zones) are or will be facing shortage of parking spaces.

It is necessary to develop a parking facility improvement plan and to carry out it. These zones indicated above shall be given higher priority for improvements in the plan.

In addition, on-street parking facilities without obstruction to smooth traffic flow should only be provided for vehicles parked for short duration. The total floor area of off-street parking facilities to meet the above-described demand is approximately 46,100 m².

The zone facing shortage of parking spaces in 2001 are:
[13][14] Phsar Thmei I, II [28] Monourom: 180



Balance of Parking Supply and Demand in CBD Zones

(6) Traffic Safety Education

It is important to enhance traffic safety consciousness and education including educational activities tailored for the type of audience.

Proposed activities of traffic safety education are as follows:

Regular Traffic Safety Campaign

It is proposed to implement traffic safety campaign regularly. As proven by the "Traffic Safety Campaign 2001" implemented in the Study, traffic campaigns are effective.

Training for Instructors

It is indispensable to train instructors:

- Teachers of school
- Traffic police officers
- Driving school instructors

Establishment of Police Unit for Safety Education

The education of pupils and children in schools is promoted by establishing a special unit for traffic education in the Central Traffic Police Department.

Traffic Safety Education Curriculum at School

It is proposed that the traffic education is brought into a part of the school curricula.

Traffic Park

Traffic park is a useful facility to familiarize children with the traffic situations by exposing them to the simulated traffic situation while at play.

(7) Traffic Enforcement

Strengthening of traffic enforcement is proposed in order to improve the current traffic situation where traffic accidents are likely to increase rapidly in the near future.

Strengthening of Advising to Drivers and Enforcement for Illegal Drivers

It is more effective to select certain regulations and enforce them emphatically at a selected time period, day of week etc. rather than trying to enforce all of the rules at the same time. This method of selective enforcement provides a stronger impressions to drivers and is easier for the enforcement officers to implement.

Strengthening of Enforcement of Parking Regulation

Illegal parking adversely affects traffic safety and road efficiency. In particular, parking near intersections must be strictly prohibited.

Enforcement Equipment

It is urgently needed to provide enforcement equipment and make this equipment readily available to the traffic police. At present, both of the quantity and quality of equipments are insufficient.

Penalty System for Violating Traffic Rule

Introducing a penalty system for violation of traffic rule is urgently needed in Cambodia.



Traffic Safety Educational Material (1)
Provided by JICA in August 2001
- Poster for School Children with Tripod -



Traffic Safety Educational Material (2)
Provided by JICA in August 2001
- Poster for the General Public -

7. ENVIRONMENTAL ASSESSMENT

The development of the urban transport infrastructure and facilities in the Phnom Penh Metropolitan Area is expected to produce various impacts on the environment of the Study Area, which are investigated and examined in order to simultaneously develop mitigating measures to minimize any possible negative impact.

(1) Environmental Legislation

Currently, the Government is reviewing the legislation system regarding the requirements of environmental management. At present there is one environment law, which is the “Law on Environmental Protection and Natural Resource Management”. This law was approved by the National Assembly on December 1996 and issued and distributed on January 1997. In addition, the following three sub-decrees and one draft are issued based on the approval of the Prime Minister:

- Sub-decree on Environmental Impact Assessment Process
- Sub-decree on Water Pollution Control
- Sub-decree on Solid Waste Management
- Sub-decree on Air and Noise Pollution Control (Draft)

Furthermore, the Ministry of Economy and Finance attempted to assess the land ownership situation by issuing a circular instructing all Government institutions to take stock of all building and land, register them with the Land Titles Department. Then, all land and building registrations have to pass to the Ministry.

(2) Initial Environmental Examination

An Initial Environmental Examination (IEE) was carried out in order to identify the possibility of any negative impact that may result through the implementation of any of the projects in the transportation master plan and to propose adequate countermeasures.

Natural Environmental Condition

The major items of the natural environment that were investigated under the IEE include are:

- Meteorology
- Topography, Geology and Soil
- Hydrology
- Flora and Fauna
- Landscape

Results basically show the following features:

- Seasonal rainfall pattern is dominated by the influence of the monsoon climate regime; Average annual rainfall of about 1362.5 mm. Flooding is usually caused by heavy rains. Annual evaporation from 1981 to 1997 varied between 1,224 mm and 2,145mm.



Back from School on Flooded Mao Tse Toung Blvd

- Minimum and maximum temperatures are 23.8 °C and 32.3 °C in average.
- High humidity occurs during the rainy season that may reach 86%.
- Hydrology is the determining feature of the country's history and culture, centered on the annual flooding of the Mekong River and the Tonle Sap Basin.
- Landscape survey was conducted in order to identify the problems of rapid increase in vehicular traffic.
- Topographically, the Study Area generally slopes down in a moderate pattern from west to east and from north to south.
- Geological structure is the Mekong Plain with Tonle Sap as one of the physical geographic units used to characterize the physical resource base of the Lower Mekong Basin.
- Soil types are generally cohesive and compressive soil.

