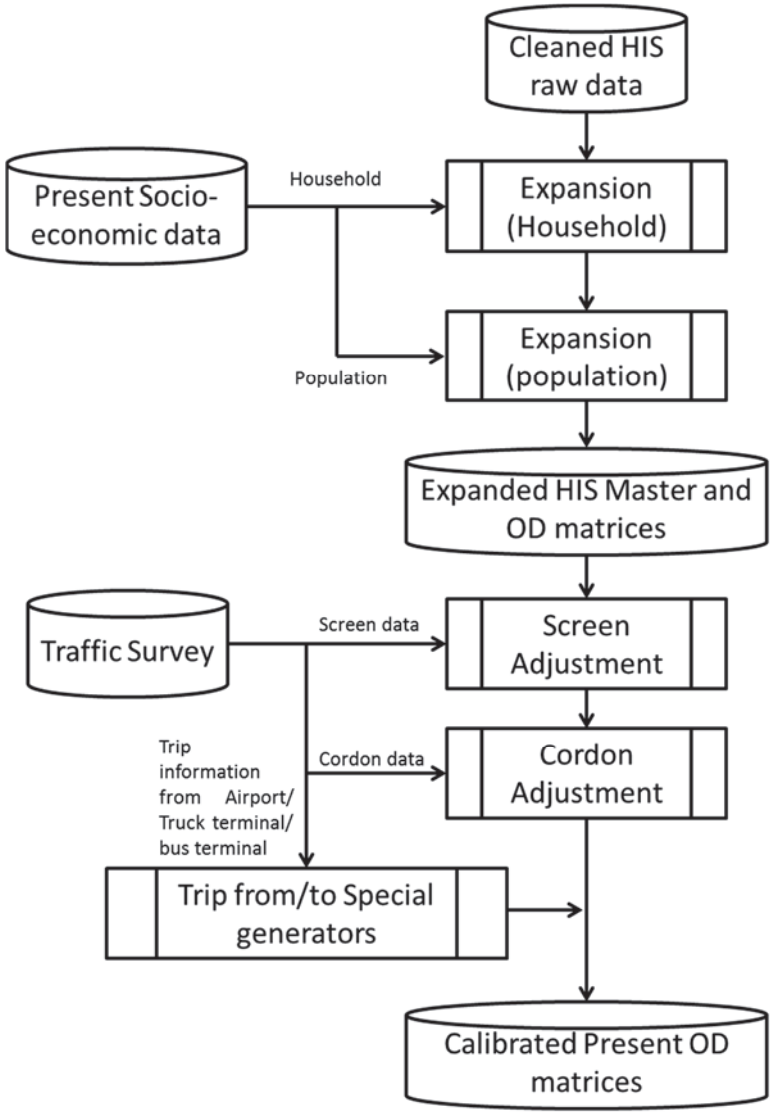
2 TRANSPORT DEMAND FORECAST

2.1 Preparation of Present Origin/ Destination Trip Matrices

The current (present) O/D trip matrices were derived from variety of survey data collected during 2013 in the YUTRA study area. The major Household Interview Surveys (HIS) master file was prepared and validated based on a series of screenline surveys in the study area. This was the major source for study area internal-internal trips. Trips to/ from external to the study area were estimated form the cordon Roadside Interview Surveys (RIS), and added the internal trips. In addition, surveys were also conducted at Bus termini, airport, truck terminal, and at key ferry ports and railway stations. The process is complex and iterative. The complete process and the use of various transport and traffic surveys at various stages of the trip matrices development is given in .Figure 2.1.1.



Source: YUTRA Project Team

Figure 2.1.1 Procedure for the Development of Current OD Matrices

2.2 Study Area Zone System

The study area 39 townships were divided into 156 internal zones as shown in Figure 2.2.1. In addition, there are 4 zones which represent special trip generation areas representing: truck, and bus termini and Yangon International Airport. These referred to as special generator zones. Areas outside the YUTRA, are represented by 27 external zones numbered from 161~187. The summary of zone system is summarised in Table 2.2.1 and a complete list is given in Appendix 2.

Source: YUTRA Project Team

Figure 2.2.1 YUTRA Study Area Zone Internal and Special Generator Zone System

Table 2.2.1 Summary of Zone System

Area Description		No. of zones
Internal zone	CBD	17
	Inner Urban Ring	29
	Outer Ring	15
	Northern Suburbs	13
	Older Suburbs	10
	South of CBD	9
	New Suburbs	37
	Periphery Area	26
Special generator zone	Airport (Zone 77)	1
	Bus termini (Zones 71 & 108)	2
	Truck terminal (Zone 63)	1
External zones (additional 13 townships, and rest of Myanmar)		27
	Total	187

Source: YUTRA Project Team

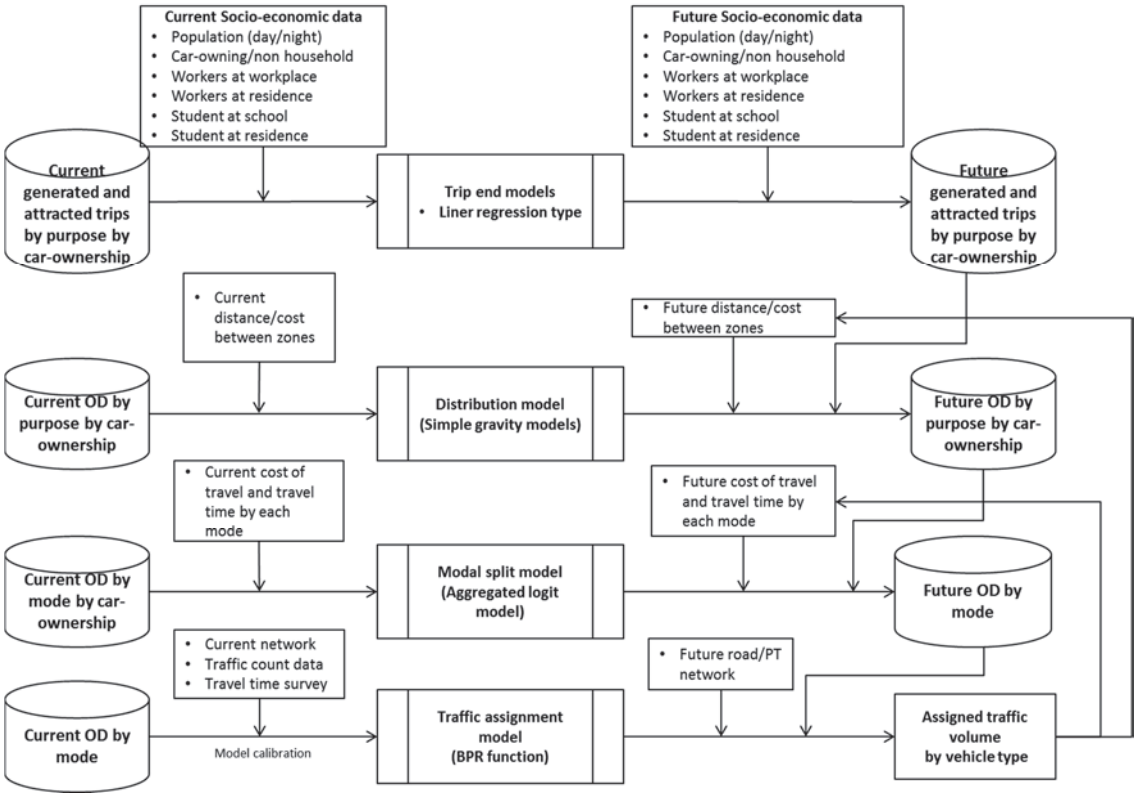
2.3 Transport Demand Models

2.3.1 Introduction

The travel demand model for Yangon was developed based on the conventional four-stage demand forecast process. The key consideration in the development of the forecast model was that it should be reflective of current low car ownership, but also be able to take account of the recent 'fast' pace of growth in car ownership. In, addition, it should be responsive to the future growth of the city anticipated to double in population by 2035, with additional population satellite sub-centres and industrial zones proposed around the currently urbanised areas.

It was also noted that the current mode share of public transport share is healthy 60+% in the study area. The Government of Myanmar policy is to retain at least the same share of public transport through the rehabilitation of the current Myanmar commuter, suburban, and intercity rail line and also complement the upgraded railways with additional rail and road based mass transit system. The model thus developed is to be responsive to forecast patronage on the future road and rail system to assess their viability and implementation plan.

The outline steps of the 4-stage demand forecast modelling procedures and flow of data is briefly illustrated in Figure 2.3.1.



Source: YUTRA Project Team

Figure 2.3.1 Travel Demand Forecast Procedure

2.3.2 Trip End Models

The trip end models were using liner regression techniques. Separate models were developed for car available and non-car available person trip generation, and single trip attraction model for each purpose irrespective of car availability. The main reason is that trip generation rates vary by vehicle availability, and this approach would yield appropriate responsive result to the rapidly increasing car ownership.

Five trip purposes were modelled by aggregating some of the trip purposes for which insufficient data was available: These are

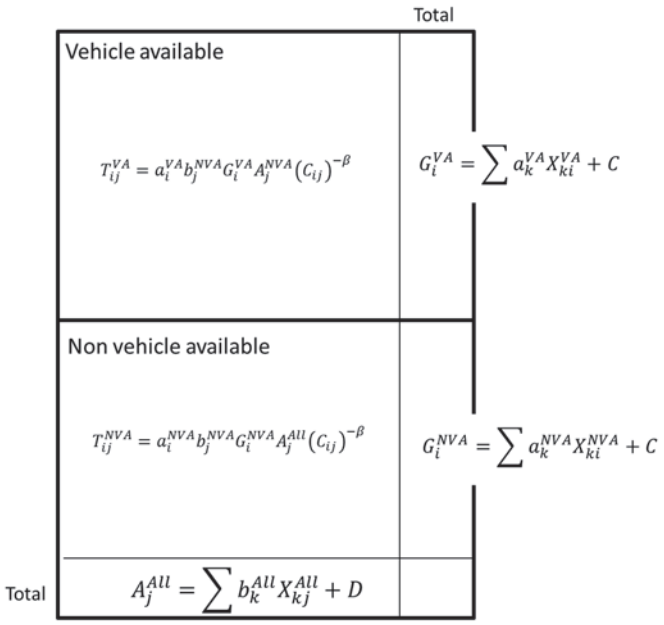
1. Home to work (typical journey from home to work) -
2. Home to school (trips to school or for higher education)
3. Home to other (trips including shopping, leisure, pickup / drop off);
4. Return to home; and
5. Non Home based trips (including business trips).

The general form of the 10 trip generation and five trip attraction models, and how these were adopted for the next-stage (trip distribution) was adopted is illustrated in Figure 2.3.2 and Figure 2.3.3. It should be noted that the in the case of to-home trips, the generation and attraction are transposed, as it is the home-end where vehicle availability is applied, instead at the trip origin.

