

2.3 Parking Facility in Future

At present, there are many vehicles parked on the sidewalks, obstructing the safe passage of pedestrians in Phnom Penh City. Therefore, such parking of vehicles must be strictly prohibited. In addition, several other measures such as on-street parking prohibition should be also introduced in order to reduce frequent congestion on the road sections. Since it is expected that traffic demand will increase rapidly in the future, securing parking spaces for vehicles will be a potential complex traffic management issue in the near future.

To explore for suitable solutions for these issues, the study team carried out a field survey in the urban area, and observed actual parking conditions under the present circumstances. And present parking capacity (parking supply) was estimated and marked on a map (of scale 1/5000) and field observational data.

Based on these basic data and number of parking vehicles predicted in future (in 2015), the following is required to be further studied, that is, whether the present parking facilities are enough, or whether off-street parking facilities are necessary in the future. In the later case, what kinds of facilities are needed should also be addressed. In examining such issue in this Study, two cases are assumed, that is, with parking prohibition on arterial streets and without it.

2.3.1 Current Issues of Parking Facilities

(1) Lack of Parking Facilities

The concept of creating parking facilities has been overlooked in Phnom Penh City although the lack of which has only been felt recently as a result of the remarkable increase in vehicle traffic around the city. There are almost no off-street parking facilities in the center of Phnom Penh City. Drivers have no choice but to park their vehicles along the curbsides or on sidewalks. This causes decrease in traffic processing capacity of road sections and pedestrians can not walk in a straight procession and safe environment.

(2) Shortage of Garages

There are also inadequate private garages to keep vehicles besides the shortage of parking facilities. It is therefore common to see drivers keeping their cars on sidewalks near their residences. How to secure spaces for keeping private cars will become a serious urban problem from now on.

(3) Illegal Parking Regulation

Regulation on illegal parking must be strengthened in order to increase traffic handling capacity of the urban roads and to improve the level of traffic safety.

(4) Absence of Obligatory Parking Provision in New Construction

Regulation on the obligatory provision of parking facilities in new buildings such as shopping centers, office complexes, hotels, and others, which stipulates that it is an obligatory responsibility to equip a new building with adequate parking facility depending on the total floor space of the proposed building. Such a regulation is commonly enforced in many major cities in other countries. With this regulation, parking facilities provided in the building would be able to accommodate parking demand of vehicles coming to that building. However, there is no such regulation in Phnom Penh City and most of the new buildings under construction in the city at present are without any parking facility.

2.3.2 Characteristics of the Existing Parking Conditions

(1) Number of On-Street Parking

Number of on-street parking vehicles were counted based on a manual at three (3) different times of the day, that is, morning, daytime and evening, on November 29th, 2000 (Wednesday) along four (4) arterial routes in the center of the city. The parking type is divided into two categories, parking on street legally and parking on sidewalks illegally.

Figure 2.3.1 shows the number of parking vehicles by each interval and the average number per 100m. This figure indicates that the following road sections with their respective lengths whose total number of parking vehicles per 100m is more than 15.

- Blvd. Kampuchea Krom with a section length of 2,000meters
between Blvd. Monivong and Blvd. Mao Tsu Tong
- Blvd. Monivong with a section length of 850 meters
between Blvd. Kampuchea Krom and Rue Tep Phan
(Note: the on-street parking is permitted on only one-side of the street)
- Blvd. Charles De Gaulle with a section length of 900 meters
between Blvd. Monivong and Rue Tep Phan
- Blvd. Preah Sihanouk with the section length of 850 meters
between Blvd. Norodom and Monivong

Note: It can be considered that the maximum number of vehicles legally parked per 100 meters is 10 on the assumption that an average headway for parking is 10 meters, and taking into account the presence of intersections where parking is prohibited.

Table 2.3.1 shows the parking conditions and number of parking vehicles by each route.

The table makes the following apparent. Blvd. Kampuchea Krom has the biggest number of total parking per 100m, which is 15.4, followed by Blvd. Charles De Gaulle. In the case of Blvd. Monivong, the number of on-street parking is less because one-side of the street is enforced with parking prohibition. The number will become larger if both sides of the street are permitted for parking.

The number of vehicles parking on sidewalks illegally is larger than that of on-street parking along all the surveyed routes. In particular, the number of illegal parking at Blvd. Kampuchea Krom is the most outstanding.

Taking such aspects into consideration, Blvd. Monivong will not have enough space for traffic flow if all vehicles parking on sidewalks are forced to move to on-street legal parking (due to one-side parking permission.). Such a measure however may be possible along other routes if concentration of parking on a certain peak time interval is not taken into account.

Table 2.3.1: Average Parking Vehicles along Major Arterial Streets

Route Name	Length(m)	On-street Parking legally		On-sidewalk parking illegally		Total	
		Cars	Cars/100m	Cars	Cars/100m	Cars	Cars/100m
Blvd. Monivong	3,550	114 (30.1)	3.2	265 (69.9)	7.5	379	10.7 (100.0)
Blvd. Kampuchea Krom	2,200	143 (42.3)	6.5	195 (57.7)	8.9	338	15.4 (100.0)
Blvd. Charles De Gaulle	2,450	142 (48.4)	5.8	151 (51.6)	6.2	293	12.0 (100.0)
Blvd. Preah Sihanouk - Blvd. Nerhu	3,800	133 (40.0)	3.5	200 (60.0)	5.3	333	8.8 (100.0)
Total	12,000	533 (39.6)	4.4	811 (60.4)	6.8	1344	11.2 (100.0)

Note: () : shows ratio of legal or illegal parking cars of the total
The parking on Blvd. Monivong is prohibited on only oen-side

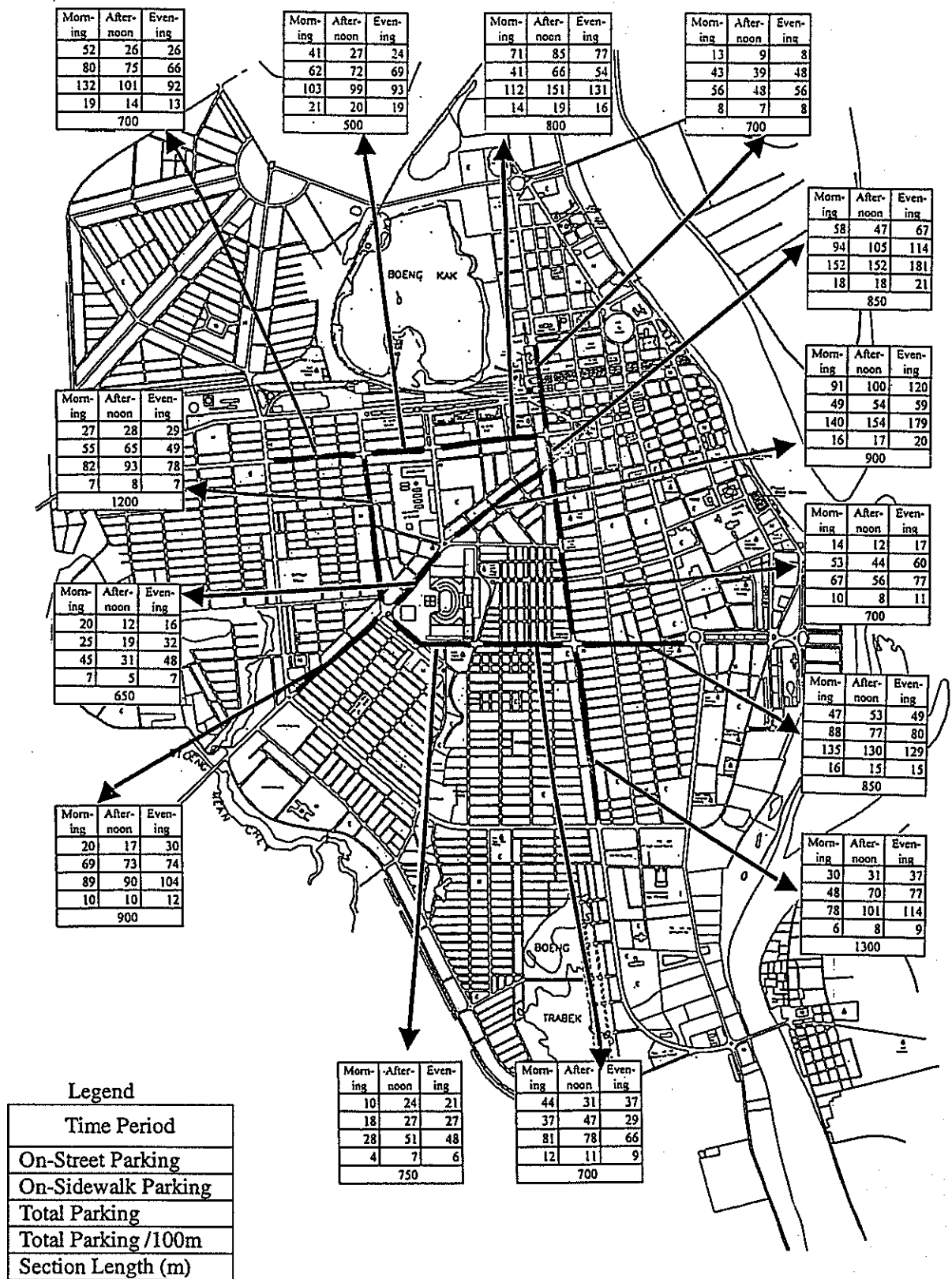


Figure 2.3.1: Existing numbers of vehicles Parked on Main Arterial Streets

(2) On-Street Parking Duration

Parking condition survey was carried out at 2 places in the center of the city on 28th November, 2000(Tuesday) for 13 hours (from 6:00 to 19:00) in order to collect data on average parking duration of on-street parking. The survey was conducted at the following two places.

- Blvd. Monivong at 200 meter south from the intersection with Blvd. Kampuchea Krom .
- Blvd. Kampuchea Krom at 300 meter west from the intersection with Blvd. Monivong

Table 2.3.2 shows the number of vehicles and their duration in 3 different period of time, morning, daytime and evening. In addition, the table also shows the average parking duration. The duration of on-street parking and their trends are almost the same at both survey road sections.

The following observations can be derived from the table.

An average on-street parking duration from 6:00 to 19:00 is about 47 minutes and this is almost the same at both locations. Focusing on different time period of the day, the average parking duration is 52 minutes during the 3 hours morning time period; and 49 minutes in daytime. These are almost the same at both streets. But parking duration in the evening time period is shorter than the other time periods, which is 28 minutes.

A similar trend in the parking duration of illegal parking on sidewalks is also observed. The duration of such illegal parking in the morning and daytime periods are almost the same and that of the evening period is shorter. However, an average duration at both locations from 6:00 to 19:00 hours is 121 minutes (about 2 hours) and this is 2.5 times compared with on-street legal parking duration.

The average parking duration of both on-street legal parking and sidewalk illegal parking is longer than 1 hour and 66 minutes.