Social Environmental Condition

The major items of the social environment that were investigated under the IEE include are:

- Demography and Community
- Land Use
- Transportation
- Infrastructure and Public Facilities
- Water Rights and Rights of Common
- Archaeological and Historical Attributes

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Major social issues and features shown by the survey are:

- Urban lands and vacant land on the city fringes are under private control. To acquire private land for urban development schemes, the Government must purchase or expropriate the land or impose development restrictions.
- The preservation of archaeological, cultural and historical attributes as well as local traditions is a main task to be considered in the Master Plan.
- Important heritage places include the Royal Palace, Wat Phnom, Independence Monument, Tuol Sreng, National Museum and Genocide Museum. Other assets include 20 historical attributes and culture assets, 85 pagodas, 13 mosques and 4 churches.

Results of the survey show that no major negative social impact is expected by the implementation of the Master Plan projects. On the contrary, better living pattern and environment with high potential of socioeconomic development are expected for the Phnom Penh residents.

Pollution Condition

Measurements were done in different locations in the Study Area in order to assess the present condition of environmental pollution and the quality levels of air, water, noise and vibration in both urbanized and suburban areas. Critical results that show very high measurements above the standard values are:

- Air quality:
 - TSP (total suspended particulates),
- Water Quality:
 - Phosphate
 - BOD (biochemical oxygen demand)
 - COD (Chemical Oxygen Demand)



Vibration, Noise and Air Pollution Measurements

Air Quality Analysis Results (in mg/m³)

Station	1**	2*	3**	4**	5**	6*	7*	Standard
TSP	0.43	0.20	0.27	0.40	0.28	0.40	0.95	0.33

Note: * Urban, ** Suburban

Water Quality Analysis Results

Parameter (mg/l)	Station					Standard	
	1*	2*	3**	4*	5**	R	L
Phosphate	1.02	2.71	0.19	9.04	0.29	-	0.05
BOD	36	56	32	88	28	1-10	-
COD	120	340	98	380	88	-	1-8

Note: * Reservoir/Lake (L), ** River(R)

In general it is concluded that water of rivers and lakes in the Study Area is not well suitable for biodiversity conservation. In addition, the noise level measurements show also high values.

Identification and Evaluation of Impacts

Master Plan projects are categorized into two main groups based on their expected negative environmental impact:

- 1: Projects with high potential negative impact
- 2: Projects with low potential negative impact

The factors examined in order to determine the importance and potential of each environmental impact are as follows:

- Number of people subject to the impact
- Extent of the impact
- Impact duration and intensity
- Components simultaneously affected
- Cumulative aspect of the impact
- Irreversibility impact
- Mitigating Measures

Mitigating Measures

The major impacts in the social environment are expected for resettlement in suburban areas. Countermeasures including resettlement plans and compensation system based on current value of housing and land should be considered. Replacing mototops by buses is expected to produce negative impact on drivers; for them new appropriate job opportunities should be provided.

For natural environment, projects in southern areas will be subject to flooding during the rainy season. In addition, projects in outer areas may affect the green belt of the Study Area. The ratio of green open spaces and roadside trees should be conserved.

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8. INSTITUTION AND FINANCE

(1) Organizational Reform

Organization reform is necessary to implement the Master Plan. The establishment of following organization is recommended also to improve efficiency and effectiveness of the institution.

- Budget Formulation Unit (7 staff)
- Public Transport Management Unit (20-25 staff)
- Laboratory Unit for Testing Materials
- Data Base Formulation Unit
- Urban Transport Research Center
(With Ministry of Public Works and Transport)

(2) Human Resource Development

In line with the proposed organizational reform, the development of human resource capacity is recommended, which is the key element for development of organizations, through the following methods.

- In-house classroom teaching by expatriates and advisors.
- On-the job training including case study by expatriates and advisors.
- The special plan arranged for DPWT personal is proposed as “2-year cycle capacity building program” for the development of performance efficiency and engineering skill. This program shall be executed in a 1.5-year period in 2002 and 2003 with the assignment of about 40 man/month of the expatriate and local consultants. The required cost is minimal but the beneficial effect is substantial.

(3) Required Legislation

The transport related legislation is recommended to be supplemented with the necessary sub-decrees and details.

- Vehicle Registration System
- Driver License System
- Private Investment Law
- Parking Facility

Vehicle Registration System as well as Driver License System is needed to properly identify the total number of vehicles and drivers and to set up as a database for further transport planning and drivers education scheme to be established.

(4) Financing

In many countries, vehicle-related revenue such as fuel tax and vehicle ownership tax are used in transport sector such as road. Also, part of the cost of public transport is often financed by the fund

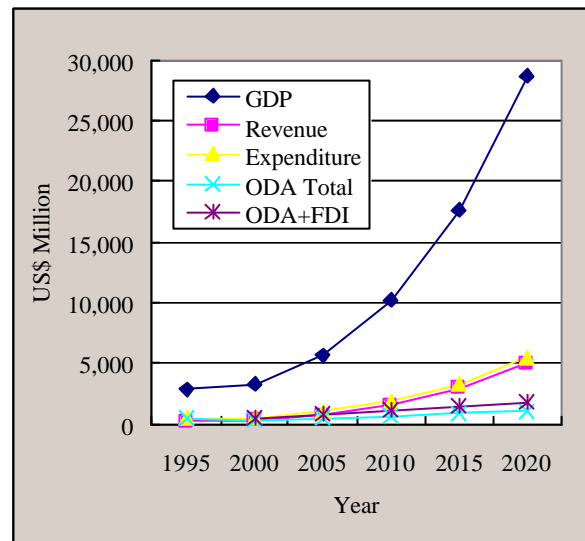
from the general account, considering the public benefit brought about by public transport such as alleviation of congestion. To raise fund for implementation of Transport Master Plan, the following possible fund resources are recommended.