	Vehicle available	Non vehicle available	Total
	$T_{ij}^{VA} = a_i^{VA} b_j^{NVA} G_i^{VA} A_j^{NVA} (C_{ij})^{-\beta}$	$T_{ij}^{NVA} = a_i^{NVA} b_j^{NVA} G_i^{NVA} A_j^{All} (C_{ij})^{-\beta}$	$G_i^{All} = \sum a_k^{All} X_{ki}^{All} + C$
Total	$A_j^{VA} = \sum b_k^{VA} X_{kj}^{VA} + D$	$A_j^{NVA} = \sum b_k^{NVA} X_{kj}^{NVA} + D$	

Source: YUTRA Project Team

Figure 2.3.2 Structure of The Trip End Model and Distribution Model for to home



Source: YUTRA Project Team

Figure 2.3.3 Structure of The Trip End Model and Distribution Model for: to Work, to School, to Other and Non-Home-Base (NHB) Trips

The equations for each purpose are detailed below.

<u>To home</u>

Generation $\mathrm{G_i^{All}} = \sum \mathrm{a_k^{All} X_{ki}^{All}} + \mathrm{C}$

Attraction (Vehicle available) $A_j^{VA} = \sum b_k^{VA} X_{kj}^{VA} + D$

(Non-vehicle available) $\mathrm{A_j^{NVA}} = \sum \mathrm{b_k^{NVA} X_{kj}^{NVA}} + \mathrm{D}$

<u>To work, To school, To other and non-home-base</u>

Generation (Vehicle available) $G_i^{VA} = \sum a_k^{VA} X_{ki}^{VA} + C$

(Non vehicle available) $G_i^{NVA} = \sum a_k^{NVA} X_{ki}^{NVA} + C$

Attraction $A_j^{All} = \sum b_k^{All} X_{kj}^{All} + D$

Where, X_{ki} : Explanatory Variable of Zone i

a_k, b_k : Parameter

The explanatory variables were selected, and then the parameters were estimated by linear regression analysis. The selected explanatory variables and best estimated parameters are given in Table 2.3.1. The observed and modelled numbers of trips by each trip purpose are compared in Table 2.3.2. The table reflects the errors in modelling, in most cases it is under 10%. The aggregate (by vehicle available + non-vehicle available) trip generation estimate was used as the final control total for each of the five trip purpose.

The models are calibrated using 2013 household interview survey data and person and the corresponding planning data variables.

Table 2.3.1 Trip end model -Parameters

Purpose	G/A	Explanatory Variable	Parameter	T-Value	Correlation Coefficient
To Home	Origin	Day time population	0.379	14.1	0.74
	VA Destination	Car available population	0.586	53.6	0.97
	NVA Destination	Non car available population	0.354	43.9	0.96
To Work	VA Generation	Car available workers at resident place	0.358	25.5	0.89
	NVA Generation	Non car available workers at resident place	0.364	31.6	0.93
	Attraction	Total workers at work place	0.360	12.1	0.69
To School	VA Generation	Car available students at resident place	0.802	24.7	0.89
	NVA Available Generation	Non car available students at resident place	0.320	20.6	0.85
	Attraction	Students at School Place	0.370	10.0	0.62
To other	VA Generation	Car available others at resident place	0.736	28.3	0.91
	NVA Generation	Non car available others at resident place	0.357	21.7	0.87
	Attraction	Day time population	0.140	10.8	0.65
Non-home-base	VA Generation	Car available population	0.226	27.1	0.91
	NVA Generation	Non car available population	0.089	25.9	0.90
	Attraction	Day time population	0.104	12.4	0.70

Source: YUTRA Project Team

Table 2.3.2 2013 Observed and Modelled Trips by Trip Purpose

Purpose	Vehicle Ownership	Observed	Modelled	M/O
To Home	Origin	2,176,965	1,701,968	1.28
	VA Destination	385,329	389,548	0.99
	NVA Destination	1,791,636	1,725,467	1.04
To Work	VA Generation	109,314	102,771	1.06
	NVA Generation	813,621	745,439	1.09
	Attraction	922,937	655,614	1.41
To School	VA Generation	97,258	94,096	1.03
	NVA Available-Generation	333,507	282,087	1.18
	Attraction	430,766	365,441	1.18
To other	VA Generation	169,484	145,637	1.16

Purpose	Vehicle Ownership	Observed	Modelled	M/O
	NVA Generation	635,933	505,826	1.26
	Attraction	805,420	596,719	1.35
Non-home-base	VA Generation	148,397	141,521	1.05
	NVA Generation	451,096	390,448	1.16
	Attraction	599,493	457,143	1.31

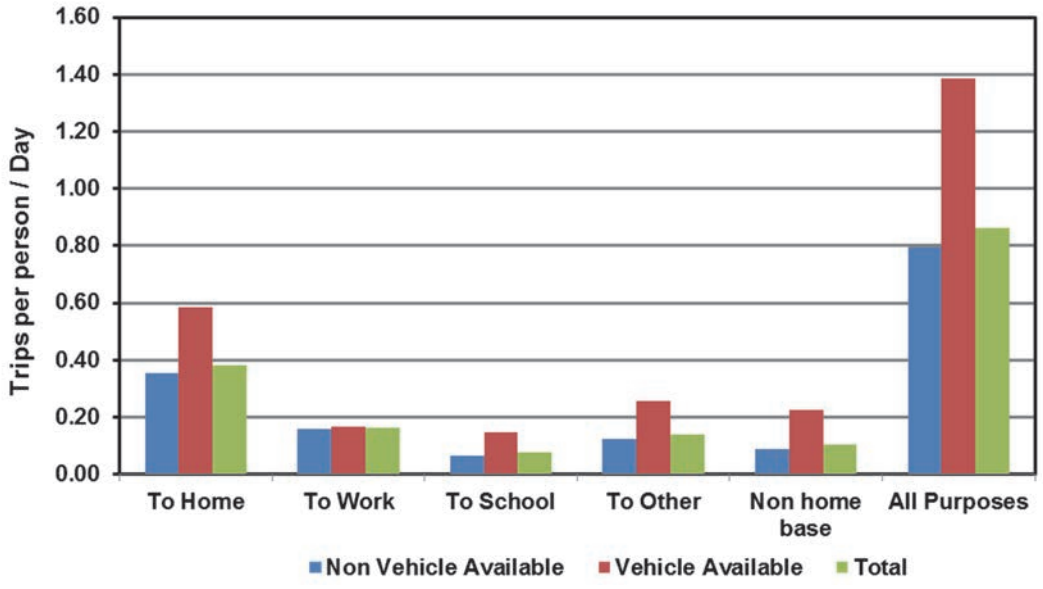
Source: YUTRA Project Team

Trips production rates generally increase with vehicle ownership category, and differ by trip purpose. The observed trips by household group and trip purposes are given in Table 2.3.3 and Figure 2.3.4.

Table 2.3.3 YUTRA Person Trip Rates by Household Group, and by Trip Purpose, 2013

Mode	Trip Purpose					
	To Home	To Work	To School	To Other	Non-home-base	All Purposes
No Vehicle Available	0.35	0.16	0.07	0.13	0.09	0.80
Vehicle Available	0.59	0.17	0.15	0.26	0.23	1.38
All Groups	0.38	0.16	0.08	0.14	0.10	0.86

Source: YUTRA Project Team



Source: YUTRA Project Team

Figure 2.3.4 YUTRA Person Trip Rates by Vehicle Availability, and by Trip Purpose, 2013

2.3.3 Trip Distribution Models

Simple doubly constrained gravity models were developed for simultaneous distribution of each of the household (car available (VA) and non-car available (NVA) categories) to a single category of attractions. The models were for all mechanized modes of travel (combined). The zone-to-zone generalised (including fares, tolls, vehicle operating cost etc) travel cost was used as impedance to travel. The general form of the models and its application is illustrated mathematically in the following equations.

Trips from i to j (Vehicle available) $T_{ij}^{VA} = a_i^{VA} b_j^{VA} G_i^{VA} A_j^{All} \left(C_{ij}\right)^{-\beta}$

Trips from i to j (Non vehicle available) $T_{ij}^{NVA} = a_i^{NVA} b_j^{NVA} G_i^{NVA} A_j^{All} \left(C_{ij}\right)^{-\beta}$

Where, G_i : Total trip generations in zone I;

A_j : Total trip attractions in zone j;

β: calibration parameter for each purpose and and vehicle availability group;

a &b balancing factors estimated through iterative process such that attractions= generations (VA + NVA)

C_{ij} : Impedance between zones i & j

The above process is used for the estimation of all Tij (for all trips where i≠j, and for i=j separate parameter 'α' was calibrated as the cost Cii, could not be estimated from the limited mechanised Tii trips observed in the HIS surveys. The following Table 2.3.4 summarises the calibrated parameters of all five trip distribution models.

Table 2.3.4 YUTRA Person Trip Rates by Household Vehicle Ownership Group and by Trip Purpose, 2013

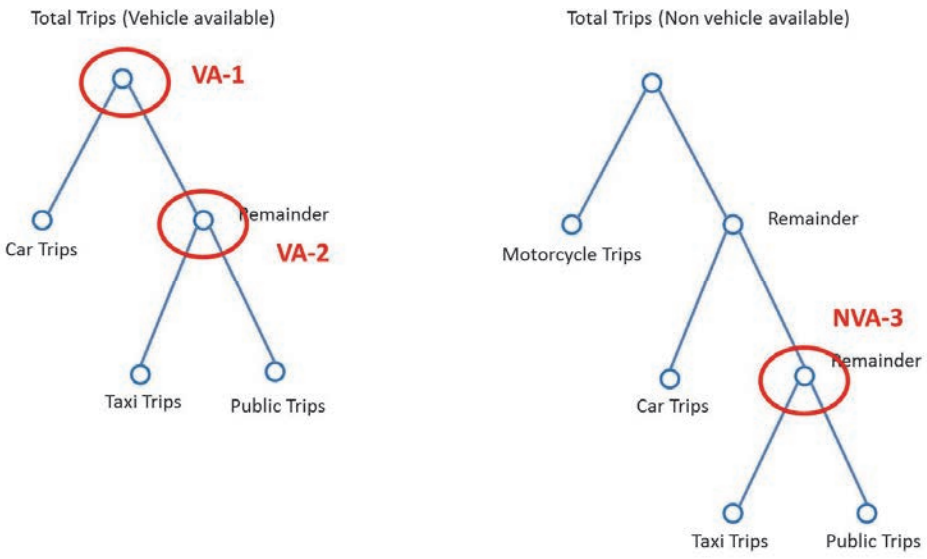
Trip Purpose	Vehicle Availability	Calibrated α and β		Average Trip Length (GC)	
		α	β	Observed	Modelled
to Home	Vehicle Available	2.55	-0.140	894	900
	Non-vehicle Available	1.95	-0.250	694	690
to Work	Vehicle Available	2.38	-0.120	964	971
	Non-vehicle Available	1.65	-0.230	740	734
to School	Vehicle Available	2.10	-0.195	869	862
	Non-vehicle Available	2.80	-0.300	634	624
to Other	Vehicle Available	2.05	-0.130	896	908
	Non-vehicle Available	2.10	-0.250	650	648
Non Home Base	Vehicle Available	2.03	-0.150	776	785
	Non-vehicle Available	1.95	-0.240	630	624

Source: YUTRA Project Team

The table demonstrates that the distribution models applied fit well for the Yangon environment and with such variation in the cost of travel – the gravity model fit achieved is excellent.