Table 2.3.2: Parking Duration in the Central Business District

Route Name	Time of Day	On-street Parking legally		On-sidewalk parking illegally		Total Parking	
		Arrival Volume	Duration (min's)	Arrival Volume	Duration (min's)	Arrival Volume	Duration (min's)
Blvd. Kampuchea Krom	08 to 11	14	48	4	63	18	51
	11 to 14	11	49	2	90	13	56
	15 to 18	14	26	4	52	18	31
	06 to 19	149	46	36	103	185	57
Blvd. Monivong	08 to 11	8	59	4	83	12	66
	11 to 14	4	50	2	129	6	73
	15 to 18	10	30	5	55	15	39
	06 to 19	84	47	47	134	131	79
Average of both locations	08 to 11	11	52	4	73	15	57
	11 to 14	8	49	2	107	10	61
	15 to 18	12	28	5	53	17	35
	06 to 19	116	47	42	121	158	66

Note: The Arrival Volume is number of vehicles parked into 100 meter

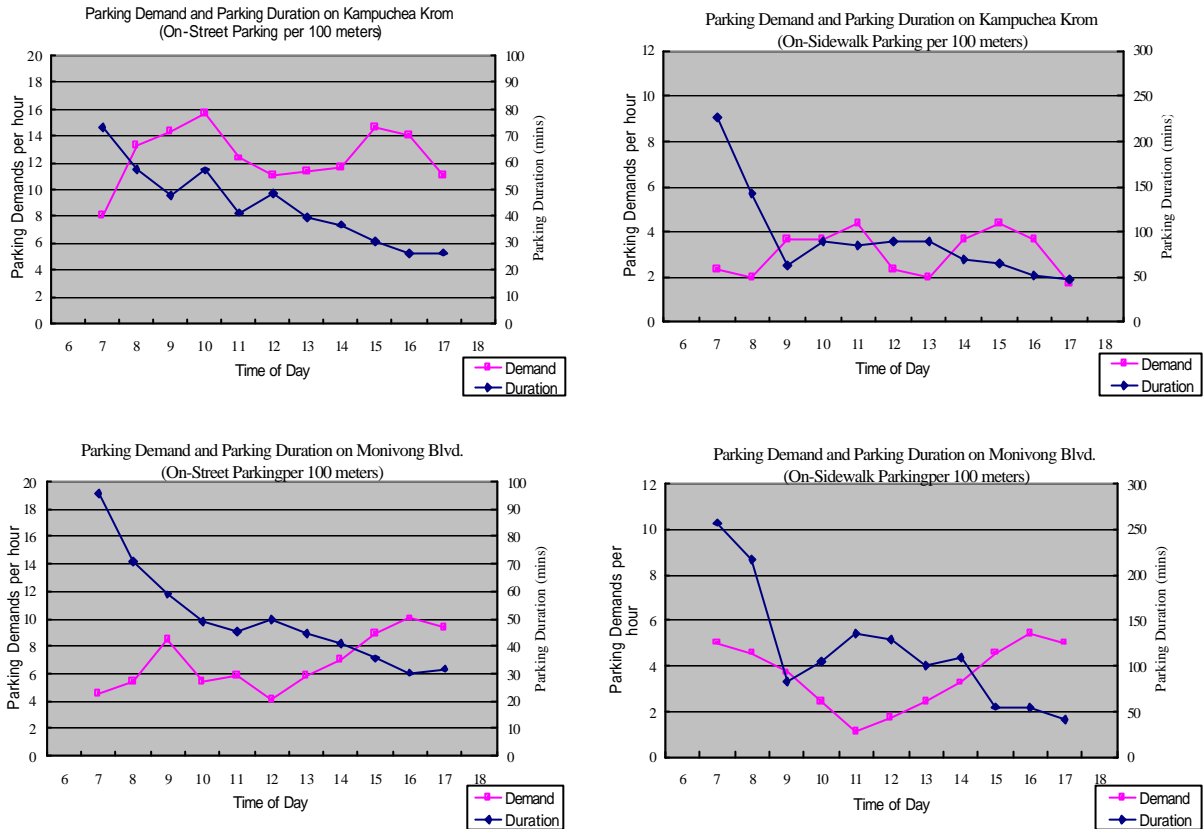


Figure 2.3.2: Parking Demand and Duration in the Central Business District

2.3.3 Existing Parking Supply in the CBD

In this section, current parking capacity in CBD area (bounded by Blvd. Sihanouk - Blvd. Nerha, Ave. Daun Penh and Bassac River) is discussed.

(1) Method

On-street parking is common in the CBD area but parking in large open areas is possible as off-street parking, that is, parking in government and other public offices, schools, first-class hotels, and market. (A 4-floor building for parking is now under construction in OuRussey Market). Considering such condition, the following two methods were used for estimating parking capacity.

a. On-street parking

Extension of roads and number of intersections by each area zone were measured from a map at a scale of 1/5000 so that capacity of on-street parking could be estimated. Then, potential number of parking vehicles in each zone was estimated, assuming that it is possible to park on both sides of the roads and that parking in and near to an intersection is impossible. However, potential parking capacity on arterial roads was estimated based on a different assumption because parking prohibition would be introduced along the arterial roads in the future.

b. Off-street parking

Area of government and other public offices, schools, first-class hotels, and others (stadium, etc.) were measured by zone for each area from a map with a scale of 1/5000. Then, the number of potential parking vehicles was estimated based on the parking capacity of each building per unit area. Sampling surveys were taken place to estimate parking capacity of each building type per unit area.

(2) Number of Potential Parking (Parking Supply)

The vehicle numbers estimated by each method are divided into two categories, those with parking prohibition on arterial streets and without. The result is shown in Table 2.3.3. It is estimated that parking supply in the CBD is 10,177 under the case of parking prohibition on major arterial streets and 11,875 without parking regulation on these streets.

Table 2.3.3: Supply of Parking Vehicles in Zones of the CBD

Area Number and Name	Area (Km ²)	Supply of Parking Cars			Total Supply of Parking Cars	
		All Streets	Building Area	only Major Streets	Parking on all Streets	No parking on Major Streets
1 [13] Phsar Thmey I [14] Phsar Thmey II [28] Monourom	0.45	525	375	244	901	657
2 [15] Phsar Thmey III [16] Boeng Reang	0.72	970	772	176	1,742	1,565
3 [17] Phsar Kandal I [20] Phsar Kandal II [21] Phsar Chas	0.66	428	202	99	630	530
4 [18] Chey Chumneah	0.77	663	325	160	987	827
5 [19] Chakto Mukh	1.11	1,234	788	228	2,023	1,795
6 [22] Vat Phnom	0.64	770	425	193	1,195	1,002
7 [24] [25] [26] [27] Ou Russey	0.31	403	295	124	698	574
8 [29] Mittapheap	0.40	618	293	209	911	702
9 [30] Veal Vong	0.96	1,030	1,219	219	2,249	2,030
10 [31] Boeng Prolit	0.37	390	150	45	540	495
Total	6.39	7,031	4,844	1,697	11,875	10,177

2.3.4 Forecasted Parking Demand in 2015

(1) Parking Demand per Day

Traffic generation and attraction volume by each zone in future are predicted and discussed in Chapter 5. Traffic generation volume is used to discuss on parking demand in the future since parking demand is equal to either traffic generation volume or attraction traffic volume in a zone. Parking demand per day by each zone in the future is shown in Table 2.3.4.

Table 2.3.4: Future Demands of Parking Vehicles into Zones of the CBD
(equal to traffic generation volumes)

Area Number and Name	Demand of Parking Cars per Day	
	2000	2015
1 [13] [14] Phsar Thmey I, II [28] Monourom	13,373	19,798
2 [15] Phsar Thmey III [16] Boeng Reang	18,293	28,320
3 [17] [20] Phsar Kandal I, II [21] Phsar Chas	7,826	14,802
4 [18] Chey Chumneah	1,520	2,480
5 [19] Chakto Mukh	8,810	13,450
6 [22] Vat Phnom	7,141	8,767
7 [24] [25] [26] [27] Ou Russey	9,136	15,015
8 [29] Mittapheap	4,261	6,505
9 [30] Veal Vong	8,879	17,552
10 [31] Boeng Prolit	2,777	4,454
Total	82,016	131,143

(2) Traffic Demands during Peak Hours

In preparing a parking facility plan in the CRD area, it is not always true that the parking facility can accommodate all vehicles in peak periods, even if it is possible when considering per day. Thus, traffic demand in peak periods on morning and evening should be taken into consideration and examined.

Traffic demands in peak periods are estimated under the following assumptions:

- Morning peak period 7.2% peak hour factor
52minute duration, turnover is 1.15 per hour.
- Evening peak period 7.0% peak hour factor
31minute duration, turnover is 1.93 per hour.

- Peak hour factors are predicted based on a characteristic of demand variation of hourly volumes at 9 main locations where 24 hour volume surveys were conducted within the CBD.
- Turnover values are estimated based on an average parking duration in the case of legal on-street parking

The estimates of parking demands by area zones are shown in Table 2.3.5. The figure indicates that parking facility issue is more critical in morning peak period than evening period in Phnom Penh City.

Table 2.3.5: Future Demands of Parking Vehicles in Peak Hour into Zones of the CBD

Area Number and Name	Demand of Parking Cars in Hour			
	Morning Peak Hours		Evening Peak Hours	
	7:00-10:00	7.2%	16:00-19:00	7.0%
	Duration (min) 52		Duration (min) 31	
	2000	2015	2000	2015
1 [13] Phsar Thmey I [14] Phsar Thmey II [28] Monourom	834	1,235	484	716
2 [15] Phsar Thmey III [16] Boeng Reang	1,142	1,767	662	1,024
3 [17] Phsar Kandal I [20] Phsar Kandal II [21] Phsar Chas	488	924	283	535
4 [18] Chey Chumneah	95	155	55	90
5 [19] Chakto Mukh	550	839	319	486
6 [22] Vat Phnom	446	547	258	317
7 [24] [25] [26] [27] Ou Russey	570	937	330	543
8 [29] Mittapheap	266	406	154	235
9 [30] Veal Vong	554	1,095	321	635
10 [31] Boeng Prolit	173	278	100	161
Total	5,118	8,183	2,966	4,743

2.3.5 Need for Off-Street Parking Facilities

In this section, a balance between parking demand and supply is considered and the need for off-street parking facilities is also discussed.

(1) A Balance between Parking Demand and Supply in Morning Peak Periods

Table 2.3.6 shows a balance between parking demand and supply by each zone per morning peak hour. This table indicates results investigated on whether the estimated future parking demand would exceed supply estimated in the previous section.

Figure 2.3.2 illustrates the number of parking supply and parking demand in 2015 by zones

In this discussion, it is assumed that on-street parking in major arterial streets is prohibited in order to maintain smooth traffic flow on the streets in the future, and sidewalk parking is absolutely prohibited

Table 2.3.6: Balance of Supply and Demand of Parking Cars in one Hour

Area Number and Name		Area	Morning Peak Hours(7:00-10:00)				
			Balance of Supply and Demand of Parking Cars in one hour				
			Supply	2000		2015	
Demand	Balance	Demand		Balance			
1	[13] [14] Phsar Thmey I, II [28] Monourom	0.45	657	834	-178	1,235	-578
2	[15] Phsar Thmey III [16] Boeng Reang	0.72	1,565	1,142	424	1,767	-202
3	[17] [20] Phsar Kandal I, II [21] Phsar Chas	0.66	530	488	42	924	-393
4	[18] Chey Chumneah	0.77	827	95	732	155	672
5	[19] Chakto Mukh	1.11	1,795	550	1,245	839	955
6	[22] Vat Phnom	0.64	1,002	446	556	547	455
7	[24] [25] [26] [27] Ou Russey	0.31	574	570	4	937	-363
8	[29] Mittapheap	0.40	702	266	436	406	296
9	[30] Veal Vong	0.96	2,030	554	1,476	1,095	934
10	[31] Boeng Prohit	0.37	495	173	322	278	217
Total		6	10,177	5,118	5,059	8,183	1,994

(2) Zones or Areas Where Parking Facility will be Lacking in the Future

This table and figure indicate the following:

- The existing supply of parking in the entire study area is larger than the demands in 2000 as well as in 2015.
- However, the parking facilities are already lacking in the zone around Central Market at present. (Even though it seems that there is no problem because these parking cars can be accommodated on the major arterial streets where parking is permitted at present)
 - [13][14] Phsar Thmey [28] Monourom) 178
- These zones lacking parking facilities will eventually expand to cover the surrounding zones from the Central Market zone by year 2015.

The zone names and shortage of parking in 2015 are estimated as follows:

- [13][14] Phsar Thmey I, II [28] Monourom 578
- [15] Phsar Thmey III [16] Boeng Reang 202
- [17] [20] Phsar Kandal I, II [21] Phsar Chas 393
- [24][25][26][27] Ou Russey 363

Thus, it is necessary to devise a parking facility improvement plan and to carry out it accordingly in future. The zones or areas, which have greater parking demand than supply as shown in the figure, shall be given higher priority for such improvement.