Local Fund

- Fuel Tax (specific purpose tax)
- On-street Parking Fee
- Vehicle Ownership Tax
- Traffic Violation Fines

Official Development Assistance (ODA)

“Reform Scenario” was formulated in “Enhancing Governance for Sustainable Development” to establish the National reform framework, in which ODA is assumed.



Source: "Cambodia: Enhancing Governance for Sustainable Development, Working Paper No. 14, Cambodia Development Resource Institute, May 2000

Cambodia Reform Plan

9. Private Participation

The following schemes are recommended to attract the private participation.

- Development Corporation as Semi-Government
- Control Authority
- Entrusted Partner
- Built-Operate-Transfer (BOT)

BOT scheme is currently adopted in the country. However, the behavior of private investors is very vulnerable and sensitive to the movement of the investment climate. Since the private participation is one of the keys in development, necessary legislation shall be prepared.

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9. OVERALL IMPLEMENTATION PLAN

The overall implementation program of the Transport Master Plan was established considering time frame, project implementation capacity, budgetary constraint, among others.

(1) Time Framework

- Short Term : 2001 ~ 2005
- Medium Term : 2006 ~ 2010
- Long Term : 2011 ~ 2015

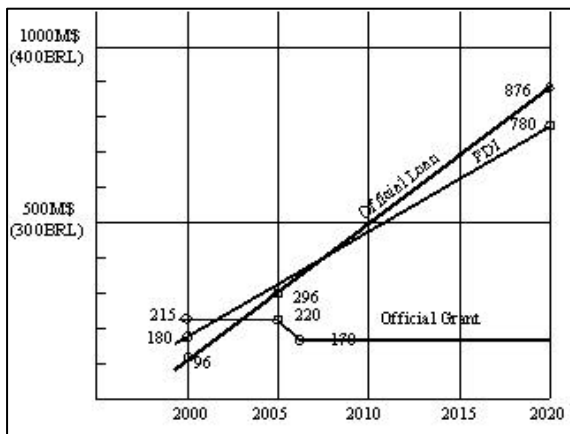
(2) Project Implementation Capacity

The administrative and technical capacity of the Government are expected to be developed through the execution of proposed institutional reform and capacity development plans, reinforced with skilled professional.

(3) Estimated Fund

The available fund for the implementation of the Plan cannot be estimated based on the past infrastructure investment in Phnom Penh since no data is available.

To predict the fund availability for the Plan, future ODA assumed in “Reform Plan” for the country was used as the base for the assumption of estimating available fund.



Source: Enhancing Government for Sustainable Development
Cambodia Development Resource Institute. May 2000
Future ODA

The available fund estimated for the Plan is:

- 2001~2005: US\$ 85 million / 5 years
- 2006~2010: US\$ 120 million / 5 years
- 2011~2015: US\$ 155 million / 5 years

The required amount of fund for the Plan is:

- 2001~2005: US\$ 106 million / 5 years
- 2006~2010: US\$ 129 million / 5 years
- 2011~2015: US\$ 141 million / 5 years

Difference between the available and required fund is within allowable range.

(4) Candidate Projects By Fund Type

The Plan proposes various projects and measures in the field of urban transport sector. Those are recommended to be implemented by selecting projects in conformity with fund characteristics. Considering the severe shortage in the Government revenue, candidate projects by fund type are tentatively proposed as follow.

Category A: Local Government Finance Type

- Traffic safety education and enforcement.
- On-street parking.
- Pavement improvement of minor local streets.
- Bus service, if economical in view of national economy.

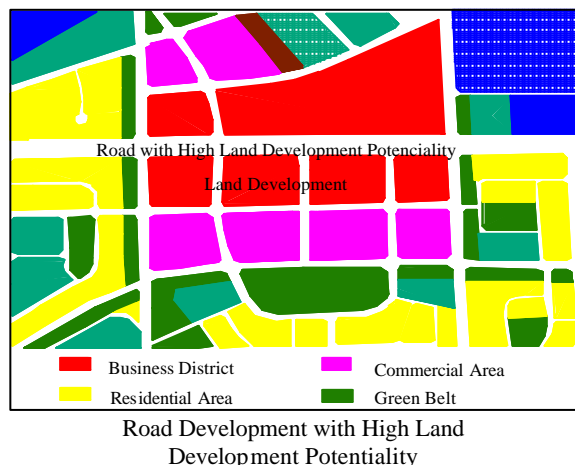
Category B: ODA Type

- Grant
- Public transport equipment
 - Traffic signal control system
 - Pavement improvement of major streets
- Loan
- Improvement of major arterial roads
 - Construction of large-scale bridges

Category C: Private Participation Type

- Road development with high traffic demand.
- Road development with high land development potential.
- Bus service, if profitable.
- Off-street parking.