2.3.4 Modal Split Models

The modal split model structure is shown in Figure 2.3.5. The constructed modal sprit model was divided for car available person and non-vehicle available person. These modal split models are two and three steps hierarchical model respectively. The split model to motorcycle and car in the model for non-vehicle available person were adopted the current share because their shares are low. Therefore three modal split equations, VA-1, VA-2 and VA-3 in Figure 2.3.5 were constructed. The difference of travel cost and travel time that were calculated from network model were adopted as the explanatory variables.



Source: YUTRA Project Team

Figure 2.3.5 Modal Sprit Model Structures

Modal share of mode A $P_A = \frac{e^{V_A}}{1+e^{V_A}}$

$$v_A = \alpha(c_A - c_B) + \beta(t_A - t_B) = \log(\frac{P_A}{1 - P_A})$$

Where, c: Travel cost

T: Travel time

The parameters were estimated for each split by using current modal share data of the selected zone pairs that has all modal choice. The parameters for the modal split model are shown in Table 2.3.5.

Table 2.3.5 Parameters for Modal Split Model

Model	Parameters	T value	R^2
VA-1	0.250003	21.40666	0.860
	0.000642	12.45704	
VA-2	0.09049	19.63378	0.834
	0.003914	9.538442	
NVA-3	0.070407	78.47914	0.869
	0.000883	6.02403	

Source: YUTRA Project Team

2.3.5 Walk and Bicycle Trips

The study area walk and bicycle trips were included in the demand model. Their forecast is based on increase in non-vehicle available trips. In the forecast years these as the transport infrastructure develops, their growth will be limited. The future year forecast trips are presented in YUTRA report Volume I, Chapter 3.

2.3.6 External Trips

YUTRA study area through trips, and internal-external trips by mode were modelled using simple growth factor techniques. The Pick-up truck trips were expected to grow in line with growth in GRDP/Capita; as these trips relate to the study population and economic growth. These trips are then added to the study area internal-internal modelled trips to form the total trip matrix by each vehicle type.

2.3.7 Goods Vehicle Trips

Pick-up truck type goods vehicle demand was based on overall growth in GRDP/capita. As such vehicle type are mostly used for distribution of small goods in the study area related to population. The growth in heavy vehicles tends to follow the over economic growth patterns of an area. Therefore, the future year heavy goods vehicle trips were forecast to grow at the same rate as the YUTRA area GRDP growth.

2.3.8 Traffic Assignment Model

At this stage each main modes of travel were assigned to its representative network e.g. private to car/ taxi and public to transit mode. The assignment of Para-transit was also considered. Goods vehicle trips was modelled as previous section and included in the assignment model as a pre-load. As traffic assignment model the user equilibrium assignment was adopted. The BPR function which was used in user equilibrium assignment was shown below. The parameters for BPR function, αand β were applied 3.0 and 4.0 respectively. Figure 2.3.6 shows the speed curve in case of these parameters.

BPR function $t = t_0 \left\{1 + \alpha \left(\frac{X}{C}\right)^{\beta}\right\}$

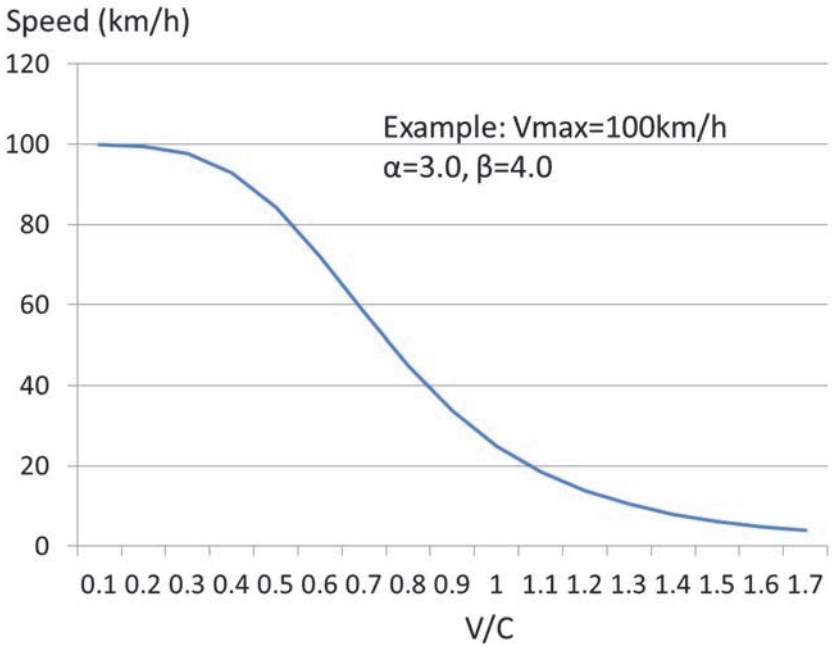
Where, t : Travel time

t_0 : Free flow time

X : Traffic volume

C : Road capacity

α, β : Parameter ($\alpha = 3.0, \beta = 4.0$)



Source: YUTRA Project Team

Figure 2.3.6 Volume Delay Function used Curve

In this stage, all trips should be converted to Passenger Car Unit (PCU). The vehicle occupancy and PCU factor are given in Table 2.3.6. The vehicle occupancy factors are average of observed number from several traffic surveys. The PCU factors are universal, and commonly used.

Table 2.3.6 Vehicle Occupancy and PCU Factors

Vehicle Type	Occupancy	PCU Factor
Bicycle	1.14	0.20
Motorcycle	1.76	0.25
Car including Vans	2.55	1.00
Taxi (Excluding driver)	2.46	1.00
Standard Bus	40.0	1.75
Pickup Truck	-	1.50
2-Axle Truck	-	1.75
3+Axle truck	-	2.00
Truck Trailer	-	2.50
Other Commercial Vehicles	-	1.75

Source: YUTRA Project Team

2.3.9 Value of Time

The value of time was used in the stage of distribution and traffic assignment. In this study the values of time each mode user were calculated from the personal income. The personal income was collected by the house hold interview survey that was carried out by YUTRA. Table 2.3.7 shows the observed personal income by mode user and the calculation of the value of time. The value of time for the forecast year was appreciated in line with growth in GRDP per capita from 2013 to the request year.

Table 2.3.7 Calculation of VoT from Personal Income

Monthly Income of Business Trip Makers (HIS Survey)			1	2	3	4	5	6	All Modes
			Bicycle	**M/cycle**	**Car & Van**	**Taxi**	**Public Bus**	**Goods Vehs**	
1	No income (voluntary work)	-	4,883	923	4,412	3,475	15,521	513	29,727
2	Below 25,000	12,500	1,673	587	468	253	3,657	-	6,637
3	25,000-50,000	37,500	5,304	4,560	1,214	2,183	14,478	1,205	28,944
4	50,001-75,000	62,500	17,219	4,986	1,671	4,478	23,844	4,080	56,277
5	75,001-100,000	87,500	23,324	8,352	6,359	5,631	36,521	5,189	85,375
6	100,001-125,000	112,500	15,822	7,903	7,656	8,751	28,112	4,612	72,855
7	125,001-150,000	137,500	9,956	3,607	5,049	12,569	22,449	5,058	58,688
8	150,001-175,000	162,500	4,877	373	2,850	2,900	7,439	2,513	20,953
9	175,001-200,000	187,500	3,223	808	5,348	10,213	11,223	2,819	33,633
10	200,001-225,000	212,500	1,393	127	1,566	5,214	7,459	519	16,278
11	225,001-250,000	237,500	430	502	1,667	1,702	2,476	307	7,083
12	250,000-275,000	262,500	-	-	802	649	804	490	2,744
13	275,001-300,000	287,500	1,022	990	4,995	11,324	6,685	478	25,493
14	300,001-400,000	350,000	1,507	107	3,063	3,540	5,233	-	13,450
15	400,001-500,000	450,000	1,104	348	5,140	3,377	6,109	425	16,503
16	Above 500,000	750,000	857	225	7,926	3,046	1,561	146	13,762
17	Unknown	-	14,315	4,230	18,280	9,455	35,974	2,007	84,261
Total Observations			92,593	34,399	60,185	79,304	193,568	28,354	488,403
Average Monthly Income (Ks/Month)			110,608	104,982	256,517	200,974	128,606	128,935	**151,062**
VoT as 90% of Income, 176 Hrs /month (Ks/hr)			566	537	1,312	1,028	658	659	**772**
VoT (Ks/min)			9.4	8.9	21.9	17.1	11.0	11.0	**12.9**

Source: YUTRA Project Team

2.4 Transport Network

The traffic model base year network was developed from GIS network data. The network model included all major road, all secondary road, part of local road and rail network in study area. The number of lanes and traffic regulation such as one way direction were defined by using the satellite data and the site observation. The Indonesian highway capacity manual was applied for definition of link capacity as shown in Table 2.4.1 and Table 2.4.2. However the high way capacity manual does not consider the intersection. Therefore the intersection factor was applied originally.

Table 2.4.1 Calculation of Link Capacity

Area	Type	Lanes	Basic Capacity/lane	Road Width factor	Side friction factor	Intersection factor	Capacity / lane/Hr (PCU)
CBD	Secondary	1	1,450	0.56	0.89	0.3	220
		2	1,500	0.91	0.92	0.3	380
	Major	1	1,450	0.87	0.89	0.4	450
		2	1,500	0.91	0.92	0.4	500
Township 7-13,15-21,24,25	Secondary	1	1,450	0.87	0.92	0.5	580
		2	1,500	0.95	0.95	0.5	680
	Major	1	1,450	0.87	0.95	0.6	720
		2	1,500	0.95	0.98	0.6	840
Township 22,23,26-39	Secondary	1	1,450	1.00	0.95	0.6	830
		2	1,500	1.00	0.98	0.6	880
	Major	1	1,450	1.00	0.98	0.7	990
		2	1,500	1.00	1.00	0.7	1,050
Bridge		1	1,450	1.00	0.95	1.0	1,380
		2	1,500	1.00	1.00	1.0	1,500

Source: YUTRA Project Team

Table 2.4.2 Definition of Link Capacity, and Maximum Speed

Area	Type	Lanes	Maximum speed (km/h)	Capacity / lane/Hr (PCU)
CBD	Secondary	1	40	2,200
		2	40	3,800
	Major	1	45	4,500
		2	45	5,000
Township 7-13,15-21,24,25	Secondary	1	45	5,800
		2	45	6,800
	Major	1	50	7,200
		2	50	8,400
Township 22,23,26-39	Secondary	1	50	8,300
		2	50	8,800
	Major	1	60	9,900
		2	60	10,500
Bridges		1	45	13,800
		2	80	15,000
Access road to expressway		1	80	15,000
Expressway		1	100	20,000
		2	100	40,000