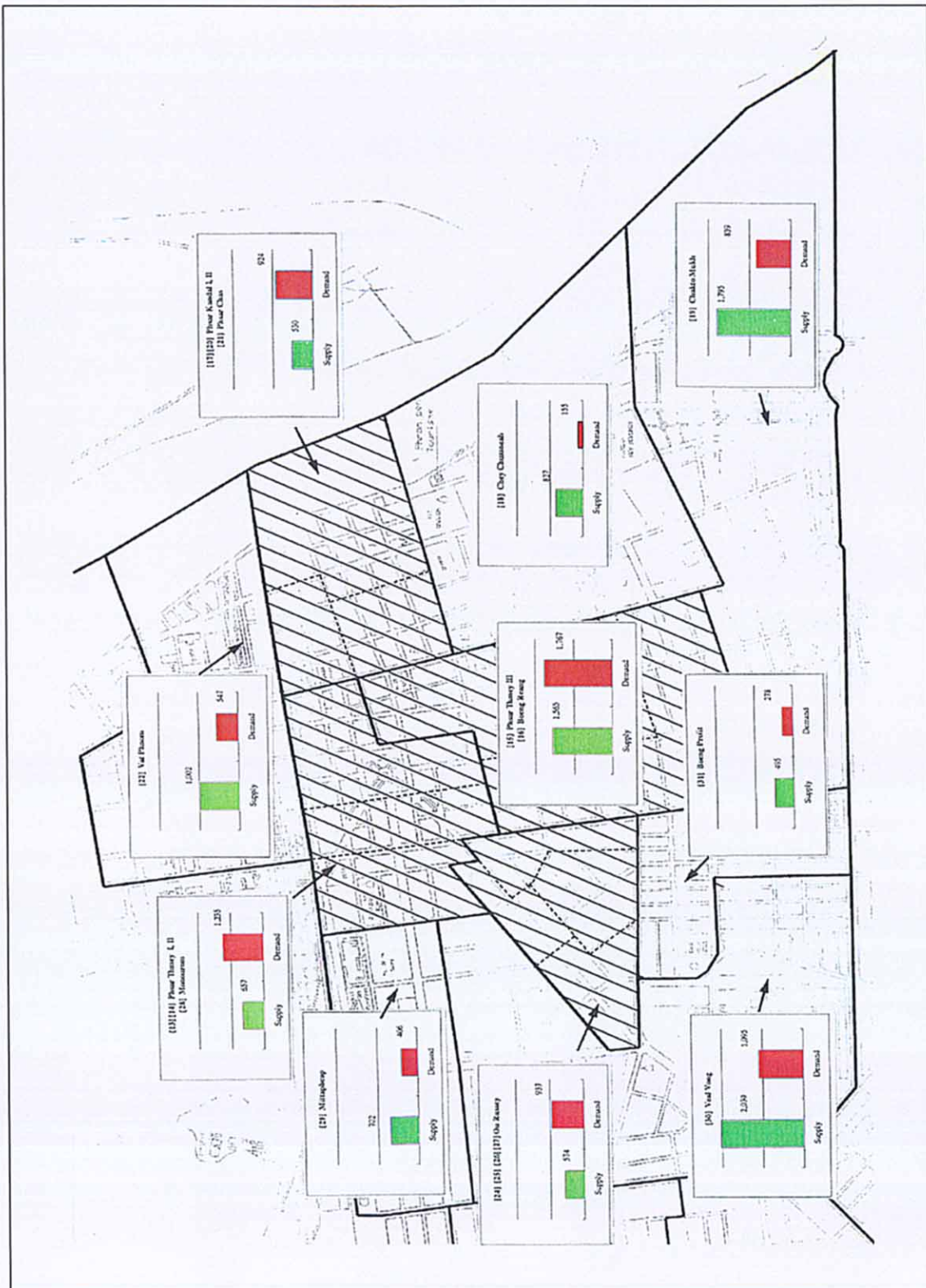


Figure 2.3.3: Balance of Parking Supply and Demand in CBD Zones

2.3.6 Preparation of Parking Facility Improvement Plan in Future

It has become apparent in the course of this Study that Phnom Penh City will face with a serious shortage of parking facilities in the central district in the future. It is surely necessary to make a parking facility improvement plan and improve parking facilities according to this plan in order to achieve effective use of road spaces and maintain smooth traffic flow in such area.

A parking facility plan should be arranged according to the following basic idea.

- Parking facility plan should be designed for zones, which will face shortages of parking facilities in the future.
- Parking facilities should be provided as an obligatory requirement by building law, in all new constructions or additions and betterment of buildings in those zones, which are facing or will face with the shortage of parking facilities.
- On-street parking facilities without obstruction to smooth traffic flow should only be provided for vehicles parked for short duration, according to the plan in order to accommodate the parking demands.
- Parking on sidewalk instead of a garage will be prohibited and provision of private garages should be a duty.

Example of Off-Street Parking Facility Plan:

Off-street parking facilities are necessary at proper timing at designated zones that will face shortage of parking spaces. If these facilities are provided by parking building style, followings estimated construction cost are required to secure 200 parking spaces building at each combined zone by year to be built. According to this estimate, each parking building is required total floor area of 6,000 square meters with 4-story by 50 lots per floor or 5-story by 40 lots per floor, and cost around 1.3 million dollars each. These facilities will be profitable, if parking regulation is secured, therefore private sector initiative is recommended. One of possible measures to increase usage of off-street parking is that large market such as Central Market subsidies parking fee as sales promotion.

Table 2.3.7 Estimated Construction Cost of Parking Facilities

Zone Area	Year to be Starting Lack of Parking Spaces	Estimated Required Parking Spaces in 2015	Required Number of Parking Buildings with 200 Parking Spaces	Necessary Total Floor Area (m ²)	Building Cost per Combined Zone* (Thousand US\$)
[13] [14] Phsar Thmey I, II [28] Monourom	2000	578	3	18,000	3,960
[15] Phsar Thmey III [16] Boeng Reang	2010	202	1	6,000	1,320
[17] [20] Phsar Kandal I, II [21] Phsar Chas	2001	393	2	12,000	2,640
[24] [25] [26] [27] Ou Russey	2000	363	2	12,000	2,640
Total		1,537	8	48,000	10,560

Unit Cost of Parking Building : \$200/m²
 Necessary Floor Area per Vehicle Parked : 30 m²
 * Including Contingency of 10 %

Table 2.3.8 Construction Schedule and Input Cost of Parking Facilities

Proposed Countermeasures	2001-2005	2006-2010	2011-2015	Total Cost
Construction of Parking Facilities	3,960	3,960	2,640	10,560

(Unit: Thousand US\$)

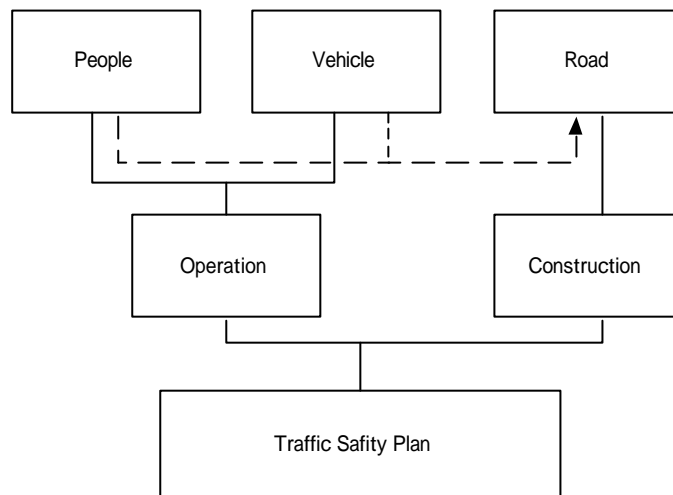
2.4 Traffic Safety and Traffic Safety Education

The final objective of formulating a traffic management plan is to realize a safe, smooth and comfortable traffic environment. In achieving a smooth traffic flow, the byproducts are in fact safe and comfortable traffic. In other words, to ensure safety and ability to travel in comfort, the traffic has to have the chief characteristic of being able to flow smoothly.

2.4.1 Approach for Formulation of Traffic Safety Plan

Before a traffic safety plan can be formulated, one has to examine the three basic elements that make up traffic, namely 'people, vehicles and roads'. To accomplish successful achievement, a plan cannot overlook any of these three elements.

The future trend in traffic safety plan is increasingly putting emphasis on viewing management from perspectives of traffic operation and roads at equal levels. In other words, roads (construction) are just 'tool' that are used by 'people' and 'vehicles' (operation) to achieve the needs for mobility and safety. Therefore it is fundamental that traffic safety plan be viewed from these two components.



Traffic safety approaches that are commonly applied include the 3E approach and time series approach described below.

(1) 3E Approach

As a common traffic safety planning approach, the 3E method means the approach with perspectives from 'Engineering', 'Education' and 'Enforcement'. However, with the increasing concerns over the degradation and need to protect the environment, many professionals are now stressing the 3E as 'Environment', 'Enforcement' and 'Education'. The previous engineering component is now embedded into the 'Environment' component.

(2) Time series approach

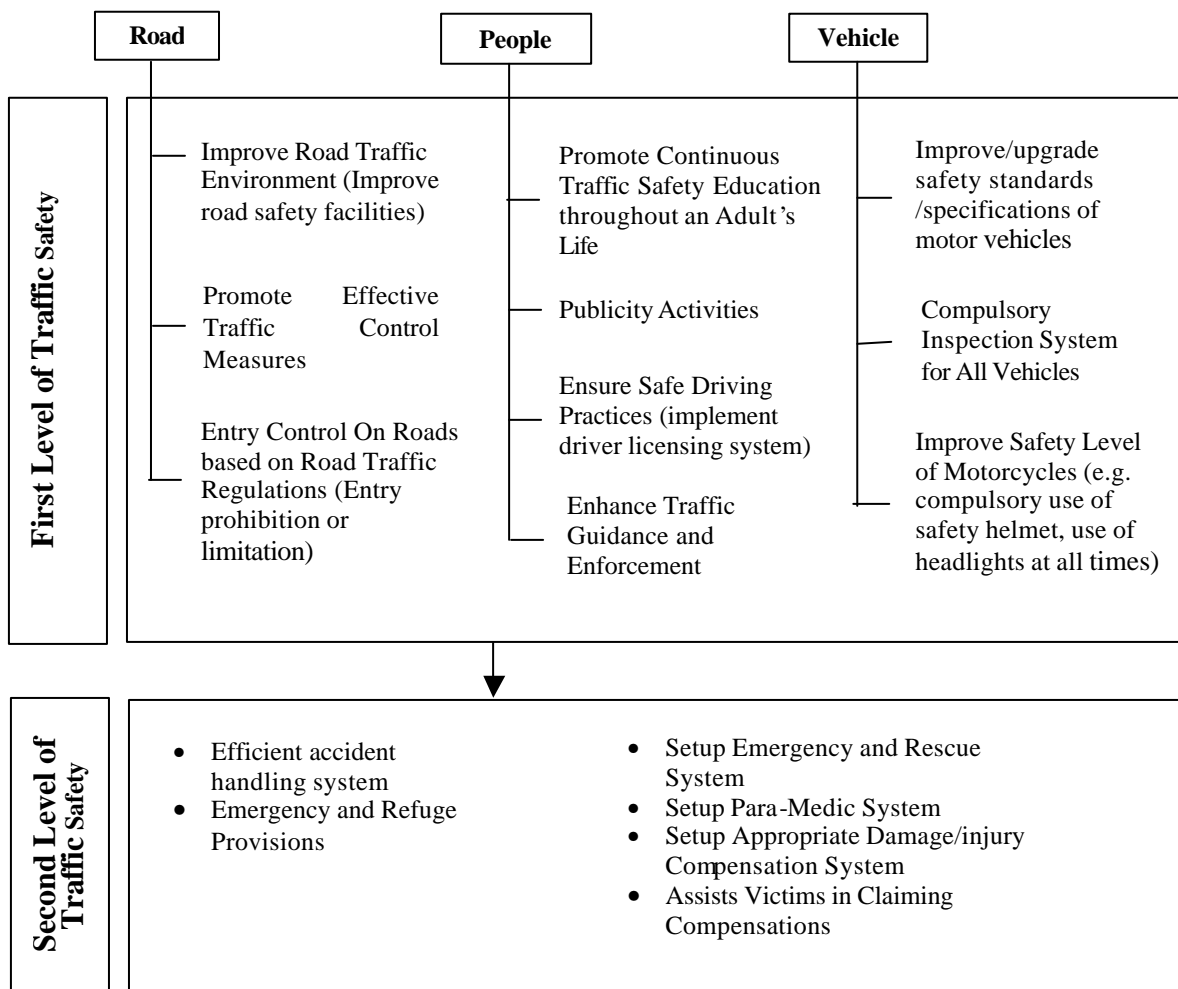
This approach differs from the 3E approach, by focusing on the underlying factors that cause traffic accidents over time in a particular sequence and then device measures to prevent their occurrences.

This time series approach has the special feature of dividing the accident phenomenon into three time related sequence: 1) Pre-crash, 2) Crash and 3) Post-crash. Measures are thus devised to address the probably causes that may lead to crashes (accidents) at these various stages.

More specifically, the approach advocates examination of traffic accident from the following 9 perspectives when the three basic elements of 'road', 'people' and 'vehicles' interact with the three time series suggested above:

Elements /Time Series	Pre-Crash	Crash	Post-crash
People			
Vehicles			
Roads			

Based on this basic concept, the approach to formulate a traffic safety plan and traffic safety countermeasures may be expressed in more concrete form as illustrated in Figure 2.4.1.