It is highly recommended that road development with high land development potential shall be executed simultaneously with land development, possibly utilizing private investment as private participation project.



TRANSPORT MASTER PLAN

Overall Implementation Schedule (2/2)

Sector	Project Code	Project Name	Length (Unit)	Cost (M\$)	Short Term					Medium Term					Long Term					
					2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Public Transport	B-1	Bus Fleet	1,306	52.2																
	B-2	Bus Terminal		2.5																
	B-3	Bus Stop	740	0.2																
	B-4	Bus Shelter	148	0.4																
	B-5	Bus Depot		1.9																
		Sub Total		57.2		20.0					12.0					20.3				
	M-1	Development of Mode Interchange Area (Station Plaza Improvement)		0.1																
		Sub Total		0.1		0.1					0.0					0.0				
	P1	Policy / Legislation (Zone System for Motodop and Cyclo, Ban the Motorumok Operation along Trunk Road)		0.1																
		Sub Total		0.1		0.1					0.0					0.0				
	Total		57.4		19.5					17.6					20.3					
Traffic Management	TM-1	Traffic Signal System		12.9																
	TM-2	Accident Analysis System		0.5																
	TM-3	On Street Parking		0.2																
	TM-4	Enforcement Equipment		0.5																
	TM-5	Public Education		1.2																
		Total		15.3		4.5					3.0					7.8				
Traffic Regulation	R-1	Institution and Organization Development		0.4																
	R-2	Human Resource Capacity		0.5																
	R-3	Vehicle Registration System		0.4																
	R-4	Driver License System		0.5																
	R-5	Private Investment Law		0.1																
		Total		2.1		2.1														
Total				74.8	26.1					20.6					28.1					
Gross Total				375.8M\$	105.7M\$					129.2M\$					140.9M\$					
Estimated ODA Fund				360M\$	85M\$					120M\$					155M\$					

The Transport Master Plan identified the numerous numbers of projects and measures in the fields of road development, public transport, traffic management and traffic legislation, classifying their urgency into the short, medium and long terms.

The Plan is composed of individual components, which are closely interconnected and come into effect by supporting each other to attain the intended objectives.

It shall be emphasized that the organization and human resource capacity development are recognized as a key for the successful implementation of the Plan.

10. TRAFFIC SAFETY CAMPAIGN

(1) Object and Outline

One of the efficient measures to cope with traffic accident problems is "Traffic Safety Campaign". The Department of Public Works and Transport (DPWT) carried out a traffic safety campaign in the Study Area, sponsored by JICA, from January 27 through February 4, 2001.

- Goal:
 - To reduce traffic accidents and to promote smooth traffic flow
- Objectives and Target Groups:
 - To educate the public on traffic safety knowledge and basic traffic rules
 - To educate drivers on traffic rules and safe driving

(2) Major Activities in the Campaign

Public Relations by Mass Media

Following mass media and others measures are utilized:

- Television
- Radio
- Newspapers
- Posters
- Banners
- Stickers

Practice of Driving Guidance and Enforcement

Phnom Penh Traffic Police Department carried out following activities at the designated intersection of Sihanouk with St.161/163 during the campaign period:

- Drivers and pedestrians were informed of their errant behavior or traffic violation, and instructed on proper behavior and safe driving method,
- Drivers with severely errant behavior or who committed a major violation were apprehended.



Pedestrians Crossing the Road



School children Distributing Campaign Stickers

Public Participation

- Distribution of stickers on site
 - Primary school children wearing yellow caps accompanied by their teachers participated in the traffic safety campaign at the intersection of Norodom Blvd with St.154 for 5 days from January 29 to February 2, 2001.
 - They distributed stickers bearing the slogan "Traffic Safety Campaign 2001" to drivers and pedestrians,
 - School children, their teachers and parents were well protected from the traffic by ample police officers at the site.
- Drawing contest on traffic safety by primary school children,
 - The contest was opened in the middle of February, and closed at the end of February 2001.
 - Excellent drawings were given prizes and displayed on buses operated by DPWT and JICA in the Public Experiment in June 2001, and also displayed in the poster of traffic safety education material provided by JICA in August 2001.

Improvement of Related Facilities before Implementing the Campaign

- Road surface and pedestrian sidewalk were improved at the selected intersections,
- Traffic markings were improved and/or installed at the selected intersections,
- Signal lights were checked to ensure they were working,
- Street lightings were also checked to ensure they were working.

(3) Impact Assessment

Results of Home / On-site Interview Studies

- 96 percent in 355 citizens interviewed were aware about the implementation of the campaign,
- 96 percent of the citizens interviewed indicated that they noticed a safer and smoother traffic flow on the streets after the campaign,
- 99 percent of the citizens wanted to see such a campaign continuing in the future,
- Drivers and pedestrians who did not understand the meaning of stop-line and pedestrian crossing markings were observed.