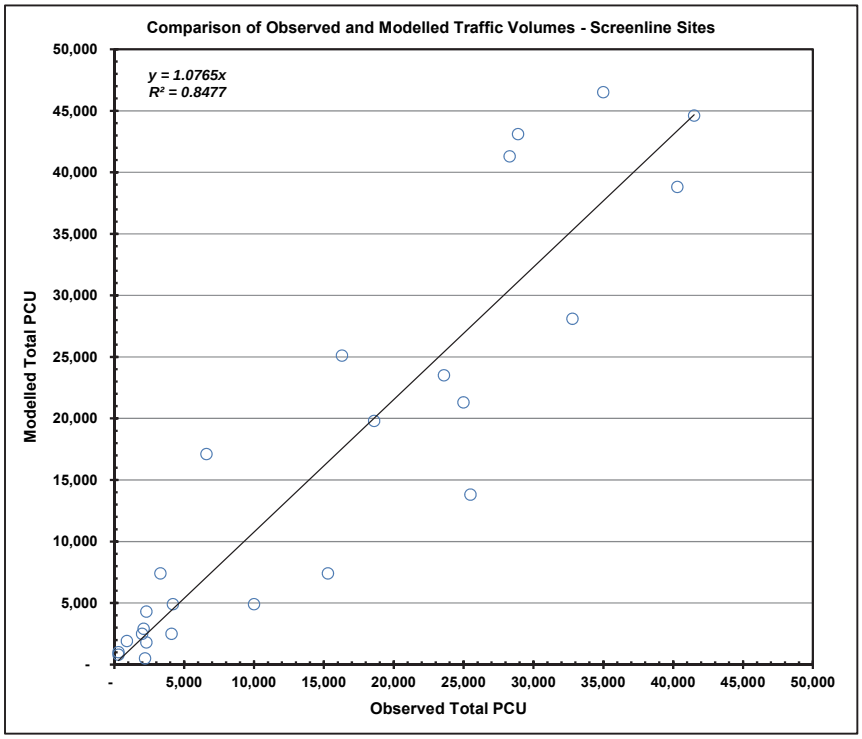
Source: YUTRA Project Team

The link capacity and maximum speed were calibrated by result of travel speed survey carried out by YUTRA. The corded road and rail network was shown in Figure 2.4.1. A simple comparison of observed and modelled screenline count site volumes are shown in Figure 2.4.2.

Road Network　　Rail network

Source: YUTRA Project Team

Figure 2.4.1　YUTRA Study Area - Road and Rail Networks



Source: YUTRA Project Team

Figure 2.4.2　YUTRA Study Area – Comparison of Observed and modelled Flows

3 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

In this chapter basic data of environmental and social considerations are described in both existing environmental conditions: (3.1) and policy, legislative and institutional framework as (3.2) well as strategic environmental assessment (3.3)

Among them descriptions in 3.1 are mostly based on the results of the Project for Strategic Urban Development programme (SUDP, JICA (2013)).

3.1 Present Condition in the Study Area

In general, existing environment conditions can be expressed with several components which subdivided into environmental items. However, expression of the components and items often varies with projects and relevant competent organizations, government and donors.

Unfortunately at present environmental components and/or items, which expresses existing environmental features are not established in Myanmar.

In this report existing environment are expressed referring to divided three components, i.e. social environment, natural environment and environmental pollution and to sub-divided environmental items as mentioned below mostly according to JICA Guidelines for Environmental and Social Considerations, 2010.

- Social Environment – Land acquisition and resettlement, local economy, land use and utilization of local resources, social institutions/split of communities, existing social infrastructure and services, transport and traffic conditions, the poor, indigenous of ethnic people; gender, children's rights, misdistribution of benefit and damage, local conflict of interests, cultural property and heritage, fishing rights, water rights and rights of commons; public health and sanitation, infectious diseases such as HIV/AIDS, working condition, hazard/risk, accidents;
- Natural Environment – Topography and geology, soil erosion, groundwater, river, canal and drainage; flora, fauna and biodiversity; protected areas, landscape, meteorology, global warming;
- Environmental Pollution – Air pollution, water pollution, soil contamination, bottom sediment, waste, noise and vibration, ground subsidence, offensive odor.

Policy, legislative and institutional framework is described with legislation regarding environmental conservation, EIA, involuntary resettlement as well as institutional arrangement.

3.1.1 Social Environment

1) Socioeconomic Scale of Yangon Region

The Yangon Region had a population of 6,944,000 at the end of 2010-2011. It represented approximately 12% of the national population. As for the economic scale, the net production value of the Yangon Region was MMK 8,818,345 million in 2010-2011, accounting for approximately 22% of the country's gross domestic product (GDP). For this

reason, Yangon is referred to as “the Economic Center of Myanmar”.

2) Population

The Yangon City Development Committee (YCDC) has experienced rapid population growth in the past decade. The average growth rate of population in Yangon City between 1998 and 2011 is 2.58% annually. In addition, the target area of the study, named, the Greater Yangon, is composed of Yangon City plus the ‘Periphery Area’ consisting of some areas of six townships in its outskirt, e.g., Kyauktan, Thanlyin, Hlegu, Hmawbi, Htantabin, and Twantay.

Table 3.1.1.1 gives the data of Yangon City’s population by township in 1998 and 2011 provided by the YCDC, and the population data of Periphery Area by township in 2011 estimated by JICA-SUDP Team.

Table 3.1.1.1 Population by Township

Township		Population		Av.Annual Growth (%)	Area(km^2)
		1998	2011	1998-2011	
1	Latha	32,535	34,125	0.37%	0.6
2	Lanmadaw	40,597	43,137	0.47%	1.31
3	Pabedan	47,461	37,551	-1.79%	0.62
4	Kyauktada	44,076	34,797	-1.80%	0.7
5	Botahtaung	52,653	49,134	-0.53%	2.6
6	Pazundaung	38,363	53,648	2.61%	1.07
1) CBD		255,685	252,392	-0.10%	6.91
7	Ahlone	43,569	65,510	3.19%	3.38
8	Kyee Myin Daing	87,491	115,841	2.18%	4.46
9	Sanchaung	78,788	105,208	2.25%	2.4
10	Dagon	39,967	24,492	-3.70%	4.89
11	Bahan	95,114	100,695	0.44%	8.47
12	Tarmwe	128,455	191,114	3.10%	4.99
13	Mingalar Taung Nyunt	109,796	155,767	2.73%	4.94
14	Seikkan	1,379	2,241	3.81%	1.17
15	Dawbon	79,582	87,284	0.71%	3.11
2) Older Suburbs		664,141	848,152	0.94%	49.42
16	Kamaryut	82,943	87,881	0.45%	6.47
17	Hlaing	167,881	151,014	-0.81%	9.82
18	Yankin	107,195	125,909	1.25%	4.79
19	Thingangyun	240,417	231,621	-0.29%	13.12
3) Outer Ring		598,436	596,425	-0.03%	34.2
20	Mayangone	183,024	205,403	0.89%	25.83
21	Insein	240,704	311,200	2.00%	31.4
22	Mingalardon	170,950	288,858	4.12%	127.96
4) South of CBD		594,678	805,461	6.01%	110.51
23	North Okkalapa	189,068	333,484	4.46%	27.76
24	South Okkalapa	220,214	191,388	-1.07%	8.22

Township		Population		Av.Annual Growth (%)	Area(km^2)
		1998	2011	1998-2011	
25	Thaketa	279,799	253,284	-0.76%	13.45
5) Inner Urban Ring		689,081	778,156	1.90%	37.83
26	Dala	77,236	181,087	6.77%	98.41
27	Seikgyikhanaungto	25,586	38,425	3.18%	12.1
6) Northern Suburbs		102,822	219,512	2.36%	185.19
28	Shwe PyiThar	172,377	295,993	4.25%	52.69
29	Hlaing Tharyar	199,190	488,768	7.15%	77.61
30	North Dagon	101,673	221,200	6.16%	24.18
31	South Dagon	140,387	370,403	7.75%	37.51
32	East Dagon	55,192	145,505	7.74%	170.87
33	Dagon Seikkan	18,279	120,161	15.59%	42.04
7) New Suburbs		687,098	1,642,030	6.93%	404.9
(I) Yangon City Total		3,591,941	5,142,128	2.58%	828.96
34	Some parts of Kyauktan	-	48,473	-	76.12
35	Some parts of Thanlyin	-	181,959	-	254.85
36	Some parts of Hlegu	-	50,793	-	101
37	Some parts of Hmawbi	-	83,719	-	84.23
38	Some parts of Htantabin	-	40,234	-	81.77
39	Some parts of Twantay	-	24,936	-	107.86
(II) Periphery Area		-	430,114	-	706.83
Target Area Total (I + II)		-	5,572,242	-	1,534.89

Source: SUDP, JICA (2013)

There are a total of 33 townships in Yangon City, and there are seven township groups, e.g., the Central Business District (CBD), Inner Urban Ring, South of CBD, Older Suburbs Zone, Outer Ring Zone, Northern Suburbs, and New Suburbs Zone.

The annual average growth rate in Yangon City was 2.58% from 1998 to 2011. The yearly population growth rate of 'Northern Suburbs Zone' alone is 2.36%. Other's population growth rate varies due to different factors, e.g., land price, density, infrastructure development, and so on.

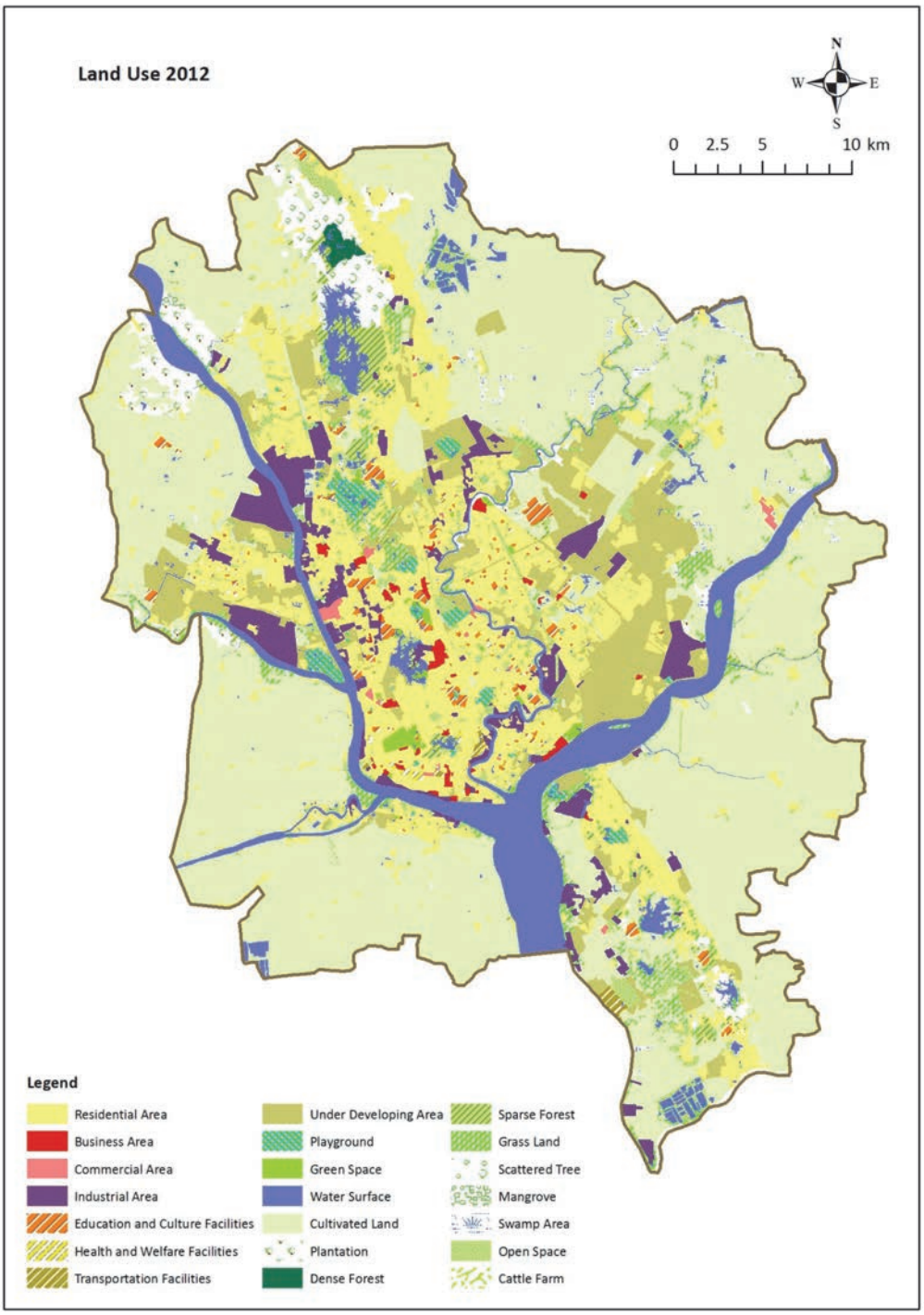
The population scale of the Periphery Area is less than 10% of Yangon City, which has 5.14 million populations.