Note: First Level of Safety: Measures taken before accidents occur.
 Second Level of Safety: Measures taken during and after the accidents

Figure 2.4.1: Time Series Approach For Traffic Management and Safety Improvement Plan

2.4.2 Traffic Accident Statistics

Traffic accident investigations in Phnom Penh city are undertaken by the Municipal Police and records of these investigation are kept in 8 Police Offices. Keeping investigation result and record is done by the central police office and 7 other district offices for each of their respective jurisdiction areas. Simple statistical data from the 7 district offices are reported to the central office.

There is no suitable data for accident analysis at the present moment. There is also no database built for the traffic accidents. All the data recording and processing are done manually.

In this Study, some traffic accident analyses were carried out after processed data was obtained from the central police office. This section describes the characteristics of traffic accidents in Phnom Penh based on the traffic accident data for the entire city in 1997-1999.

(1) Trend in Annual Total Accidents, 1997-1999

Table 2-4-1 and Figure 2-4-2 show the total accidents reported for the three year period of 1997-1999. In 1997, there were 429 cases of reported accidents. The total accidents increased to 578 cases by 1998 at a rate of 34% annually. In 1999, the reported cases were 472 in total, which amounted to a 10% increase compared to 1997 but 18% fall from 1998.

(2) Number of Fatalities and Injuries

Table 2-4-1 and Figure 2-4-3 show the number of accidents, fatalities, serious injuries and minor injuries from 1997-1999. Based on these figures, the following observations can be made:

1) Fatalities

- The number of fatalities is increasing very rapidly every year. In 1999, there were 133 fatalities. In spite of the decrease in total accidents from 1998 to 1999, the number of fatalities has increased sharply. In other words, taking the fatalities for 1997 as 1.0, the ratio for 1998 is 1.34 and this has increased further to 1.58 by 1999. This means that there was an increase of 58% in fatalities in 1999 compared to 1997.

Table 2.4.1 Accident Variation in Year in Phnom Penh

Year		1997	1998	1999
Category				
Total Number of Accidents (Ratio)		429 (1.00)	576 (1.34)	472 (1.10)
Fatality	Nos. of Fatalities (Ratio)	84 (1.00)	108 (1.29)	133 (1.58)
	[Average fatality/accident]	[0.20]	[0.19]	[0.28]
Serious Injury	Nos. of Serious Injury (Ratio)	335 (1.00)	457 (1.36)	419 (1.25)
	[average injury/accident]	[0.78]	[0.79]	[0.89]
Minor Injury	Nos. of Minor Injury (Ratio)	250 (1.00)	307 (1.23)	281 (1.12)
	[average injury/accident]	[0.58]	[0.53]	[0.60]

- Examined from another perspective, there was an average of 0.28 fatality for every accident in 1999. This means that one person was killed in every 3~4 cases of accidents. (There are some cases that several fatalities occur in one accident).

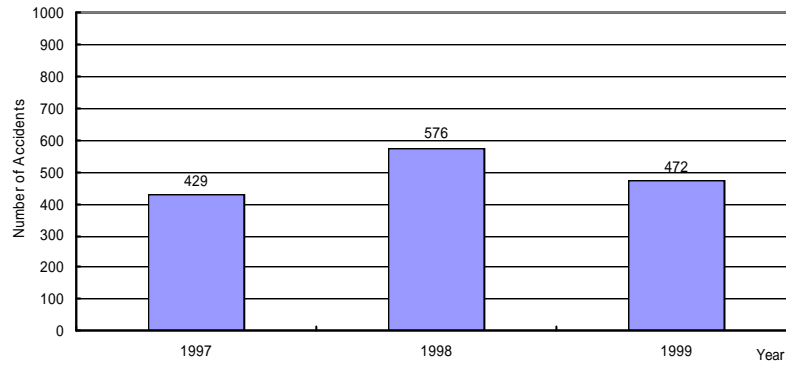


Figure 2.4.2: Total Number of Accidents, 1997-1999

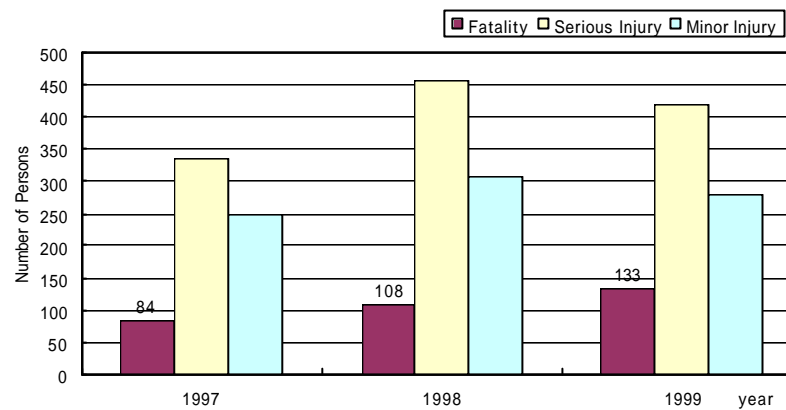


Figure 2.4.3: Numbers of Fatalities and Injuries, 1997-1999

2) Number of injuries

The yearly fluctuation of injury number has the same trend as that of the yearly total number of accidents from 1997-1999. For serious injuries, the ratio has increased from 1.0 in 1997 to 1.36 in 1998 and then to 1.25 in 1999. For minor injuries, the ratios were 1.0 to 1.23 and 1.12 respectively for 1997, 1998 and 1999.

Looking at these ratios, it is clear the increases in serious injuries are higher than in the minor injuries category. In 1999, therefore, for every traffic accident, there was 0.9 person who suffered serious injuries and 0.6 minor injuries. In other words, there was 1.5 person who suffered injuries in every accident.

(3) Accidents by Type of Vehicles

Table 2.4.2 and Figure 2.4.4 show the number of traffic accidents in 1999 by types of vehicles involved. Based on these figures, the following observations are made:

- Accidents that involved motorcycles accounted for 379 accidents or 80.3% of the total 472 accidents. (Figure 2.4.4 (1))
Motorcycle traffic may be higher than the other vehicular traffic and this high rate of accident involvement is alarming. To reduce the total number of traffic accidents, traffic safety measures targeting at motorcycles must be implemented diligently.
- Accidents involving 4 wheelers were 249 cases or 52.7% of the total. (Figure 2.4.4 (2))
Although this rate is not as high as motorcycle, the figure implies that one out of every two accidents involved a 4 wheeler.
- Accidents involving pedestrians amounted to 70 cases or representing 14.8% of the total. (Figure 2.4.4 (3))

- Accidents involving bicycles accounted for only 2.1% of the total, which is even smaller than the figure involving pedestrians.
- Accidents involving motorcycle and motor-remok warrant special concerns. Despite of the low traffic volume of motor-remok in the city, the share of 2.1% is considered to be very high.

Table 2.4.2: Accidents and Percentage Share by Types of Vehicles

Collision by Types of Vehicles	Number of Accidents	Percentage share
Car & Car	46	9.7%
Car & Motorcycle	158	33.5%
Car & Pedestrian	29	6.1%
Motorcycle & Motorcycle	166	35.2%
Motorcycle & Pedestrian	41	8.7%
Car & Bicycle	6	1.3%
Car & Cycb	1	0.2%
Car & Motor remok	2	0.4%
Motorcycle & Motor remok	10	2.1%
Motorcycle & Bicycle	4	0.8%
Non collision accidents	2	0.4%
Car & Objects	7	1.5%
TOTAL	472	100.0%

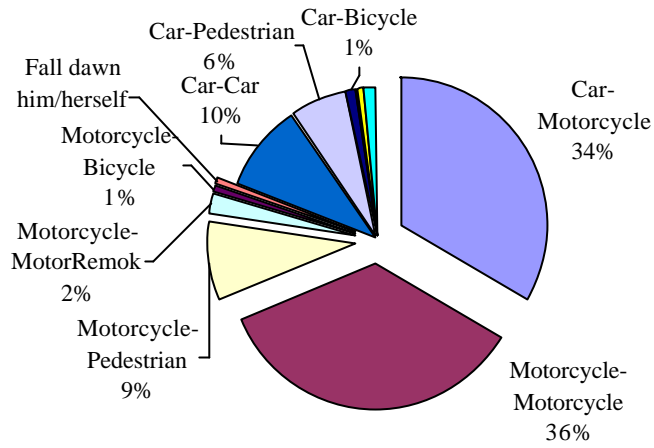


Figure 2.4.4 (1): Percent of Motorcycles Involved in Accidents

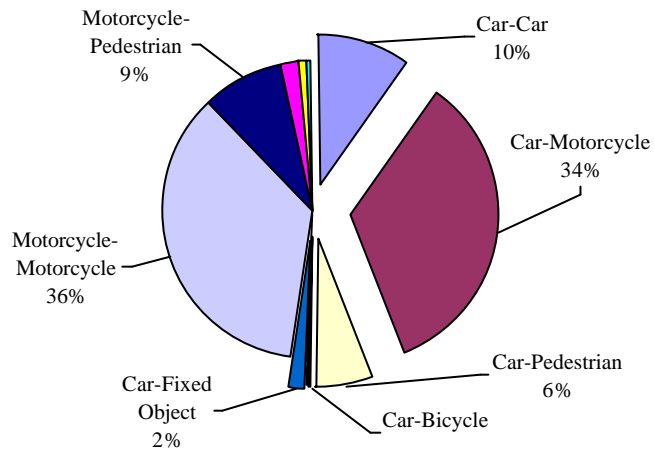


Figure 2.4.4 (2): Percent of 4 Wheel Vehicles Involved in Accidents

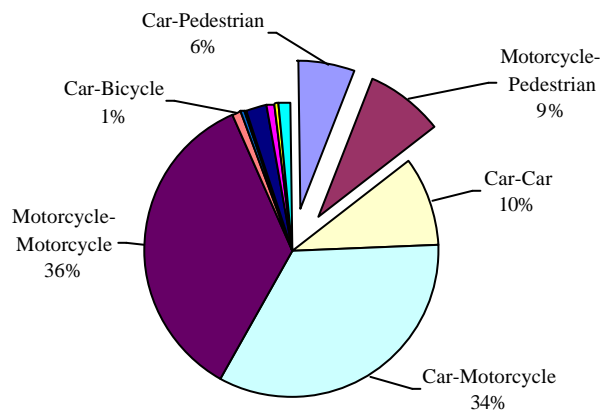


Figure 2.4.4 (3): Percent of Pedestrians Involved in Accidents

(4) Traffic accidents situation related to traffic enforcement

The following characteristic and problems are found as a result from an analysis of traffic accident statistics maintained by Traffic police Central Office in Phnom Penh City. They were analyzed focusing on traffic regulation and enforcement.

1) Seasonal traffic accidents

Figure 2.4.5 shows the seasonal trend in the variation of number of traffic accidents in Phnom Penh City from 1998 to 1999. As shown in the figure, 62% from a total of 162 cases happened within the first 6 months, from January to June, and 38% in the latter half of the year. This means that traffic accidents in Phnom Penh City are concentrated on first half of the year, especially from January to March. Thus it is important to give more attentions to proper measures of traffic enforcement within this period.

2) Traffic accidents variations between days of the week

Figure 2.5.6 shows the ratio of traffic accident occurrences between weekdays and weekends respectively. Accidents occurring on weekends account for 59% of the total accidents which is a higher ratio than 41% for weekday. In addition, it was reported that the number of calls for ambulances to hospitals is much higher in the weekends. Thus, traffic enforcement on weekends must be given more emphasis.

3) Traffic accident occurrence at night

Figure 2.5.7 shows the ratio of traffic accident occurrences between different times of the day. The figure indicates that the ratio of accident occurrences at night is high with 36% of the total accidents concentrated within the period from 18:00 to 24:00 hours. Thus enforcement at night must also be given equal attention as that during the day time.