Results of Traffic Flow Analyses

Video recordings were carried out to compare the traffic flows before and after the campaign at the intersection of Sihanouk Blvd with St.163.

Changing traffic flows in the intersection are:

- 30 percent of motorcycles stopped over the stop-line after the campaign compared with 62 percent before,
- Motorcycles stopping on the opposing road decreased by 4 point after the campaign,

Survey	No.of Vehicle Stopping over Stop-Line		No.of Vehicle Stopping on Opposing Road	
	Car	M'cycle	Car	M'cycle
Before	23.2%	61.7%	3.6%	21.7%
After	3.4%	30.1%	1.7%	17.3%

Time Period --12:00-12:30



Poster and Newspaper Announcement

- With the campaign, the number of signal cycles with congestion has decreased from 8 to 3 cycles within one hour. It is found that this type of congestions will be further reduced with better driving manners and behaviors among the drivers. There was no congestion during the campaign.

Survey	No.of signal Cycles	No.of Cycles with Congestion
Before Campaign	60	8 13%
During Campaign	60	0 0%
After Campaign	60	3 5%

Time Period --9:00-10:00

Opinions of School Children and Teachers

Their main opinions are as the follows:

- I am afraid of traffic accident which may destroy my future,
- I must follow the traffic law from now through the future,
- I want teachers to integrate a traffic safety lesson into the normal educational program,
- Road conditions are not good, so that most drivers can not follow the traffic law,
- I am very happy today for the participation in this campaign.

As a result, it is noticeable that these activities led to smoother and better traffic flows and safer road crossing manners by pedestrians. In particular, most of vehicles were observed to stop before the pedestrian crosswalks, and less vehicles ignored the traffic signals.

(4) Future Expectations

The effectiveness of the traffic safety campaign was demonstrated in the Study Area with its citizens appreciating its importance and the positive impacts on the traffic conditions. If such campaigns are carried out regularly, the effects will be accumulated over time and eventually contribute greatly to decreasing traffic accidents, while increasing road capacity and smoother traffic flow.

Traffic safety campaign is relatively straightforward to implement because its operation cost is much cheaper than that of road construction and the implementing duration is shorter.

It is strongly recommended that such campaign be carried out regularly.

TRAFFIC CAMPAIGN AND EXPERIMENT

11. BUS OPERATION EXPERIMENT

(1) Background, Purpose and Strategies

The purposes of this experiment are summarized below:

- To identify the potential and effect of bus services in Phnom Penh, as one of the main topics of the Transport Master Plan of the Phnom Penh Metropolitan Area;
- To collect data for estimating the demand for bus services;
- To find out the problems to be solved for the smooth operation of bus services in the Area; and
- To help the citizens of Phnom Penh understanding the merits of bus system.

The following strategies are established to achieve the above-mentioned purposes:

- To create “catch name” and logo of bus which widespread appeal to Phnom Penh citizens as the new public transport system



Bus Body Sticker

- To develop an adequate publicity campaign using TV, radio, newspaper and banners, etc.
- To prepare a comfortable mode of transport by air-conditioned minibus
- To secure the punctuality of bus operation
- To develop a better operational environment for bus operation such as installation of bus stop marking
- Others (PPCS Gallery inside buses)

(2) Outline of Bus Operation Experiment

The proposed city bus operation for public experiment is presented in the figure below.