3) Land Use

In 2002, Greater Yangon has an urbanized area which expands with an area of approximately 505 km2. The urbanized area was originally developed around Shwe Dagon Pagoda and along the Yangon River areas which perform as the city center of Yangon (CBD) with high density of houses and shops today. Urban central functions including administration, banking, business and commerce are located in the CBD.

Urbanization tends to have expanded northwards and eastwards rather than southwards and westwards.

Current land use of 2012 is shown in Figure 3.1.1.1. Regarding land use type, the dominant land use type is agricultural area, which occupies about 51% of total area, followed by urbanized area, which consists of 22% of the built-up area and 9% of under-developing area as shown in Table 3.1.1.2.



Source: SUDP, JICA (2013)

Figure 3.1.1.1 Land Use Map of 2012

Table 3.1.1.2 Land Use by Type of 2012

Land Use Type		Area (km^2)	(%)
1	Built-up Area	360.7	22
2	Under Developing Area	139.7	9
3	Agricultural Area	815.8	51
4	Playground	11.5	1
5	Open Space	36.4	2
6	Water Surface	139.9	9
7	Green Area	96.3	6
Total		1600.3	100

Source: SUDP, JICA (2013)

4) Industrial Structure

The industrial structure in Myanmar comprised the agriculture, livestock, fishery, and forestry sectors (36%); trade sector (20%); process and manufacturing sector (20%); and services sector (18%).

Meanwhile, the industrial structure in Yangon Region composed of the processing and manufacturing sector (37%); trade sector (25%); and services sector (24%). The agriculture, livestock, fishery, and forestry sector accounted only 8% of the total production value.

Yangon heavily leans towards manufacturing industries. It is quite different from Myanmar's industrial structure that is concentrated on agriculture, livestock, fishery, and forestry.

It is thus reasonable to refer Yangon as the "Commercial and Industrial City" rather than a "Commercial City", judging from the present industrial structure.

5) Economic Sectors

(1) Agriculture, Fishery and Forestry Sectors

The agriculture, fishery and forestry sectors contribute largely to the country, representing 36% of the national economy in 2010-2011.The contribution ratio of the Yangon Region to the national net production values of the agriculture, livestock, fishery and forestry sectors based on the data in2010-2011.

The contribution ratio of the Yangon Region is very small in these sectors, e.g., 3% in the agriculture sector, 9% in the livestock and fishery sector, and 1% in the forestry sector. In fact, agriculture production is not so extensive in the Yangon Region.

In the Yangon Region, a total land area of more than 5600 km2 was used for sowing paddy; and a total land area of about 880 km2 was used for sowing other crops such as fruits, vegetables, rubber, oilseeds, coconut, sugarcane, pulses, and medicinal plants in 2009-2010.

Regarding fishery sector, Yangon Region was ranked third for fish and prawn production, accounted for 9% in 2009-2010.

Myanmar is filled with forest, but the Yangon Region has a quite low profile in forest resource. Teak and hardwood logs are export articles.

(2) Energy and Mining Sector

The energy and mining sector has only 1% contribution in the national economy in 2010-2011. In addition, the contribution ratio of the Yangon Region was only 5% in this sector.

Myanmar is richly endowed with natural gas resource. Natural gas is produced mainly at Yadana and Yetagun gas fields in the Gulf of Martaban or in the sea area of Tanintharyi at present. Main natural gas users in the Yangon Region are four gas-fired power stations located in Hlawagar, Yawma, Ahlone, and Thaketa; and CNG1 fuel-based city buses and taxies.

One of the four Myanmar's oil refineries is located in Thanlyin Township of the Yangon Region. It is operated at low utilization rate, due to shortage of crude oil supply. About half of demanded petroleum products relied on imports from foreign countries.

Myanmar has produced and exported mineral resources such as copper, lead, silver, zinc concentrate, tin, tin concentrate, tin/tungsten concentrate, and coal. Besides, it has gold, iron ore, limestone, industrial minerals, and barite, which are produced and consumed within the country. Jade and gems including ruby and sapphire are also important export articles. Mines Tanintharyl, Bago, Magwe and Manadalay; however, are not in the Yangon Region. Mines however, are not distributed in the Yangon Region.

(3) Processing and Manufacturing Sector

The processing and manufacturing sector accounted for 20% of the national economy in 2010-2011. The Yangon Region largely contributed to the processing and manufacturing sector in the country by 41% which is the largest in all economic sectors.

There are a total of 15,089 factories or workshops in Yangon Region in 2010-2011, composed of 111 state-owned, 66 cooperative-owned, and 14,912 private-owned. In the 39 townships, where the Study Area is included, there are 13,582 factories or workshops.

By business category, the food and beverage is the largest category accounted for 24%, followed by construction materials (12%), and garment (10%).

(4) Electric Power and Construction Sectors

The electric power and construction sectors accounted for 1% and 5% of the national economy, respectively in 2010-2011. The contribution ratio of Yangon Region was 22% in the electric power sector, and 25% in the construction sector.

(5) Service Sector

The service sector accounted for 17.8% of the national economy in 2010-2011, composed of transportation (12.9%); communications (0.8%); financial institution (0.1%); social and administrative services (2.1%); and rental and other services (1.8%).

The contribution ratio of the Yangon Region was 29% in the total service sectors; 29% in the transportation sector; 41% in the communications sector; 59% in the financial institution sector; 38% in the social and administrative services sector; and 15% in the rental and other services sector.

(6) Trade Sector

As mentioned above, the trade sector accounted for 20% of the national economy in 2010-2011. The Yangon Region's trade sector contributed 28% to the national economy.

Generally speaking, in Myanmar, goods are retailed at the traditional markets, street stores or family-run small stores. In Yangon City, modern shops have been built since the early 1980s and shopping style is gradually changing.

On the other hand, foreign direct investment for setting up a large commercial facility may render a large impact on the existing traditional markets, street stores, or family-run small stores. Accordingly, the Myanmar government is observing cautious process in approving foreign direct investment for setting up a large commercial facility under the Foreign Investment Law, although such investment itself is not prohibited by the law.

6) Social Services

(1) Water Supply System

The service coverage of YCDC water supply system was approximately 42% in 2010 and the remaining 58 % of population depends on either private well/pond or rainwater.

In addition, access to safe drinking water is not secured, except for those who can use deep wells, although there is no data on the water quality of private wells.

Among the six periphery townships in Greater Yangon, four townships, namely, Hlegu, Hmawbi Htantabin,and Twantay have no available water supply system.

(2) Sanitary Condition

Existing sewerage system covers only a small part of the CBD area. The sewerage system was established in 1888 and the service area was expanded in 1929. Construction of the first wastewater treatment plant (WWTP) was completed in 2005.

People living outside the sewerage service area employ on-site disposal systems such as septic tank. The deterioration of water quality is high concern as human waste sewage often flows into the drainage directly without appropriate treatment.

Habitual flooding by tidal backwater occurs in lowland areas without any flood protection. Flooding results in accumulation of floating debris in the drainage. Wastewater without proper treatment gives rise to poor water quality and offensive odor. Consequently, this wastewater may flow directly to the rivers and it is a great concern that wastewater causes deterioration of the river's water quality.

(3) Education System

There are significant differences among the number of students enrolled at primary school (463,664) and the number of students enrolled at the middle school (292,158), and the number of students enrolled in high school (112,603). These indicate that large numbers of students are unable to continue education beyond the primary school. The main reason for not attending school is the inability of parents to meet school expenses. Therefore, children are prohibited from learning the skills and qualifications they need to be able to survive later in life. Ultimately, this situation allows them to continue living in the wheels of poverty and will likely never to come out from the poverty cycle. Such a scenario is much true to

poorer communities in Yangon Region.

(4) Health Services

(i) Lack of health facilities: From 2005 to 2010, only five new hospitals were added in the health facilities. In addition, there are 11 townships in Greater Yangon where there are no hospitals at all (with more than 25 beds). In terms of bed occupancy, eight out of twelve specialist hospitals have bed occupancy of less than 50%.There is no station hospitals which achieve 50% and above bed occupancy rate.

(ii) Health work force: The largest number of doctors can be seen in public general hospitals with specialist services followed by public specialist hospitals. Station hospitals usually have an average of one doctor. Generally, rural and sub-rural health centers do not have a doctor among their staff.

(5) Urban Poor Community

The poverty line was defined as an income of US$ 3 per day (6.3% of total population). Households below poverty line are located in periphery areas (Kyauktan, Thanlyin,Hlegu, Hmawbi, Htantabin, Twantay) and south of the CBD (Dala,Seikgyikanaungto) with limited access to urban services. Accordingly, the housing conditions in these areas are poor. Majority of houses have a living space below 200 ft^2 and their construction type is either stable wooden frame with leaf roof house or temporary house. Informal sector population is also high in these areas particularly in Hlegu and Twantay townships. The highest number of informal settlers (slum dwellers) is found in Hlaing Tharyar Township.

(6) Gender

There is gender gap in the labor market and in employment opportunities. Also, there is an increase in female's vulnerability to trafficking. Community awareness and understanding of the needs of women is still low.

7) Disaster/hazard

People living in Greater Yangon have repeatedly suffered from natural disasters. Situation of some types of disasters are as follows:

(1) Floods

Flooding is one of the major hazards in Myanmar accounting for 11% of all losses by disasters. Flood in Myanmar usually occur during two distinct periods, i.e. from June to August and from late September to October, with largest intensity observed in August at the peak of monsoon season. Floods in the Greater Yangon can be classified into three types;

(i) River floods

(ii) Localized flood inundations in urban areas with a combination of such factors as cloudburst, poor infiltration rate, poor drainage infrastructure and in rural areas due to decrepit dams, dykes and levees;

(iii) Floods due to cyclone and storm surge.