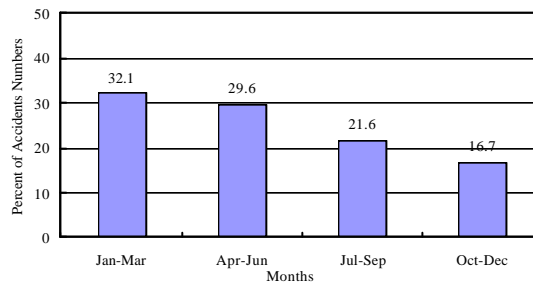


Figure 2.4.5: Accident Variation in Months

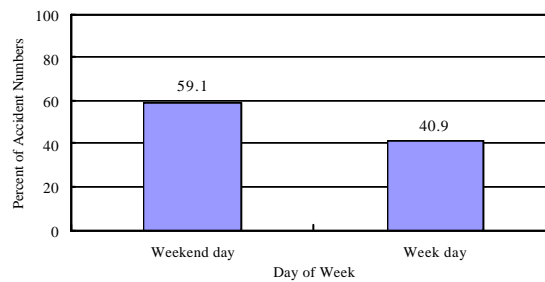


Figure 2.4.6: Accident Variation in Day of Week

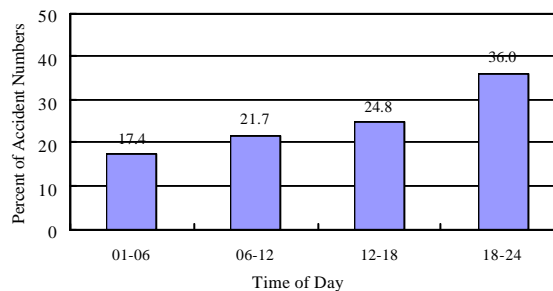


Figure 2.4.7: Accident Variation in Time of Day

4) Traffic accidents caused by drunken driving

Figure 2.4.8 shows the percent share of traffic accident numbers by causes in the whole of Phnom Penh City in 1999. Drunken driving accounts for 21% of the total. Accident occurrences at night as mentioned before are also likely to be linked to drunken driving. Thus, enforcement on drunken driving should be given emphasis.

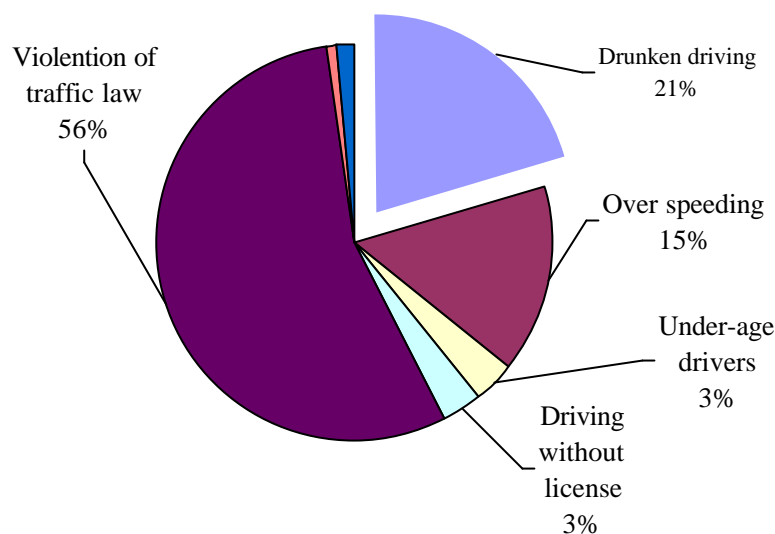


Figure2.4.8: Percent of Accident by Causes

(5) Poor knowledge of vehicular drivers

The majority of drivers in the city do not seem to be aware of the danger, seriousness of traffic accident and the need to observe traffic safety rules. Most of these drivers can be seen to drive with the notion that if they act more aggressively, other road users would surely give way to them.

1) Including the motorcycle drivers, most drivers in the city can be observed to behave with the following manners:

- There is almost no concept of 'give way' to pedestrians on sidewalks, pedestrian crossings or at/near to bus stops or other public vehicle terminals.
- There is a lack of respect for the right-of-way of vehicles already traveling within the designated traffic lanes.
- There is also no awareness of priority traffic stream at non-signalized intersections.
- Some even travel against the designated traffic direction just so they can get ahead and cut into the opposite side of the road. This is a total disregard of traffic safety of other road users and should be strictly prosecuted.
- Drivers are also found to ignore the left turning prohibition measure. This is another serious traffic offence.
- Ignoring traffic signals (another serious traffic offence).
- Parking within or near to intersections (another traffic offence)
- Entering the intersections even though the downstream exit is already congested, thus creating gridlock situation when the signal light changes.
- Rampant changing of lanes when traveling and keeping unsafe headway to the vehicle in front.

Motorcyclists also have the following undesirable behaviors:

- Ignore the requirement to use safety helmets when driving. Many of them are seen to wear high heel sandals without realizing the danger they pose.
- Many young motorcyclists are driving without licenses. Stricter enforcement on underage motorcyclists should be carried out. (3% of the total reported traffic accidents involved drivers who are below 15 years of age).

2) Low-speed Vehicular Traffic

- Cyclos, motor-remoks and bicycles are traveling at speeds far slower compared to those of 4 wheelers and motorcycles. There is a need to segregate these two groups of vehicles on the roads.
- These low speed vehicles would travel on the motorcycle lane nearest to the curbside along road sections with clear pavement markings. However, when it comes to an intersection and making a left turn, these vehicles shift to other lanes and they tend to turn from any lane.

Drivers of these low speed vehicles are quick to seek any shortcuts even to the extent of infringing on the opposing traffic lanes when making a left turn.

2.4.3 Present Traffic Safety Education

Any traffic safety education for Phnom Penh must be planned with the entire city's population in mind. All vehicle drivers are also pedestrians themselves at other times. In the present situation, many pedestrians are found to cross any streets randomly without any regards to their own safety as well as other road users.

Except for those unfortunate few who had experienced personally the trauma of accidents, many residents here can be said to be quite unaware of the horror of traffic accidents. Most residents here have a very low awareness of traffic safety. Information on accidents is not widely propagated to drivers nor the general public. Statistics show that traffic accidents, fatality and injuries from accidents are on a rising trend. This phenomenon can become a major social problem in the future if it is not addressed soon and properly.

With such a background, the city of Phnom Penh has recognized the importance of traffic safety education to its residents. Consequently, a traffic safety campaign was implemented in the city throughout February and March 2000.

(1) Program of Traffic Safety Education Campaign

The Municipality of Phnom Penh, the Department of Public Works and Transport and the Traffic Police have jointly conducted a traffic safety education campaign in February and March, 2000. The campaign was aimed at educating and enhancing the traffic safety awareness among children and students, as well as the general public, particularly the drivers of cars and motorcycles. It was the first time in Cambodia.

(2) Traffic safety education for schools

Traffic safety education for primary, secondary and high schools was introduced as part of the traffic safety campaign in year 2000. No such education was given previously.

Traffic safety education conducted this time can be considered to be very effective. Traffic police officers were first dispatched to various schools to instruct the teachers on traffic safety. The teachers then pass on such knowledge to the students. However, it is not realistic to expect all the students to be completely conversant with all the traffic rules and regulations with only one classroom session. It is essential that such classroom education on traffic safety be continued. Furthermore, efforts must be also made to further improve and strengthen the teaching materials as time goes on.

The young generation is to become the pillars of society and knowledge acquired when young is less likely to be forgotten. It is therefore very important for this education program to be given appropriate priority.

(3) Traffic safety education for the public

In the traffic safety campaign, TV and radio were used to broadcast news on traffic accidents in an attempt to impart awareness on the importance of safe driving, observing traffic rules as well as the horrors or losses due to traffic accidents. Through this effort, many residents are made aware to a certain extent on the traffic accident issue that is affecting them.

Traffic safety and accident are also widely reported in the local news media, namely Rasmey Kampuchea and Kaoh Sante Peap. Wherever there is a major accident, pictures of the accident scene are also printed to give certain level of 'shock' treatment to residents, forcing them to rethink when the next time they drive recklessly.

Radio broadcast is through FM 105.0 MHz radio station. News on major traffic accidents are frequently broadcast to the public.

(4) Traffic safety education for drivers of 4wheel vehicles

A legal driving license issued by the Ministry of Public Works and Transport is required for driving a 4wheel vehicle on the public roads. To obtain such a license, the following conditions must be met:

- Above 18 years of age,
- Learned the technique of driving by attending a private driving school and completed at least 16 days (0.5 to 1.0 hour/day) of practical driving under guidance on the public roads,
- At the same time, attend classes to learn the basic traffic rules, safe driving and basic mechanism of a vehicle.
- To pass the paper test and driving technique conducted by the Ministry of PWT.

In meeting these requirements, most 4wheel drivers can be said to have acquired the basic traffic rules and safe driving techniques. The learning material used in Cambodia is the 'What the drivers have to know?' published by the Ministry of Public Works and Transport. This teaching material is divided into three parts:

- Discipline and safety in driving,
- How to drive (Traffic rules and regulations)
- Automobile mechanism

This material however has lots of written passages and it is not easy to comprehend if the learner has not achieved a certain level of formal education. It is therefore doubtful that all the public can sufficiently be taught on traffic rules and regulations only by using just one such material.

It is also essential that a simpler teaching material be produced and made easily available to the general public in the near future.

(5) Traffic safety education for motorcycle drivers

One of the main traffic safety problems in Phnom Penh is the lack of traffic safety awareness and knowledge among the motorcycle drivers. Either they have not formerly received any instruction on traffic safety or there is little opportunity for them to undertake such learning.

Anyone above the age of 16 can drive a motorcycle without any legal license. However, a license to drive is required by law if the motorcycle is of 100 cc and above. (at present such license has not be issued)

The current situation in the city is that many motorcycle drivers are driving on the public roads without receiving proper education on traffic safety and rules or regulations. Considering such condition, education in schools is thus even more important.

(6) Teaching material

For all the public to be taught on traffic rules and regulations, it is essential that a simpler teaching material be produced and made easily available to the general public in the near future

2.4.4 Suggestion of Concrete Remedial Measures on Traffic Safety Education

With regard to spreading traffic safety perception and education, the identification of an object or target group is a crucial issue.

The target audience may be identified based on age group, such as children, students, the young, adults and older adults. The approaches or methods or contents for each group are likely to be different. On the other hand, they may also be identified based on travel modes, such as pedestrians, cyclists, motor cyclists, and vehicle drivers. Different contents and methods may be devised for such groups as well. Paradoxically speaking, however, the enhancement of traffic safety perceptions and education are required for all levels of society, no matter how old they are and which travel mode they use.

In this section, enhance traffic safety perception and education is discussed, including the kind of educational activities that are required depending on the audience categories. These are examined based on the present traffic accident condition, characteristic of accidents and result of daily traffic observation in Phnom Penh City. Consequently, priority areas and effective solutions are also suggested.

The following 4 methods are suggested in this section

- Implementing regular traffic safety campaign
- Introducing new curriculum on traffic safety education in schools
- Construction of traffic parks for traffic education
- Training of traffic instructors

(1) Implementing regular traffic safety campaign

One of the effective methods to overcome the problem of high traffic accidents is traffic safety campaign targeted at all citizens, namely the general public, school children, parents and drivers. Such campaign has been introduced and implemented regularly in major cities over the world with reported remarkable results. Thus, traffic safety campaign is suggested to be introduced urgently as one of the effective means and first priority in Phnom Penh City.

Such a campaign was carried out from January 27th to February 4th, 2001, as a social experiment of this study and has made a remarkable achievement. This is reported in chapter 12.

1) Purpose of campaign

The purpose of the campaign is not only to reduce traffic accidents but also to increase traffic processing capacity on road section by maintaining smooth traffic flow.

2) Determination of campaign slogan

Although a traffic safety campaign was carried out in 2000 in Phnom Penh, such effort was not easily recognized or identified by the public.

The point to be given much heed is to narrow down to a focus for the campaign and to show the detailed contents of such a campaign so that the public can understand them and take part in the campaign.

If the campaign slogan is too abstract, for example “Take notice of traffic accident”, no effect can be expected even if it is given much publicity through all the media. This is apparent from the Japanese experience. The following suggestion is on such a condition. For example,

1. 「Securing children’s life in Phnom Penh

~ When crossing, used pedestrian crossings; when driving, be friendly to pedestrians ~ 』

2. 「Observe traffic rules, ensure safe walking and safe driving

~ When crossing, use pedestrian crossings; when driving, avoid opposite lane ~ 』

3. 「Observe traffic rules, ensure safe walking and safe driving

~ When crossing, use pedestrian crossings, and obey traffic signals ~ 』

3) Regular implementation, time and duration

The most important factor of implementing the campaign is to carry it out once or twice a year, at corresponding periods in each year. At least one campaign every year is surely necessary. It is also important to provide safety education to all public arduously.