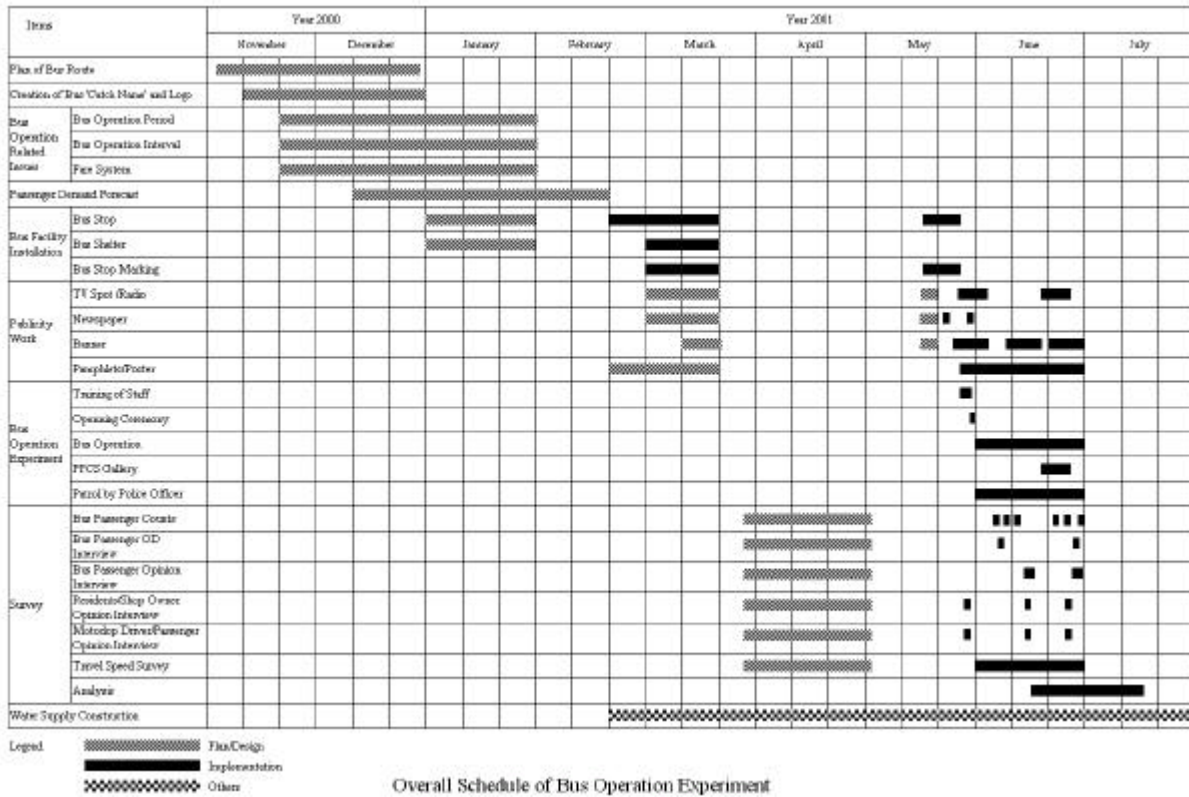
Outline of Bus Operation Experiment

<p>a. Bus route Radial route and ring route</p> <p>b. Bus fleet 23 air-conditioned minibus (29 seats) With logo sticker, front board and designated number</p> <p>c. Fare system 800 riels flat fare (Cheaper fare of 500 riels for the first 5 days and the last 8 days)</p> <p>d. Operation hours and frequency 5:30 - 19:30 (14 Hours) Every 6 - 10 minutes</p> <p>e. Bus stop and bus shelter Installation of 56 bus stops and renovation of 8 shelters Bus stop will be provided every 300 - 500m</p> <p>f. Improvement of the circumstances of the bus routes Prohibition of motorcycles along bus route Installation of bus stop marking on the routes Prohibition of parking in front of bus stop</p> <p>g. Advertisement and others Traffic campaign Public information by TV, radio, banner and newspaper Distribution of posters and pamphlets</p> <p>h. Bus passenger demand forecast 500 riels flat fare: 12,900 passengers/day 800 riels flat fare: 4,900 passengers/day</p>	<p>Phnom Penh City Shuttle-PPCS Line 1 (Along Monivong Blvd.)</p> <p>Phnom Penh City Shuttle-PPCS Line 2 Clockwise One-way Operation (Sihanouk-Nerhu-Kamphaeng Krom-Norodom)</p> <p>Bus Fare: 800 Riels Flat</p>
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TRAFFIC CAMPAIGN AND EXPERIMENT

(3) Activities

Overall schedule of bus operation experiment is shown in below.



The preparatory work for the bus operation experiment was carried out in the 2nd phase of the Study (November 2000). Major activities of preparatory work are as follows:

- Planning of bus routes,
- Creation of bus 'catch name' and logo,
- Design and installation of bus stops and bus shelters, and
- Design and conduct of publicity campaign, etc.

A two-day dry run was conducted prior to the bus operation experiment. The Governor of Phnom Penh, the Ambassador of Japan, representatives of JICA, JICA Experts of MPWT, MPP/DPWT officers, students and some members of the media were invited to the opening ceremony, which was held a day before the bus operation experiment.

Actual experiment started from 1st June 2001, and utilized a fleet of 23 buses and 88-staff. The maximum number of daily bus passengers reached 5,487 at the beginning of the experiment. This relatively high number was due to a flat fare of 500 riels, was also as a result of the good impact of advertising by TV, radio, newspapers and banners. Subsequently, the number of passengers decreased to as little as 2,300, due to the increase of the fare to

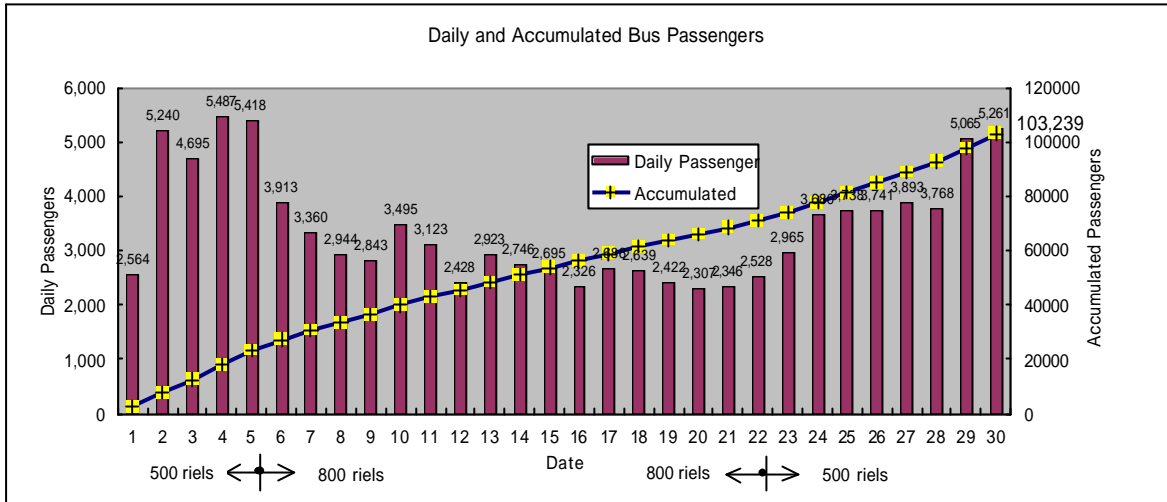
800 riels. The bus operation experiment finished on schedule with more than 100,000 participants (bus passengers), without any serious accidents. Total fare revenue was more than US\$150,000.