(2) Cyclones

Cyclones that originate in the Bay of Bengal generally move westward heading for India and then turn towards Bangladesh and Myanmar. Severe cyclones tend to occur either during the pre-monsoon season from April to May or post-monsoon season from October to November. Cyclones have three destructive forces, namely: i) storm surge, ii) heavy rainfall and iii) strong winds.

8) Accidents

From the past trend of the number of road accidents by vehicle type in Greater Yangon. The following characteristics are pointed out from record of accidents

(i) The number of total accidents generally increased from 2008 to 2011 for accidents which resulted in deaths and injuries; although, the numbers slightly decreased in 2010.

(ii) Accidents in 2011 recorded the highest number in the past four years (208 died, and 1,830 injured).

(iii) Many accidents mainly involved buses and private cars. Particularly, accidents related to buses per 10,000 vehicles shows an extremely high number (i.e., 697.5 in 2011) as compared with other vehicles. The reasons for the high accident rate of buses were due to their operation system to pick up/drop passengers on the road side, fast driving speed, and overloading of passengers.

3.1.2 Natural Environment

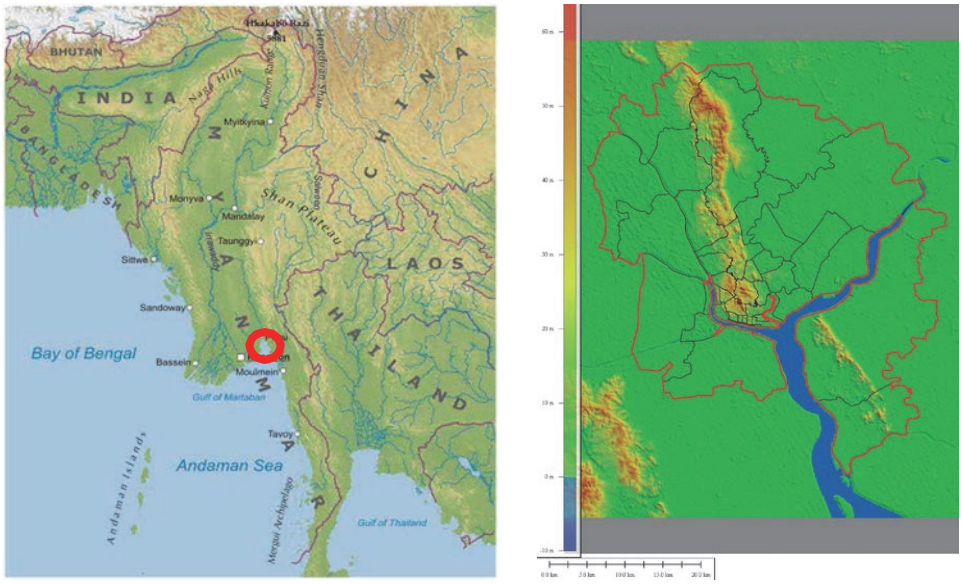
1) Topographic Conditions

(1) Topographic Features of Myanmar and Greater Yangon

Myanmar, with the total area of 678,500 km2, generally slopes downward from the north to south. Mt. Hkakabo Razi, located in Kachin State is the highest mountain in Myanmar with an elevation of 5,881 m. (Figure 3.1.2.1)

The Ayeyarwaddy River, which originates from Mt. Hkakabo Razi and flows southward to Andaman Sea, is the longest river in Myanmar with the total length of approximately 2,170 km. The river has an approximately 255,081 km² of river basin.

The Greater Yangon lies along the Yangon River between around 17 06’ and 16 35’N latitude and between 95 58’ and 96 24’ longitude, east of the Ayeyarwaddy River delta. Yangon City is located 34 km upstream from the river mouth of Yangon River. The City has low hills which are a long and narrow spur of Pegu Yomas hill range in the central area running in N-S direction with an average height of 30 m and degenerates gradually into delta plains in eastwards and westwards.

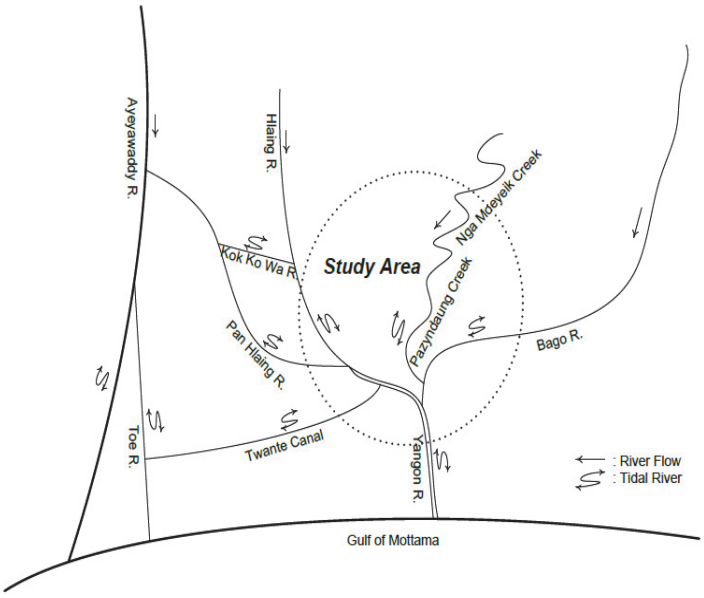


Source: SUDP, JICA (2013)

Figure 3.1.2.1 Topographic Map of the Study Area

(2) River System in and around Greater Yangon

The river system in and around Greater Yangon is schematically shown in Figure 3.1.2.2.



Source: SUDP, JICA (2013)

Figure 3.1.2.2 River System In and Around Greater Yangon

Yangon City is bounded on the south, southeast and southwest by the Yangon, Hlaing and Bago Rivers. The Nga Moeyeik Creek flows into the centre of Yangon city and changes its name to the Pazundaung Creek and penetrates the centre of the city to the Bago River. The river system of western side of the Greater Yangon is more complicated. A few of tidal rivers, namely the Kok Ko Wa River, the Pan Hlaing River and the Twante Canal flow into

the Yangon River. Significant sedimentation can be observed at the junction of the Pan Hlaing River and Kok Ko Wa River. Recently, main stream of the Upper Pan Hlaing River has shifted to flow directly to the Kok Ko Wa River instead to the Lower Pan Hlaing River.

(3) Water Body in Greater Yangon

The largest water body is the Yangon River, which accounts for 27.80 % of the total area, and is managed by the Myanmar Port Authority (MPA). The Second largest water body is the Bago River in Thanlyin Township with 13.82 % of total area. Both of the water bodies are influenced by tides and have saline water. In regard to inland waters, the Mingaladon Township, comprising Hlaw Ga Lake (the major source of water supply for the Greater Yangon), accounts for 8.16% of the total area. Botahtaung, Dagon and Pazundaung Townships have 1.0 to 2.0 ha of water body within each Township. Botahtaung and Pazundaung Townships are suffering from rainwater congestion problem. One of major cause of the problem might be less water body area. Table 3.1.2.1 shows water body areas such as lakes, ponds, rivers and canals on the Township basis within the Greater Yangon.

Table 3.1.2.1 Water Body Area in Greater Yangon

Township	Lake/Pond		River/Canal		Total	
	Area	Weight	Area	Weight	Area	Weight
	($km^{2)}$	(%)	(km^2)	(%)	(km^2)	(%)
Botahtaung	0	0	0.01	0.01	0.01	0.01
Pazundaung	0	0	0.01	0.01	0.01	0.01
Ahlone	0.04	0.03	0.02	0.01	0.06	0.04
Kyee Myin Daing	0.01	0.01	0.05	0.04	0.06	0.05
Dagon	0.02	0.01	0	0	0.02	0.01
Bahan	0.54	0.4	0	0	0.54	0.4
Tamwe	0.01	0.01	0.04	0.03	0.05	0.04
Mingalar Taung Nyunt	0.04	0.03	0.08	0.06	0.13	0.09
Seikkan	0	0	0.35	0.25	0.35	0.25
Dawbon	0.04	0.03	0.12	0.09	0.16	0.12
Kamaryut	0.09	0.06	0.01	0	0.09	0.07
Hlaing	0.09	0.07	0.52	0.38	0.61	0.45
Thingangyun	0.02	0.01	0.96	0.7	0.98	0.72
Mayangone	2.79	2.03	0.24	0.18	3.03	2.21
Insein	0.81	0.59	1.71	1.25	2.52	1.84
Mingaladon	11.2	8.16	0	0	11.2	8.16
North Okkalapa	0.15	0.11	0.99	0.72	1.14	0.83
South Okkalapa	0.03	0.02	0.25	0.18	0.28	0.2
Thaketa	0.28	0.21	4.29	3.12	4.57	3.33
Dala	0.81	0.59	0.32	0.23	1.13	0.82
Seikgyikanaungto	0.13	0.1	1.56	1.14	1.7	1.24
Shwe Pyi Thar	0.54	0.4	1.56	1.13	2.1	1.53
HlaingTharyar	0.76	0.55	5.68	4.14	6.43	4.69
Dagon Myothit (North)	0.14	0.1	0.92	0.67	1.06	0.77
Dagon Myothit (South)	0.4	0.29	0.41	0.3	0.81	0.59
Dagon Myothit (East)	1.16	0.84	5.07	3.69	6.22	4.54
Dagon Myothit (Seikkan)	0.02	0.02	9.44	6.88	9.47	6.9
Kyauktan	3.62	2.64	2.69	1.96	6.31	4.6
Thanlyin	3.55	2.59	18.96	13.82	22.51	16.41
Hlegu	1.19	0.86	1.19	0.87	2.37	1.73
Hmawbi	0.93	0.68	2.68	1.96	3.61	2,63

Township	Lake/Pond		River/Canal		Total	
	Area	Weight	Area	Weight	Area	Weight
	($km^{2)}$	(%)	(km^2)	(%)	(km^2)	(%)
Htantabin	0.14	0.11	5.79	4.22	5.93	4.33
Twantay	0.05	0.03	3.51	2.56	3.56	2.59
Area Managed by MPA	0	0	38.13	27.8	38.13	27.8
Total	29.62	21.59	107.56	78.41	137.18	100

Note: MPA - Myanmar Port Authority
Source: SUDP, JICA (2013)

(4) Geological features

(i) Tectonics

There is the Andaman Trench in Bengal Bay, west of Myanmar, in which the Indian Plate is moving northward and subducting underneath the Burma Plate from west to east. Sagaing Fault, boundary between Burma Plate and Sunda Plate, is located eastern of Myanmar which tends to cause large scale earthquakes in Greater Yangon.

(ii) Geomorphological and soil conditions

Most of Greater Yangon area consists of fluvial flood plain which is associated with the area lies in the delta of the Ayeyawaddy River and along Yangon, Hlaing and Bago rivers and Nga Moeyeik Creek. The rivers transfer and deposit sediments, and form soils which can be classified and described below.