Preferable campaign time is to coincide with the beginning of schools' new semester (autumn), and a duration of 10 days is considered appropriate. The preparation period is set around this suggested duration.

4) Cooperation between the school authorities and students

Cooperation from students will not only contribute to the prevention of students' involvement in accidents as a direct effect but also spreading safety perception to parents and families as the indirect effect. As a result, such a traffic safety campaign will eventually involved all the public in Phnom Penh since attention to "children" is strong no matter which country or society it is. Thus the direct involvement of students in safety campaign can help to spread the desired campaign objectives.

5) Contents of campaign implementation

- a. Instruction and enforcement for drivers at major intersections in the city (during the campaign period)
- b. Campaign propaganda and highlighting traffic safety by mass media

- TV, Newspaper etc.
- Posters, banners
- Stickers etc.

In particular, producing a video to show the appropriate way of driving is an effective way to educate the public.

- c. Selecting " Student traffic police" at representative schools in the city and addressing safety at pedestrian crossings near schools
- d. Traffic safety contest and awarding ceremony
 - Holding written composition and picture contests on traffic safety for pupils and students in the city,
 - Holding safe riding bicycle contests.Excellent students are to be given prizes and the awarding ceremony is to be reported on radio, TV and newspapers.
- e. Holding symposiums on preventing accidents (Including awarding ceremony for excellent students)
- f. Conduct traffic safety parade in the city

6) Main body for implementation

The Department of Public Works and Transport, MPP will be the main organization to implement the safety campaigns. Besides, cooperation from institutions such as The Central Traffic Police Office, all the seven District Traffic Police Offices, Education Youth and Sport Service are required. The Information Social Affairs, Labor and Medical Units will work closely with MPP. A planning, and implementation committee will be set up in DPWT.

In particular, the city should plan out the schedule well so that the Mayor can attend the campaign even if it is just for a short period of time. If the Mayor can participate in the campaign, the public can recognize that the city tries to improve the traffic safety situation in a serious and sincere manner. This is quite important to enhance the results or outcomes of the campaign.

7) Finance

Reasonable amount of finance depending on contents or duration is needed to implement the campaign. However, it is impossible to implement it within the present operation budget of the DPWT. Special supplementary budget from the Government is a prerequisite. Contributions from the private sector must be discussed in advance since direct finance from the city may be impossible or insufficient.

8) Measuring the effects of the campaign

Temporal, economic, labor contributions are required in implementing the campaign. The degree of effects by these contributions should clearly evaluated. This effort is quite difficult but surely required. Major viewpoints and contents of evaluation are as follows:

- Comparison of before, interim, and after the campaign, on the numbers of pedestrian accidents, fatalities and injured.
- Comparison between before and after the campaign, on the behavior of pedestrians and drivers.
- Comparison between before and after the campaign, on the general perception on traffic safety.
- Estimation of the effects by type of media used, and by the sum of capital outlay; highlighting the highest and lowest items.

(2) Training instructors for traffic safety education at schools

One of the reasons that current traffic safety education has almost no impact on the public arises from the absence of adequate and qualified instructors. It is indispensable to train instructors for such jobs. There are 3 types of instructor groups to be trained as follows.

- Instructors for traffic safety education at schools
- Traffic police to be trained on Traffic Safety Education,
- Driving instructors at private driving schools to be trained on Traffic Safety Education

1) Training instructors for traffic safety education at schools

It is desirable that a traffic safety education course is regularly provided in the curriculum of the public schools and students who wish to be a teacher have to master it before becoming schoolteachers. However, for the present, a short-term intensive remedy is suggested, that is, some teachers are chosen and given training so that they can instruct traffic safety to their pupils and students. The target group is representative teachers from all kindergartens, primary schools, junior high schools, and high schools.

2) Traffic safety education for traffic police as instructors

It is surely necessary for traffic polices to be educated on traffic safety since they have a responsibility to spread safety education to the public and to carry out traffic enforcement. They can instruct the public and drivers only after they have acquired enough knowledge and technique of comprehensive traffic rules and traffic safety education management.

Regular traffic safety education is required to train traffic police officers on the true meaning of traffic safety education. All traffic police officers can be the target group.

3) Traffic safety education for driving instructors at private driving schools

Traffic safety education and driving skill learning to obtain drivers' license are provided at private driving schools. Instructions at the driving school is a good opportunity to give traffic safety education to drivers and it can achieve a great deal. Thus, education and training of instructors of such schools are suggested since further improvement of their knowledge and technique may benefit the public in general. All the instructors of the schools are the target group.

4) Contents of training

Basic contents to be taught as traffic safety instructors can be divided roughly into two categories, That is, knowledge on traffic safety and its skill. The course of lectures comprises the following.

a. Knowledge on traffic safety

- General traffic psychology
- Genetic psychology and behavioral trait of pupils and students
- Traffic accident mechanism
- Traffic law
- Traffic engineering
- Road engineering
- Traffic accident statistics and analysis
- Automotive engineering
- Educational assessment
- Emergency medical care and first-aid treatment
- Preparing curriculum and teaching method

b. Skill on traffic safety

- Safe walking and crossing road skill

- Safe bicycle riding and turning skill
 - Development of teaching aid and utilizing skill
 - Educational assessment skill
 - Publicity media technique
 - First-aid treatment skill
- 5) Training method and place
The training comprises both lecture and skill learning. The skill learning in particular, should be carried out in an actual road situation as far as possible. Training venue can be at normal schools, traffic police related organizations and research institutes.
- 6) Training time and duration
Training time is to be decided by Phnom Penh city finally. Summer vacation that is before a new semester is recommended as a possibility.
Training duration depends on the components of training or training hours. A week is possible as an initial standard.
- 7) Instructor for training
It is important to chose instructors from university or persons with recognized experiences in such matters or academic standings. Participation by the traffic police, as instructors on practical and skill related topics are also crucial.
- 8) Expanding from Phnom Penh City to other parts of Cambodia
The various recommendations are aimed at only Phnom Penh City in the short-term, by holding a safety education instructor workshop in order to train instructors to fulfill the imperative need. In the long term, it is expected that the Government of Cambodia will develop a special instructor training program suited to Cambodia and applied throughout the nation.

(3) Establishing traffic safety patrol instruction institution

Traffic safety education for pupils and children in schools is promoted by the central traffic police patrol and instruction unit. The opportunity for such instruction at the present setup is extremely low and no opportunity is given to some schools. To improve this current situation, urgent remedial measure is suggested.

- 1) Arrangement of professional traffic safety instructors
At present, it is difficult for the traffic police to patrol the entire city and give appropriate instructions to the public at the same time. Thus, professional instructors whose responsibility is mainly to support traffic police are needed. They would visit all kindergartens, primary schools, secondary schools and high school in the city regularly and provide traffic safety education to them. These professional instructors are to be organized under the police patrolling unit and should obey its orders. Female police officers are most suitable for such task.
- 2) Composition of professional traffic safety instructors
A group is comprised of two professional traffic safety instructors. Several groups are formed and aimed at various schools. They would visit the schools according to a preset plan throughout a year.
- 3) Installing patrolling cars
The instructing group would use a police patrol car, to be equipped with the necessary teaching materials, set and this would contribute to make the instruction work quick and flexible. A 4-wheel drive vehicle is suitable for such a patrol car considering the frequent flooding. The necessary teaching materials on the car are described as follows.
- Traffic instructing board (or Power Point Projector)
 - Note type personal Computer
 - Video Deck
 - Simulated signal
 - Simulated crossing

- Mobile speaker
- White line drawer
- Play set
- others

4) Training professional traffic safety instructors

Traffic police will provide training to employed professional instructors. The training comprises of contents and teaching methods on traffic safety education for children. This training is drawn upon the training at normal school for instructors.

(4) Introducing traffic safety education to school education curriculum

After introducing the traffic safety education workshop for schools teachers, training professional traffic safety instructors and establishing the required institute, it is suggested that safety education is brought in to be a part of the school education curriculum. Traffic safety education for children is worth doing, as it is useful for the entire terms of their lives. This is particular essential in the case of Cambodia, since there is no opportunity for motorcyclists to learn traffic safety, traffic rules, and safe driving skills. Thus to offer traffic education at schools is the only feasible measure to improve such situation.

Traffic education instruction curriculum must be planned out carefully depending on the type of schools and grades before implementing it. In planning, it is important to clearly define the required knowledge (Purpose of instruction) for children and students and instructing contents needed for accomplishing the purpose and definite methods.

In addition, appropriate different teaching aids depending on the type of schools and grades are also required.

1) Example of curriculum for children at kindergartens and lower grade primary schools

Table 2.4.3 shows example of a program for children at kindergartens and lower grade primary schools. (This is modified from Japanese case)

Table 2.4.3: Safety education program for children at kindergartens and lower grads primary school

Topics	Educational Program
Importance of life	Understanding preciousness of life Compassion for others
Safe walking	Understanding road Walking place Walking straight Understanding right and left
Safe crossing road	Understanding crossing place Safe crossing
Meaning of signal and watching	Meanings of signals and order of change Direction of watching signals
Dangerous run out	Stopping once in the road Dangerous run out
Safety in rainy day	Safe clothes Safe walking
Safe play and playing place	Safe play Distinction of dangerous playing places
Utilization of carriage safety	Safe getting on and off
Appropriate understanding of vehicle and motorcycle	Appropriate understanding on speed, relation between vehicles and life
Safe riding in vehicles	Riding place Riding way

2) Example of curriculum for pupils of upper grade primary schools

Table 2.4.4 shows an example of issue and purpose of program for pupils of upper grade primary schools. The purpose is to improve traffic safety knowledge, attitude and behavior of the pupils.

Table 2.4.4: Object of safety education for pupils of upper grade primary school

-
- To impart perception on dangerous road to children
 - To educate traffic rules on walking and riding bicycle
 - To instruct basic way of riding on bicycles safely
 - To master how to keep safety when riding on the back seat of motorcycle
 - To recognize the need to be courteous, considerate and careful in the present traffic condition
 - To understand horror of accident and behavior encountering accidents
-

3) Example of curriculum for secondary school students

Table 2.4.5 shows an example of issue and purpose of safety education for this group of students.

Table 2.4.5: Safety education object for junior high school students

-
- To instruct safe riding skills
 - To educate and understand traffic rules
 - To understand horror of accident and behavior encountering accidents
 - To master appropriate attitude as pedestrian or motorcyclists.
 - To instruct responsibility in possessing and driving motorcycle in future
-

(5) Construction of Traffic Park for Traffic Safety Education

1) Traffic park

Traffic park is a useful facility for children to familiarize themselves with the simulated traffic situations. One of the purposes of a traffic park is to learn the traffic rules and acquire ways in protecting themselves from traffic accident while playing safely in the facility. There are successful examples of traffic parks in Singapore and Japan (See Figure 2.4.9).

2) Main functions and equipment

Children will be kindly and easily guided and educated for traffic safety through various activities in the park by the park officers with high level of knowledge on traffic safety.

- Children can ride a bicycle and drive a miniature car on the roads with pedestrian crossings, traffic signals, traffic signs, etc. in the park,
- Children can have a lecture on traffic safety by the park officers,
- Children can watch a movie and carton regarding traffic safety and others,
- Special events will be regularly carried out for children such as various festivals.

3) Expectation of traffic park facility to be constructed

A member of the Study Team had fortunately a chance to meet the representatives of all the kindergartens and primary schools in the city. It is found in the meeting that a traffic park has been expected by most of these representatives in order to effectively educate children of kindergartens and schools on traffic safety and safe behaviors in the simulated traffic situations.

2.4.5 Expects in the Future

Improvement of traffic safety education contributes not only to decrease accidents but also reduce congestion through smooth traffic flow, as proven by the actual performances of the traffic safety campaign held by the study team.

It is necessary to implement several measures repeatedly with a long-term perspective in mind and perseveringly in spreading traffic safety education to all levels of society. If only a few campaigns are carried out, the result is often short lived and with little impacts. For example, if satisfactory safety education is offered to school children now, the result can be observed in 5 or 10 years later. This means that when they become a generation to drive vehicles or motorcycles they will follow the traffic rules they have learned and put safety driving into practice.

Operation cost of the measure on traffic safety education is relatively cheaper than that of road construction or improvement. Such an educational measure is highly feasible since the implementing methods are relatively easy. Driving and walking instructions by traffic police for example has been pointed out as a low cost but effective measure that can be easily implemented regularly.