To promote additional passenger demand in the latter half of the experiment, a drawing contest on traffic safety campaign was held from 17 to 27 June among the school children in Phnom Penh City. The winning drawings were exhibited in so called as the "PPCS Gallery" inside the buses.



Opening Ceremony of Hun Sen Park

TRAFFIC CAMPAIGN AND EXPERIMENT



The following supplemental traffic surveys related to bus operation were conducted with the experiment to understand and realize the characteristics of bus operation, bus passengers, shop owners, motodop drivers, etc. The data obtained were used in Public Transport Planning.

- Bus Passenger Counts
- Bus Passenger OD Interview
- Bus Passenger Opinion Interview
- Residents/Shop Owners Opinion Interview
- Motodop Driver/Passenger Opinion Interview
- Bus Travel Speed Survey by GPS



Conductor in the Bus

The problems encountered during the experiment and the results/effectiveness of the experiment are summarized below.

Encountered Problems

- Complaint from the owners of shops in front of bus turning point where the buses blocked customers access
- Minor traffic accident but no injured
- Rumor of a motodop drivers who are afraid of decrease in passenger strike against the bus operation experiment but no strike took place
- Illegal parking in the bus stop zones
- Blocking of bus stop by the water supply construction. However, the installation of movable bus stops settled the problem



Banners and PPCS Bus



Students waiting for PPCS Bus

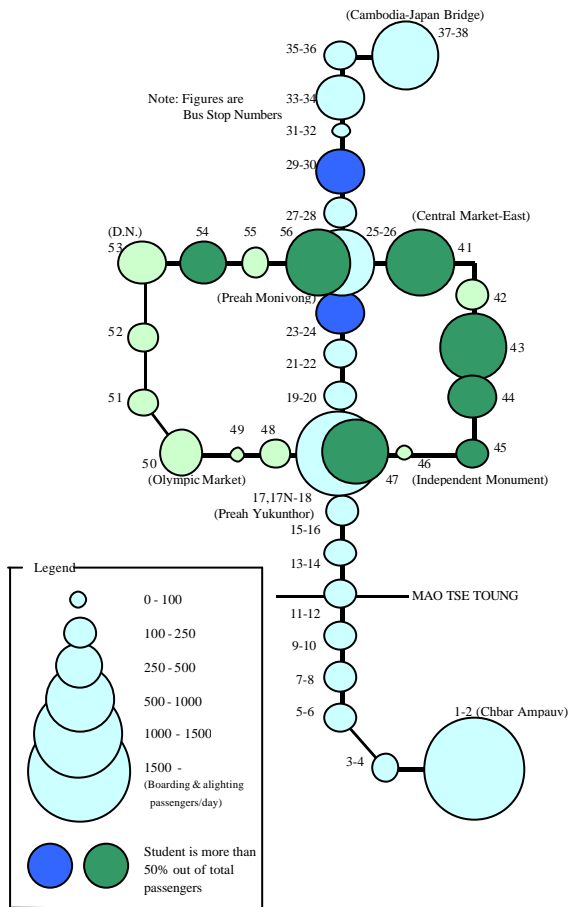
(4) Results and Analysis

Passenger Characteristics

The total number of bus passengers from 1 to 30 June is 103,239 (Line 1: 60,276, Line2: 42,963). The average daily passengers and passengers per bus were 3,441 and 156 (Line 1: 126, Line 2: 206), respectively. The maximum number of daily passenger was 5,487 on 4 June. The percentage of transfer out of total passengers was approximately 25%.

TRAFFIC CAMPAIGN AND EXPERIMENT

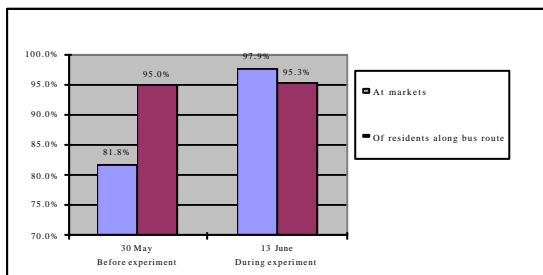
- The busiest bus stop was Chav Ampav with 1,741 boarding/alighting passengers per day, according to the bus passenger count survey by bus stop on 29 June.