- **Meadow soils and meadow alluvial soils**: The meadow soils which can be found near the river plains with occasional tidal floods are non-carbonate and usually contain large amount of salts. Meadow alluvial soils can be found in the flood plains, and has the texture of silty clay loam and neutral soil reaction.
- **Lateritic soils**: These soils are found on well-drained low uplands and at the foot of low hills. These are formed under the influence of the tropical forests under the conditions of wet tropical monsoon climate with 2000-5000 mm of rainfall. Morphologically, yellow or yellow brown and reddish brown colors characterize these soils. The humus content of these soils in forest area is high, but can be less in the deforested areas. The soil reaction is acidic in the upper horizon and can be more acidic at the lower horizons.
- **Yellow brown forest soils**: These soils are closely connected with the red brown forest soils in the soil distribution and usually replacing these soils down the slope. These soils mainly exist in the region of gentle slopes of low hills and foot hills at the elevation of 90-450 m above sea level. These soils are typical for the monsoon or tropical mixed deciduous forests and contain more percentage of clay and humus than the red brown forest soils. According to the land use classification, great majority of these soils are classified as good garden lands.
- **Saline swampy meadow grey:** These soils occur in the Ayeyarwady Delta and along the river bands of the Gulf of Motama and the marine flat lowlands influenced by the tidal sea water, which is always salty.

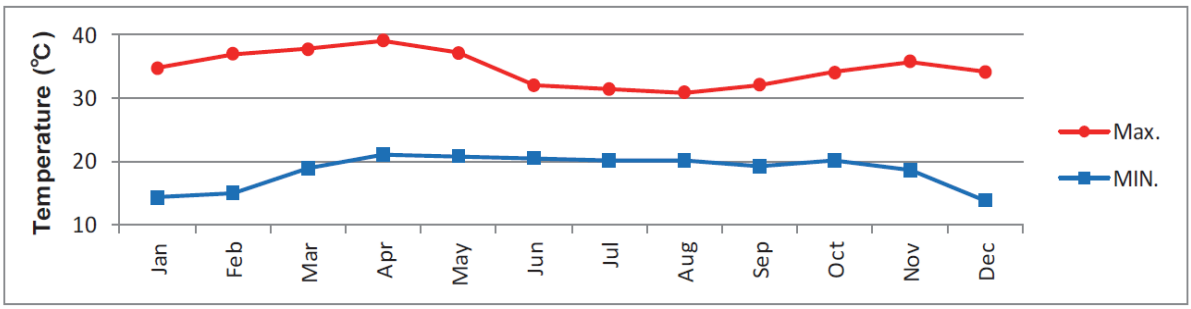
2) Climate

Greater Yangon to tropical monsoon climate, characterized by three distinct seasons, namely, summer (March to middle of May), rainy (Middle of May to middle of October), and cool (Middle of October to February) seasons.

The Kaba-aye Meteorological Station, managed by the Department of Meteorology and Hydrology, Ministry of Transport (DMH, MOT), has been observing meteorological conditions of Greater Yangon since 1968 at the location of 16° 54' latitude, 96° 10' longitude, and +20.0 m in elevation. Six parameters are observed daily which are: 1) temperature, 2) humidity, 3) wind speed and its direction, 4) evaporation, 5) sunshine hours, and 6) rainfall.

(1) Temperature

Generally, temperature in April is high, the maximum monthly temperature recorded in April 2001 was 39.1 °C. Minimum monthly temperature recorded in December 2004 was 13.8 °C The difference between the monthly maximum and monthly minimum temperature is more than 20 °C from December to February and around 10 °C from June to August, which are the peak seasons of monsoon rainfall. (Figure 3.1.2.3)



Source: SUDP, JICA (2013)

Figure 3.1.2.3 Mean Maximum and Minimum Temperature at Kaba-aye (1991-2008)

(2) Relative Humidity

The humidity difference between the morning and evening is quite small. The annual mean relative humidity at 9:30 and at 18:30 is 72.3% and 72.8%, respectively. The maximum mean monthly relative humidity is 90.6% in August, while the minimum mean monthly relative humidity is 51.4% in February.

(3) Wind Speed and Direction

Annual mean wind speed at the Kaba-aye Station is 1.1 m/s. Maximum wind speed was 42.9 m/s recorded in May 2008 at the time of Cyclone Nargis. Wind directions are generally in the SW during summer (March to middle of May) and rainy (Middle of May to middle of October) seasons, and NE in the cool season (Middle of October to February).

(4) Evaporation

Annual mean evaporation is 1,348.6 mm. Evaporation in the summer of March to middle of May is higher than that in rainy season of middle of May to middle of October. Maximum mean monthly evaporation is 183.6 mm in April.

(5) Sunshine Hours

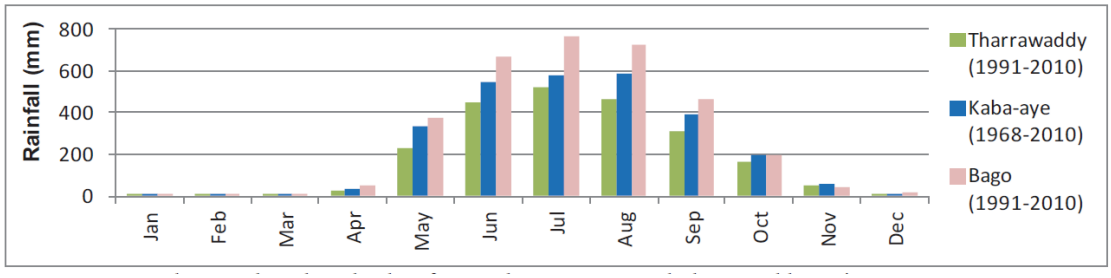
Sunshine hours during December to April are approximately 8-10 hours a day, while that during June to August are approximately 2-3 hours a day due to monsoon rainy weather.

3) Hydrology

(1) Rainfall

(i) Monthly Rainfall in and around the Greater Yangon

The rainfall in Greater Yangon is observed at the Kaba-aye Meteorological Station, and rainfall data of other stations in and around the Study Area are available from a few other sources including Irrigation Department, Ministry of Agriculture and Irrigation (ID, MOAI). The Bago Rainfall Station is located in Bago City, the Bago River basin and the Tharrawaddy Rainfall Station is located upstream of Hlain River, respectively. As shown in Figure 3.1.2.4 at Kaba-aye Meteorological Station, mean annual rainfall is 2,749 mm and maximum mean monthly rainfall is 591 mm in August and minimum mean monthly rainfall is 3 mm in January and February. Maximum annual rainfall was recorded as 3,592 mm in 2007. Maximum monthly rainfall was 868 mm in August 1968 and minimum monthly rainfall was zero in the past several months. Mean annual rainfall in Bago is 3305 mm while that in Tharrawaddy is 2,220 m.



Source: SUDP, JICA (2013)

Figure 3.1.2.4 Mean Monthly Rainfall in and around Greater Yangon

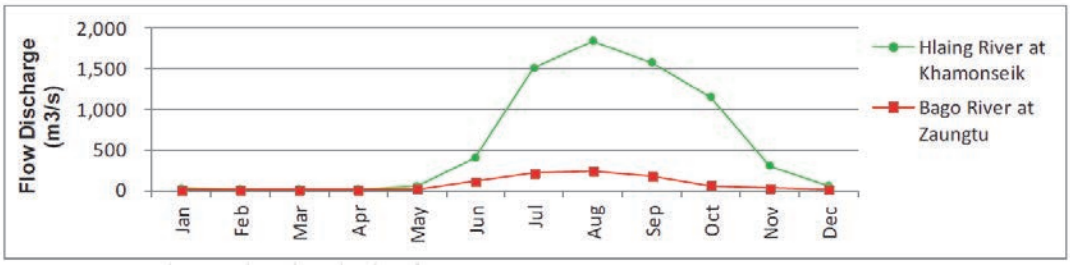
(ii) Short intensity rainfall

Rainfall in Greater Yangon is short in duration and intensity. Remarkably, 50-year probable 60-minute rainfall intensity exceeds 100 mm/hour. Such a high intensity of rainfall is a major cause of inundation problems in downtown Yangon.

(2) River flow discharge

River flow discharge is measured far upstream from Greater Yangon to avoid tidal effects.

Tidal phenomenon makes it difficult to carry out precise discharge observations. Figure 3.1.2.5 shows mean monthly flow discharge of the Hlaing River at the Khamonseik Station and the Bago River at the Zaungtu Station, both of which are measured by DMH. Both Khamonseik and Zaungtu stations are located far upstream from the junction of the Yangon and Bago rivers, with the distance of approximately 300 km and approximately 200 km, respectively.



Source: SUDP, JICA (2013)

Figure 3.1.2.5 Mean Monthly Flow Discharge of the Hlaing and Bago Rivers (1987-2000)

The Hlaing River flow discharge in Khamonseik is 1,851 m^3/s in August and 17 m^3/s in March with a difference of about hundred times. The Bago River flow discharge in Zaungtu is 242 m^3/s in August and 2 m^3/s in January and February with a large difference. The maximum daily flow discharges in Khamonseik and in Zaungtu were recorded as 2752 m^3/s in October 1997 and 1,237 m^3/s in July 1994, respectively.

(3) Tidal Conditions

For the tidal condition, the available information is based on past observation records at Yangon Port (Sule Pagoda Wharf, 16° 46' latitude and 96° 10' longitude) and the river mouth of Yangon River (Elephant point, 16° 30' latitude and 96° 18' longitude) as shown in Table 3.1.2.2 The highest high water level (HHWL) is +6.74 m and mean water level (MWL) is +3.121 m and ground elevation is normally indicated from MWL. Hence, it can be said that HHWL around Yangon Port is approximately +3.619 m on ground elevation basis.

Myanmar International Terminal Thilawa, a private firm operating the terminal, has observed tidal condition at the Thilawa Terminal for more than 16 years. According to their information, maximum water level was recorded during a storm in 2007 at +4.14 m, and Cyclone Nargis in May 2008 caused approximately 0.5 m higher than this, although the water level was not recorded. Reliability of the information cannot be confirmed.

Table 3.1.2.2 Tidal Features of Yangon Port (Sule Pagoda Wharf)

Items	Tidal Height	Observed Date
Highest High Water Level (HHWL)	+6.74	Sep.1899
Mean Water Level (MWL)	+3.121	Upto1936
Lowest Low Water Level at Bo Aung Kyaw Street Wharf	-0.24	Dec. 1902
Indian Spring Low Water Mark	+0.338	-

Source: SUDP, JICA (2013)

4) Plants, Animals, and Ecosystem

(1) Endangered species

Myanmar has rich biological resources. Although the biodiversity inventory has not yet been completed in Myanmar, it is officially stated that there are 350 mammal species, 300 reptile species, 350 freshwater fish species, 800 butterfly species, 1035 bird species, and 9600 plant species in Myanmar. Among them, endangered species are recorded and reported to be 153 species (Table 3.1.2.3). In avifauna, five species in Myanmar are listed

as critically endangered species, seven species are endangered species, and 37 species are vulnerable species. There are 38 plant species in Myanmar recorded as globally threatened. The major threat to globally threatened plant species in Myanmar is the degradation and/or loss of forest.

Table 3.1.2.3 Threatened Species listed under IUCN Red List 2011

Taxonomic Group	Critically Endangered	Endangered	Vulnerable	Total
Mammal	4	10	26	40
Bird	5	7	37	49
Reptile	6	13	6	25
Invertebrate	0	0	1	1
Plant	13	12	13	38
Total	28	42	83	153

Source: SUDP, JICA (2013)

Greater Yangon is recorded to have three threatened animal species and two threatened plant species as shown in Table 3.1.2.4. All these threatened species are also protected by the Forest Law in Myanmar.