2.5 Traffic Enforcement

Measures to strengthen traffic enforcement are suggested in this section in order to improve the current traffic situation where traffic accidents are likely to increase rapidly in Phnom Penh City in the near future. The measures are put forward with the main focus on drivers' behaviors which are main causes of traffic accidents.

2.5.1 Basic Policy

The following three areas are the main targets of traffic enforcement.

- Ensure safe driving considering drivers' manner and habits.
- Ensure vehicle safety focusing on car maintenance and road worthiness
- Ensure safety by making road traffic orderly, focusing on regulating traffic operations.

In this section, measures to ensure orderly traffic on the roads are discussed.

It must be pointed out that data on traffic accident statistics (1997 to 1999) obtained from the Traffic Police Central Office, MPP and visual observation on the daily driving behavior of road users form the basis for the following analyses and proposals for the improvement measures. Based on the results of analyses on the traffic accident data, urgent corrective measures for the contents and methods of present traffic control and enforcement are suggested.

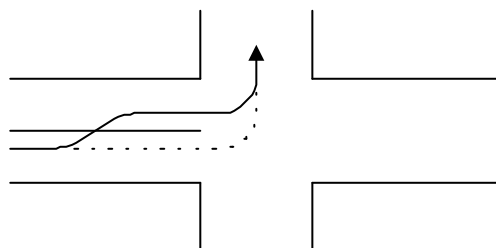
2.5.2 Poor Driving Manner and Exiting Traffic Enforcement

(1) Causes of accidents due to poor driving manners

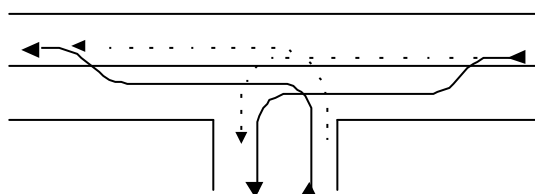
The following describes the extremely dangerous driving behaviors of 4 wheel vehicles and motorcycles.

1) Driving on the opposing roadway

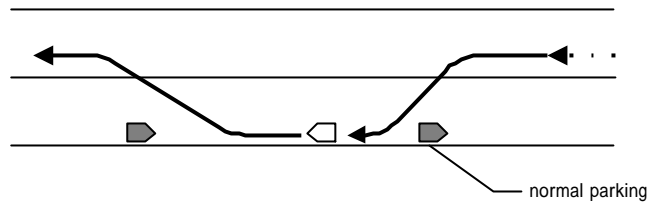
- Drivers infringing onto the opposite roadway are commonly seen in Phnom Penh (not including areas where it is allowed or when overtaking). Although such driving behavior is illegal, the following types of maneuvers are observed:
 - when making a left turn at a cross road junction, instead of making the turn within the intersecting area in the junction, many drivers are observed to just shift to the exit point of the opposite traffic stream and then make a quick left turn. (see illustration below)



- Drivers exiting a small side street or from an individual driveway into a main road also tend to travel in the roadway meant for the opposing traffic for some distance before weaving into the correct roadway, thus creating havoc to the traffic flow.



- Infringing on to the opposite traffic roadway when attempting to park the vehicle in the opposite direction or exiting from the parking lot.



Driving in the opposite roadway poses great danger to all road users including the driver himself and such behavior must be strictly enforced and outlawed.

- When waiting for the green signal at a signalized junction, instead of forming a queue behind the stop line, most of the motorcycles would amass around the stop line, often spilling on to the exit lanes of the opposing traffic stream. When the signal turns green, the exit point of the opposing traffic stream is often blocked, creating unnecessary traffic jams.
 - Similar behavior can be also seen along any traffic queue along a road section. Being impatient to wait for the queue to clear, they would try to get ahead of the queue by traveling on the opposite roadway or the pedestrian sidewalk. Such a behavior would only exacerbate the congestion situation and would result in greater delay for all road users.
 - Finally, at traffic junctions, many drivers do not seem to understand that through traffic has the right-of-way over right or left-turning traffic. Left-turning vehicles often would get into way of the opposing through traffic within the junction. Although they have the right-of-way in entering the junction, the opposing through traffic has to give way to the left turning vehicles as their exit is blocked. This creates the wrong perception to other road users that the left-turning vehicles have the rights-of-way.
- 2) Ignoring traffic signal
- There are some drivers who would ignore traffic signals at junctions. Such a behavior is extremely dangerous and a main cause of occurring traffic congestion. The vehicles ignoring signal in a beginning part of red indication after the yellow will block the traffic movements in the crossing direction.
- 3) Ignoring pedestrians
- Most drivers seem to ignore pedestrians on roadways, even on pedestrian crossings. They do not seem to understand that pedestrians have the right of way over vehicle traffic, and the need for vehicles to give way to pedestrians in order to protect them from traffic accident.
- 4) Parking in or near intersections
- 4-wheeler drivers are often observed to park randomly or stop their vehicles without much thought or consideration to other road users. Parking of vehicles in or near to an intersection is universally prohibited anywhere in the world. However, most Phnom Penh drivers ignore or do not understand this basic driving regulation. Uncontrolled parking actions can easily disrupt smooth traffic flow and endanger other road users.
 - Illegal parking and stopping at the entry or exit points of a junction must be strictly enforced. Double parking is also common whereby an entire road section may be crippled. Enforcement is particular needed on such behavior where it adversely affects traffic flow, particularly at traffic junctions
 - Parking on pedestrian sidewalks is rather common in Phnom Penh. Drivers seems to regard pedestrian sidewalks as convenient parking lots without thinking that they are taking away the safe walking space for the pedestrians. Such behavior should not be allowed.

5) Other behaviors of motorcycle drivers

- In Phnom Penh, motorcycles are both used as private transport and for business called motorlop (motorcycle taxi). In the latter case, more often than not, there would be more than 2 passengers including the driver on such vehicle. As many as 5 persons on one motorcycle can sometimes be observed.
- Motorcycles are more versatile in maneuvering various types of spaces besides the usual roadways such as pedestrian sidewalks or even spaces within the gasoline stands. They are often seen to take 'short-cuts' by diverting to such areas or passages just to get ahead of the traffic. Once a certain motorcycle finds a 'short-cut', the others behind him seem to follow. Such a phenomenon is very common in Phnom Penh.
- It is not compulsory by law to put on the protective helmet when driving, and very few motorcyclists use them.
- Many motorcyclists wear sandals when driving and it is particularly dangerous for females wearing high heel sandals to drive motorcycles.
- Some motorcyclists do not switch on the headlights when driving at night.

(2) Existing Enforcement Methods

Examining the existing enforcement method, some issues of traffic enforcement will be taken into account when formulating the proposed measures.

1) Enforcement setup and equipment

Traffic rules enforcement is carried out by the municipal traffic police force. There are about 500 persons under this force.

Equipment available to this setup for traffic rules enforcement includes :

- 20 white police motorcycles equipped with microphones,
- Microphones installed at 5 major intersections along Blvd.Monivong.

However, there is no such equipment as speed measuring devices, breath testing device for alcohol, etc. which are essential for traffic enforcement particularly on speeding and drunken driving.

2) Enforcement methods

Three common methods in enforcement are practiced in Phnom Penh.

- Policemen are stationed at the major intersections along major roads. Vehicles violating the traffic rules are stopped and they are reprimanded for their illegal behavior or violations. They are told on the correct behavior and safe driving methods.
- White police motorcycles are used to patrol the roads. When any violation by vehicle is spotted, the driver is reprimanded for their actions and instructed on the proper behavior.
- When congestion or an accident occurs, the police will take over the control of the traffic until it returns to normal.

3) Penalties

No penalties have been enforced. Fines are not collected from drivers by the municipal government or police. Drivers are only instructed on the proper driving manners by traffic policemen.

Plan to impose fines on errant drivers from 2000 is underway. Two types of traffic violation tickets are being prepared which will be given out to errant drivers depending on their severity of violations.

2.5.3 Offering Concrete Suggestions on Traffic Enforcement

Issues focusing on drivers in Phnom Penh City were extracted based on characteristic of traffic accidents, driving behavior, and the current condition of traffic regulation and enforcement. In this section, urgent remedial measures based on the analysis so far are suggested.

In proposing such measures, the current manpower of the traffic police in Phnom Penh City is also considered and priority enforcement is emphasized rather than trying to strengthen all the enforcement practices.

(1) Strengthening of driving instruction for illegal drivers

1) Points for enhancement and improvement

It is unrealistic to expect immediate results by stepping up traffic enforcement on illegal driving now, considering the drivers' habits.

Thus, it is suggested that a grace period of about one year for enforcement will be set up with a focus on providing instructions on proper driving during this period.

2) Selection of target routes and intersections

It is suggested that arterial roads in the city center be chosen as target points for carrying out enforcement on driving instructions because vehicles are observed to reduce their speed due to congestion and there are many traffic accidents around there.

More specifically, Blvd. Monivong radial road and Blvd. Sihanouk radial road can be the model routes, and about two intersections from each radial road may be identified for such purpose.

3) Providing advance publicity activities

Advance publicity activities are required to let the public notice which routes will be a target of driving instruction. And it is necessary that the activities comprise the following components, that is, the reason of determining the model routes, importance of correct driving and dangerous driving behaviors. And the publicity activities should also emphasize on the importance of using pedestrian crossings and observing signals for pedestrians at the same time in order to maintain safety.

4) Publicity activities media

Such mass media as TV, radio, newspaper, letter from school to pupils and students, and banner can be used as media and they can make a broad appeal to the public. Especially, a large advertising display or a banner should be placed before the target intersection and indicate clearly that the intersection is the driving instruction model intersection.

5) Method of instructing

About 8 to 12 traffic police officers are to be stationed at an intersection and carry out the instructions. The objective is not to punish illegal driving but to provide instructions on proper driving manners. So, all the police officers are required to stop dangerous drivers, introduce the object of the instruction campaign and provide handbill or sticker showing proper driving behaviors.

6) Selection of regulations and enforcement

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 the rules. This method of selective enforcement provides more impressions to drivers and is easier for the enforcement officers to conduct their duties.

In selecting the regulations to be enforced, violations or causes of traffic accidents that are most frequently occurred can be listed up based on analyses of traffic accidents and then given priority. Those with high priority will then be selected for enforcement.

In this manner, more effective results can be achieved by the enforcement efforts. Moreover, with such selective enforcement, there is a better chance to reduce traffic accidents at a faster rate. Furthermore, drivers will be able to receive a more effective traffic safety education.

The selective enforcement based on site observations and the survey data are as follows:

- Driving on the opposing roadway
- Drunken driving
- Ignoring traffic signal
- Ignoring pedestrians on crossing walk
- Parking in or near to intersections

(2) Strengthening illegal parking enforcement and disclosure of model intersection

1) Points of enforcement and improvement

Parking ban can be set up at road sections where parking vehicles obstruct traffic flow. However, if the enforcement can not be carried out accurately, the law will exist only in name. Especially, illegal parking around intersections adversely affects traffic safety and road efficiency in the city. Thus enforcement at intersections must be emphasized.

2) Extracting target intersections

It is impossible to carry out enforcement at all intersections in the city, thus, it is suggested to select several intersections as model.

In selecting a model intersection, existing signalized intersection will be chosen in the first stage. The number of model intersections to be chosen should be determined taking into considerations on the number of police officers to be involved in the campaign. 5 or 6 intersections in the center of the city are manageable as the model intersections.

3) Installing “Parking enforcement group”

In carrying out the enforcement, it is preferable to install “Parking enforcement group” in the traffic police. A group comprises about 2 or 3 traffic police officers and 2 or 3 groups will be responsible for one model intersection. Enforcement is performed mainly in the day times and the group responsible shall carry out patrol enforcement.

4) Disclosure of model intersection

The enforcement will not be carried out without advance notice and making the information public in advance, such as target intersections, date and hour through various mass media. The disclosure is to be carried out 5 or 6 months in advance before actual enforcement. Warnings and instructing on errant drivers should be emphasized during such period rather than punishment.

Introducing such publicity contributes not only to reduce parking vehicles but also recognition on the prevention of parking around intersection by the general drivers.

5) Warning methods

After the grace period of warning and instructing, enforcement will then be put into operation.

One of the effective ways to warn illegal parking driver is that by the use of parking ticket (impressive collar, made of large vinyl), by fixing it to the side mirror with a lock. And after the driver reports to the central traffic police office or a district traffic office and pay the penalty established by law, the lock is unhooked.