Boarding and Alighting Passengers by Bus Stop (29 June 2001)

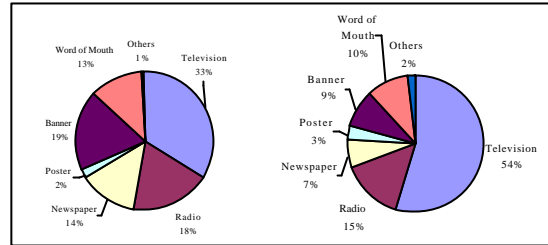
Bus Passenger, Shop Owner, and Motodop Driver's Opinion

- Degree of awareness and social acceptance of city bus system
 - The degree of awareness of city bus system by the citizens was high for both before and after the experiment.



Degree of awareness of the experiment Type of media (30 May)

- Television and radio are the most popular media of promoting awareness of the bus operation experiment, followed by the road banner.
- There was a high degree of acceptance of the bus operation experiment with many positive opinion given.



Type of Media (30 May 2001)

- Utilization of bus
 - More than 60% of interviewees at markets utilized the bus. The average number of usage was 4.1 rides per person.
 - The percentage of usage of bus by residents along the bus route is higher than those at the markets. Average number of usage of bus was approximately 12 rides per person.
 - 49.2% of the total interviewees were students, followed by housewives with 15.2%.
 - The percentage of "To/from School" was smaller on 28 June than on 13 June, consequently, the percentage of other trip purposes such as "to/from work" and "to/from shopping" became larger. As the days of the experiment went by, the trip purpose of bus passengers became varied.
- Evaluation of bus system by the bus passengers
 - All of the evaluation items under "degree of satisfaction of bus passengers" received high marks. This indicates that bus passengers were almost fully satisfied.

Results / Effectiveness

- Preparatory work and implementation of bus operation experiment by the collaboration between public and private sectors
- Widespread acceptance of the city bus system among the citizens of Phnom Penh
- Various database concerning the bus operation
- Continuation of bus operation by DPWT.

TRAFFIC CAMPAIGN AND EXPERIMENT

12. EXPERIMENTAL PAVEMENT IMPROVEMENT

(1) Objectives

Restriction of 2-wheel Vehicle Passage

When the bus-favored policy is implemented, 2-wheel vehicles, which use the outer lanes, may block the bus operation. Therefore, 2-wheel vehicles are needed to be restricted on the bus routes and the diversion roads for 2-wheel vehicles must be improved. The experiment was to examine if this diversion was effective.

Traffic Distribution on Local Streets

One of the problems on the roads in the urbanized area is the excess concentration of traffic on the arterials due to poor condition of collectors/local streets. The experiment is to examine the effect of traffic distribution resulting from the improvement of collectors/ local streets parallel to the arterials.



Location of Experimental Pavement Improvement

(2) Improvement

The improvement works of St. 63 were as follows:

- Pothole repair
- Overlay with 5-cm thick asphalt concrete
- Repair of curbs
- Road markings
- Cleaning of drainage facilities

The improvement works of St. 105 and St. 278 were as follows:

- Reconstruction of pavement
- Repair of curb
- Road marking
- Cleaning of drainage facilities



Before Improvement (St. 105)



After Improvement (St. 105)

TRAFFIC CAMPAIGN AND EXPERIMENT

(3) Effect

Traffic Volume

- Immediately after the improvement works were completed, traffic volume on St.105 increased from 2,300 vehicles per day to 15,100 vehicles per day, while motorcycles on Monivong Blvd. decreased by more than 20,000 vehicles per day. This shows that the traffic on the arterials will divert to local streets if improved.
- Number of motorcycles on Monivong Blvd. kept decreasing thereafter up to about one fifth of that before the experiment, but did not vanish in spite of experimental implementation of no-entry regulation.
- Traffic volume on St.63 increased after the public experiment of bus operation.

Travel Speed

Average speed on Monivong Blvd. increased after the improvement works were completed, while those on St.63 and St.105 slightly decreased (but did not jam) as the traffic volume increased.

Average Travel Speed (km/hr)

	Prior to Improvement (Jan. 2001)	After Improvement (Mar. 2001)	During Public Experiment (Jun. 2001)	
Monivong	17.1	22.6	21.4	21.9
St.63	19.0	18.8	16.4	16.7
St.105	16.6	15.3	15.0	15.2

Effort of Cambodian Side

Cambodian side made the following voluntary efforts to enhance the effect of the improvement:

- The Municipality of Phnom Penh installed streetlights along the improved section of St. 105.
- Many roadside residents rehabilitated the sidewalk in front of their residence by their own expenses.
- Roadside residents paved 100-m section of St.242 between St.105 and Monivong Blvd. at their own expenses.

Likewise, it is expected that the road improvement project will induce the local efforts of Cambodian side for betterment of the city.

Change of Opinion of Roadside Residents on Regulation

The opinion of roadside residents/shop owners along Monivong Blvd. on the regulation of no entry for 2-wheel vehicles was affected as follows:

- Before the public experiment, 70% of the residents were against the regulation.
- During the public experiment, the percentage of the opponents dropped to 29%.

Achievement of Objective

Thus, the objectives of the experiment, to know (i) the acceptability of regulation on 2-wheel vehicles and (ii) diversion of traffic to local streets, were well achieved.