(3) Maintenance and plenitude of enforcement facilities

1) Maintenance and plenitude of facilities

It needs to be discussed urgently to maintain enforcement facilities and make them complete at Phnom Penh central traffic police. Both of quantity and quality of facilities are lacking. Especially, the followings are preferable to reduce congestion accident. Quantity is estimated as a rough standard considering number of vehicles passing Phnom Penh City.

2) Types of facilities

- Communication phones between police officers on site
- Microphones installed at major intersections for drivers’ and pedestrians’ guidance
- Respiratory alcohol detector
- Speed enforcement facility

(4) Introducing a penalty system for violating traffic rule

Introducing a penalty system for violating traffic rule is really required in Phnom Penh City. The introduction of the system may face some problems; for example, the penalty delivered to the traffic office is less than those issued due to difficulty in collecting penalty.

However, the system aims are not just the collection of penalty in a complete way but also to achieve several other merits such as on driving operation, that is, eliminating dangerous drivers, creating good drivers, selecting companies to receive instructions.

Figure 2.5.1 shows an example of a system for traffic violation enforcement penalty.

An object of the system in future is that registering each driver's license and central control of traffic violation record by computer.

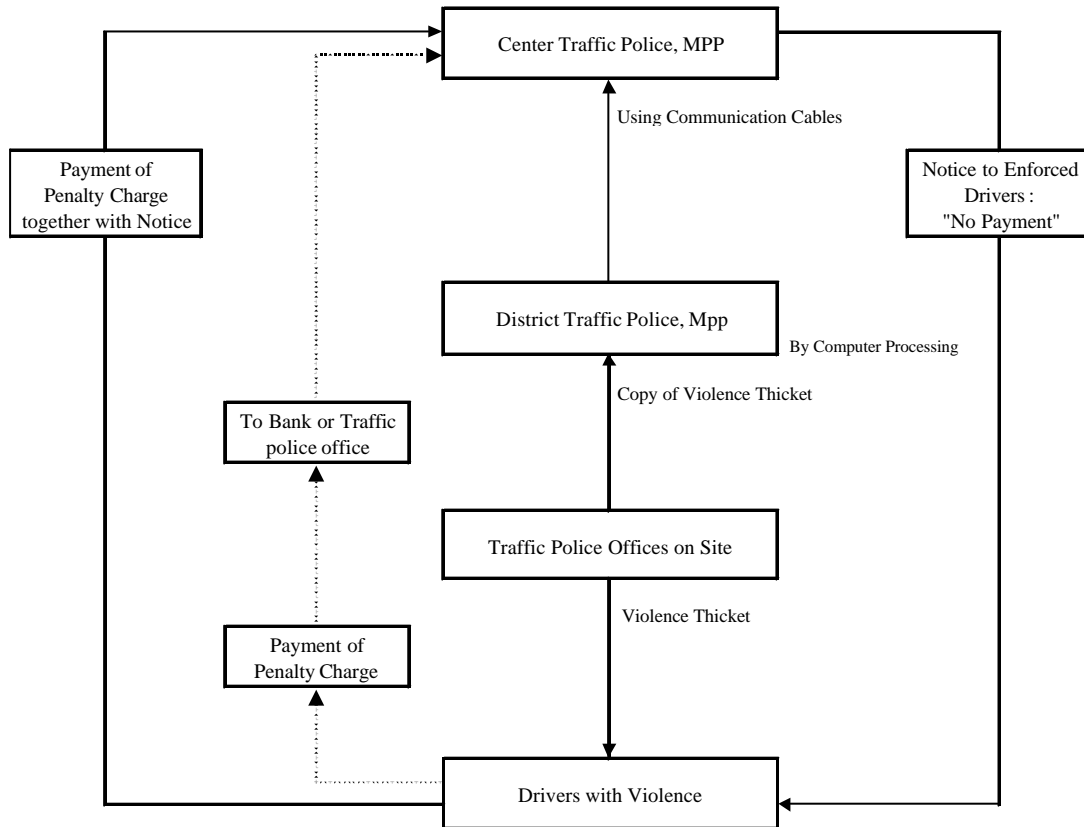


Figure 2.5.1: An Example of a System for Traffic Violation Enforcement

(5) Discussion on how to keep finance resources

An appropriate finance resource is required to fund activities on traffic safety recognition by the public and strengthening traffic violation enforcement. This issue must be well discussed among the related agencies.

The most preferable way for maintaining a finance related to traffic safety education is that some portions of the traffic penalty collection be allocated as funds for the traffic safety activities.

2.5.3 Expect in the Future

With the present conditions of road development, much of the present errant driving behavior may not seem to be serious in affecting traffic flow and a cause for accident and congestion. However, as roads in the city improve in the near future and traffic demand increases, such a behavior will undoubtedly become a major cause of traffic confusion and eventually accidents and chronic congestion.

Now it's the time to try to get rid of this unwanted driving habit by strengthening traffic enforcement to improve the drivers' driving manners and perceptions. If such habit is left unchecked, serious accidents and severe traffic congestion can be expected in the near future.

2.6 Staging Plan and Preliminary Cost estimate

Several traffic management issues such as unsatisfactory traffic engineering practices, traffic safety, traffic enforcement and parking facility planning, were discussed and examined in details in this study. Remedial measures for these issues are of immediate applicability and importance and are feasible for implementation in the short term. These measures do not include large and high-cost projects such as new construction of roads or railways. The city of Phnom Penh would be able to afford the implementation of such measures from its operational budget as they are relatively low cost.

2.6.1 Timing for Implementing the Plan

Remedial measures suggested by the Study Team are divided roughly into two categories based on their different fund requirements.

The first category includes such contents as traffic management, road maintenance management, traffic safety education, and traffic enforcement, which are necessary to be implemented regularly and continuously and thus requires definite annual appropriation. The other category is for traffic signal control improvement, traffic accident analysis system, installing parking facilities, and thus requires procuring of the necessary equipment or materials.

The cost for the latter category can be further divided into two types, that is, the cost for formulating the system or procuring equipment and annual operating cost. Measures from both categories are possible to be implemented simultaneously since they can be carried out with relatively low cost. However, if this is not possible, then some measures such as construction of parking facility and also system formulation or procuring equipment and materials for the latter category may be postponed to the next stage depending on the availability of budgets.

The plan suggested in this study has carefully considered the urgency and importance of all the measures. These measures are then phased out into three 5 year plans depending on their feasibility as shown in Table 2.6.1.

Table 2.6.1: Staging Implementation Plan

Proposed Countermeasures		2001 - 2005	2006 - 2010	2011 - 2015
TM-1	Traffic Signal System			
	1-1 Improvement of Traffic Signs	—	—	—
	1-2 Traffic Signal System	—	—	—
TM-2	Accident Analysis System	—		
TM-3	Parking Facilities			
	3-1 Construction of Off-Street Parking Facilities (Private Sector)	—		—
	3-2 Installation of On-Street Parking Lots	—	—	
TM-4	Enforcement Equipment	—		
TM-5	Enforcement Capacity and Penalty System (Nationalwide measure)		—	
TM-6	Public Education			
	6-1 Implementation of Traffic Safety Campaign	—	—	—
	6-2 Training of Instruction for Traffic Safety	—		
	6-3 School Education and Curriculum	—		
	6-4 Patrol System for Traffic Safety Education	—	—	
	6-5 Traffic Park	—		

2.6.2 Staging Plan and Basic Conditions for Preliminary Cost Estimate

This section deals with staging plans and a preliminary cost estimate for implementing traffic management plan proposed by this study. The preliminary cost of each countermeasure is estimated using 2000 as the base year cost under the staging plans and the following basic conditions.

(1) Traffic Engineering

1) Improvements of road and traffic operation

- Cost of road improvement, flood mitigation measures and geometric improvements
The costs of road improvement, flood mitigation measures and geometric improvements are dealt with in Chapter 13 of Main Report.
- Pavement markings
Pavement markings are consumables so that they should be regularly replaced and always maintained in good conditions. The cost of pavement markings on all the roads in Phnom Penh is estimated under the assumption of:
 - installing pavement markings regularly every 2 years for major arterial and collector roads and every 3 years for local streets,
 - using unit cost per road length (meter) for major arterial road, collectors and local streets.
- Traffic signs
The cost for this item is estimated under the assumption that 2 regulatory signs are installed at each intersection and the number of intersections is computed based on road length.

2) Traffic signal system

The cost of this item is estimated for requirements in 2 stages,: Stage 1 and Stage 2.

- in Stage 1 (from 2001 to 2005), 33 intersections will be operated under isolated signal control
- in Stage 2 (from 2006 to 2010), 58 intersections will be signalized under progressive control along 5 routes.
- in Stage 3 (from 2011 to 2015), approximately 117 intersections will be centrally and remotely operated from a traffic control center.

3) Provision of accident database and analysis system

This system should be provided immediately. No traffic management plan can be made without traffic accident data.

The cost consisted of system design cost, equipment cost including installation, cost of development of software and operation cost. However such personnel costs as traffic engineers, traffic policemen, maintenance and operators to operate the system after the completion of the system is not included in the estimation.

(2) Construction of Parking Facilities

Necessity of parking facilities is different depending on each zone and thus construction of parking facilities should be implemented with appropriate timings.

The cost is estimated under the assumption of constructing exclusive parking buildings for vehicles which can not be parked in the destination zone, and the size of a parking building is about 30 meters by about 50 meters with 5 floors in which 250 vehicles can be accommodated.

(3) Traffic Safety and Education

The suggested countermeasures regarding traffic safety education should be carried out at least once a year. It is suggested that trainings for school teachers should be held twice a year.

The costs of countermeasures regarding traffic safety education mainly comprised of personnel costs such as traffic engineers, traffic policemen, school teachers, public participants and others, but they are not included in this estimate, because these are factors which have to be decided by the Phnom Penh City when

carrying out the countermeasures.

Thus, this estimate only discussed on the various direct costs of the following countermeasures:

- 1) Implementation of Traffic Safety Campaign
- 2) Training of Instructors for Traffic Safety
- 3) School education and curriculum
- 4) Establish of patrol system for traffic safety education
- 5) Provision of traffic park for school children

(4) Traffic Enforcement

In the same manner, the enforcement costs are also mainly personnel costs of traffic policemen and their assistants, but they are not included in this estimate. Thus, this estimate only discussed on the direct costs of the following items:

- 1) Strengthening of enforcement on traffic rule violations
- 2) Provision of enforcement equipment
- 3) Introduction of penalty system

2.6.3 Estimation of Project Cost by 5 Year Periods

Table 2.6.2 shows the total estimated project cost for each work by every five years until 2015. In the total cost item, road improvement costs are excluded. Personnel cost of traffic education and enforcement are also excluded.

The following measures are not included directly in works which the Phnom Penh City implements.

- Construction of off-street parking facility (will be carried out by private sectors)
- Establish of penalty system for driving violators (will be carried out by nationwide)

The table indicates that the first five year period from 2001 to 2005 requires \$4.5 millions, the second five year period from 2006 to 2010, \$ 3.0 millions, and the last from 2011 to 2015, \$7.7 millions, which amounts to a total of \$15.3 millions in 15 years. The cost of the signal system occupies about 84% of the total cost.

Table 2.6.2: Cost of Implementing Plans in each Five Years

Proposed Countermeasures		Cost (\$1,000)			
		2001-2005	2005-2010	2010-2015	Total
TM-1	Traffic Signal System				
	1-1 Improvement of Traffic Signs	50	62	59	171
	1-2 Traffic Signal System	2,782	2,529	7,418	12,729
	Sub-total	2,832	2,591	7,477	12,900
TM-2	Accident Analysis System	527	0	0	527
TM-3	Parking Facilities				
	3-1 Construction of Off-Street Parking Facilities (Private Sector)	(8,810)	0	(1,224)	(10,034)
	3-2 Installation of On-street Parking Lots	100	100	0	200
	Sub-total	8,910	100	1,224	10,234
TM-4	Enforcement Equipment	500	0	0	500
TM-5	Enforcement Capacity and Penalty System (Nationwide measures)	0	(3,000)	0	(3,000)
TM-6	Public Education				
	6-1 Implementation of Traffic Safety Campaign	191	191	191	573
	6-2 Training of Instruction for Traffic Safety	24	24	24	72
	6-3 School Education and Curriculum	52	52	52	156
	6-4 Patrol System for Traffic Safety Education	116	58	0	174
	6-5 Traffic Park	200	0	0	200
	Sub-total	583	325	267	1,175
Total including Private Sector and Nationwide Measures		13,352	6,016	8,968	28,336
Total excluding Private Sector and Nationwide Measures		4,542	3,016	7,744	15,302