Table 3.1.2.4 Animal and Flora Species Recorded as Threatened during the Period from September 2012 to November 2012

No.	Scientific name	Common name	Family	IUCN, 2011
1	*Lissemys punctata*	Indian flap shell turtle	Trionychidae	Endangered
2	*Indotestudo elongate*	Yellow tortoise	Testudinidae	Endangered
3	*Pythonmolurusbivittatus*	Burmese Python	Boidae	Endangered
4	*Dipterocarpus alatus*	Kanyin-phyu	Dipterocarpaceae	Endangered
5	*Hopea odorata*	Thin-gan	Dipterocarpaceae	Vulnerable

Source: SUDP, JICA (2013)

(2) Protected Areas and Parks

(i) Protected Areas

In Myanmar the Protection of Wildlife, Wild Plants and Conservation of Natural Area Law was enacted in 1994. A target has been set to increase the protected area up to 5% in the short term, and 10% in the long term. There are at present 40 protected areas in Myanmar including wildlife and bird sanctuaries, national parks, and nature reserves (Table 3.1.2.5). Myanmar is also a Party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora, and Ramsar Convention.

Table 3.1.2.5 Protected Areas and their Locations in Myanmar

No.	Name	General Location
1	Pidaung Wildlife Sanctuary	Kachin State
2	Shwe-U-Daung Wildlife Sanctuary	Mandalay Region
2	Shwe-U-Daung Wildlife Sanctuary	Shan State
3	Pyin-O-Lwin Bird Sanctuary	Mandalay Region
4	Moscos Islands Wildlife Sanctuary	Taninthayi Region

No.	Name	General Location
5	Kahilu Wildlife Sanctuary	Karen State
6	Taunggyi Bird Sanctuary	Shan State
7	Mulayit Wildlife Sanctuary	Karen State
8	Wethtikan Bird Sanctuary	Magwe Region
9	Shwesettaw Wildlife Sanctuary	Magwe Region
10	Chatthin Wildlife Sanctuary	Sagaing Region
11	Kelatha Wildlife Sanctuary	Mon State
12	Thamihla Kyun Wildlife Sanctuary	Ayeyar-wady Region
13	Htamanthi Wildlife Sanctuary	Sagaing Region
14	Minwuntaung Wildlife Sanctuary	Sagaing Region
15	Hlawga Park	Yangon Region
16	Inlay Wetland Bird Sanctuary	Shan State
17	Moeyongyi Wetland Bird Sanctuary	Bago Region
18	Alaungdaw Kathapa National Park	Sagaing Region
19	Popa Mountain Park	Mandalay Region
20	Meinmahla Kyun Wildlife Sanctuary	Ayeyarwady Region
21	Lampi Island Marine N. Park	Taninthary Region
22	Hkakaborazi National Park	Kachin State
23	Loimwe Protected Area	Shan State
24	Parsar Protected Area	Shan State
25	Natmataung National Park	Chin State
26	Lawkananda Wildlife Sanctuary	Mandalay Region
27	Indawgyi Wetland Wildlife Sanctuary	Kachin State
28	Kyaikhtiyoe Wildlife Sanctuary	Mon State
29	Minsontaung Wildlife Sanctuary	Mandalay Region
30	Hukaung Valley Wildlife Sanctuary	Kachin State
31	Kyauk Pan Taung Wildlife Sanctuary	Chin State
32	Hponkanrazi Wildlife Sanctuary	Kachin State
33	Rakhine Yoma Elephant Range	Rakhine State
34	Panlaung-pyadalin Cave Wildlife Sanctuary	Shan State
35	Maharmyaing Wildlife Sanctuary	Sagaing Region
36	Lenya National Park	Taninthary Region
37	Taninthary National Park	Taninthary Region
38	Bumhpabum Wildlife Sanctuary	Kachin State
39	Hukaung Valley Wildlife Sanctuary (extension)	Kachin State
40	Taninthayi Nature Reserve	Taninthayi Region

Source: SUDP, JICA (2013)

Among them The Hlawga Park (No.15 in Table 3.1.2.5 and Figure 3.1.2.6) in Greater Yangon has an area of 2,342 ha which is managed strictly as Watershed Protection Forest. Not everyone can enter the park without permission. Teaks and other trees are planted in the Hlawga Park every year.

The Hlawga Park has the objectives of providing environmental education facilities

and protecting the forest and plant cover in the catchment area of the Hlawga Lake. It is situated in Mingaladon Township of the Yangon Region. The southern part of the park is the Hlawga Forest Reserve. According to a scientific report (Myanmar Protected Areas -Context, Current Status and Challenges), the site conserves three types of habitat, i.e., evergreen forests, mixed deciduous forests, and swamp forests. In all, there are 108 tree species identified. Barking deer, hog deer, and wild boar are the most common of the 12 mammal species.

Source: SUDP, JICA (2013)

Figure 3.1.2.6 Hlawga Park in Greater Yangon Area

(ii) Public Parks

In the low hills, several lakes and marshes remain in the urbanized area. Of those, Kan Daw Gyi Lake and Inya Lake are protected as public parks. Other lakes and marshes should also be given more attention in terms of conservation, because these water areas are very important and needed for flood control and mitigation of environmental pollution.

In YCDC, total areas of 139 ha are allotted for public park area which seems to be quite small, considering the population of approximately 5.14 million. If the public park area is divided by the number of population, the parameter of park area per person in YCDC, results to 0.27 m^2 which is a small figure compared with other cities in the world, such as 29.3 m^2 in New York and 4.5 m^2 in Tokyo. Thus, it is necessary to introduce urban greenery actively in the city for the mitigation of “Heat Island Phenomenon” and also to increase the quality of urban amenity.

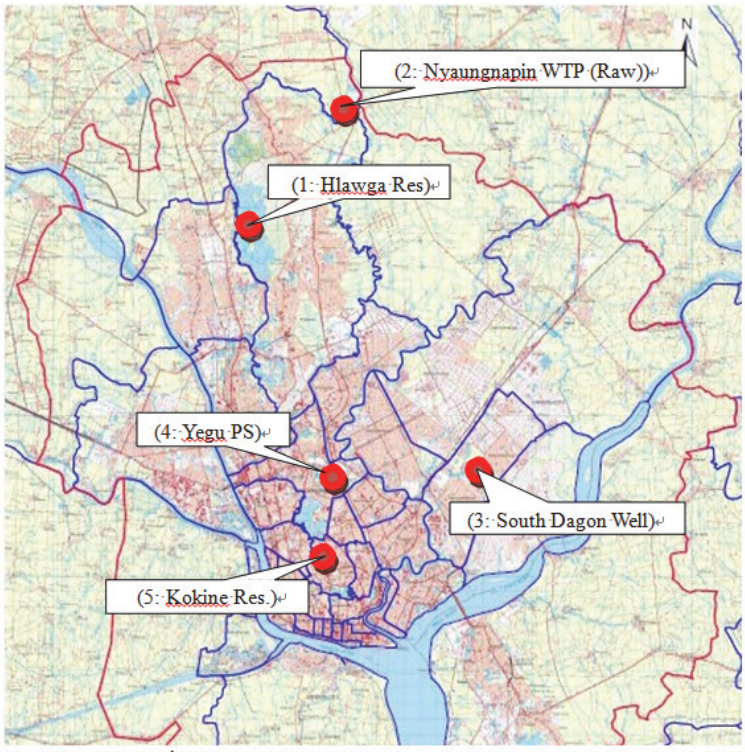
3.1.3 Environmental Pollution

1) Water Quality Data

(1) Water quality data

Until now regarding environmental quality data such as air quality, water quality, ambient noise, which indicate level of environmental pollution as well as features, actual quantitative measurements have been hardly found even in the Greater Yangon.

The results of recent survey carried out by Ministry of Economic and Trade and Industry (METI), Japan on five sampling stations are shown in Table 3.3.1.1 and Figure 3.1.3.1 and Table 3.1.3.1. Compared to standard values of WHO Guideline, although turbidity and total coliform show higher values, the other parameters were mostly lower.



Source: SUDP, JICA (2013) (cited from "The Study on the Improvement of Water Supply and Wastewater Treatment in Yangon (2012)", METI, Japan)

Figure 3.1.3.1 Sampling Points of Water Quality

Table 3.1.3.1 Water Quality Results

No.	Parameters	Unit	1	2	3	4	5	WHO Guideline
			Hlawge Res.	South DagonWTP (Raw)	South Dagon Well	Yegu PS	Kokine Res.	
1	pH		7.35	7.37	8.1	7.08	7.52	Preferably S<8.0
2	Turbidity	NTU	5	45	5	7.5	7.5	5
3	Colour	Pt-unit	<5.00	<5.00	<5.00	<5.00	<5.00	15
4	Aluminum(Al)	mg/l	<0.10	1	<0.10	1	<0.10	0.2
5	Arsenic (As)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
6	Calcium(Ca)	mg/l	5.2	7.2	16	6.8	5.6	-
7	Chloride (Cl)	mg/l	4.32	7.57	54.1	8.66	3.24	250
8	Copper(Cu)	mg/l	<1.00	<1.00	<1.00	<1.00	<1.00	1.0
9	Cyanide (CN_2)	mg/l	-	-	-	-	-	0.07
10	Hardness	mg/l	33	52	84	38	38	-
11	Iron(Fe)	mg/l	0.01	0.5	0.4	0.1	0.1	0.3
12	Manganese (Mn)	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
13	Lead(Pb)	mg/l	<0.01	<0.01	<0.10	<0.01	<0.01	0.01
14	Magnesium(Mg)	mg/l	4.86	8.26	10.69	5.1	5.83	-
15	Nitrate (NO_3)	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	-
16	Sulfate	mg/l	22.22	9.67	23.66	8.43	22.83	250
17	Total dissolvedsolids	mg/l	113.5	122.3	404.3	110	125.2	1000
18	Zinc (Zn)	mg/l	<1.00	<1.00	<1.00	<1.00	<1.00	3
19	Total Coliform	No/100ml	>16	>16	2.2	>16	>16	0
20	*E.Coli*	No/100ml	Isolated	Not isolated	Not isolated	Not isolated	Not isolated	0

Source : Source: SUDP, JICA (2013) citer from "The Study on the Improvement of Water Supply and Waste water Treatment in Yangon(2012, METI, Japan)"

(2) Existing situation of water pollution

As mentioned in 3.1.1 6), existing sewerage system covers only a small part of the CBD area and people living outside the sewerage service area lack of proper sewage treating systems. Thus, human waste sewage often flows into the drainage directly without appropriate treatment.

In addition, habitual flooding by tidal backwater occur in lowland areas without any flood protection. Flooding causes accumulation of floating debris in the drainage. Waste water without proper treatment results to poor water quality and offensive odor. Consequently, this waste water may flow directly to the Yangon River resulting in degradation of the river water quality.

Further, solid waste disposal in Greater Yangon is being operated in an open dump site. Therefore, there is a concern that untreated leachate might cause water quality degradation, including ground water.

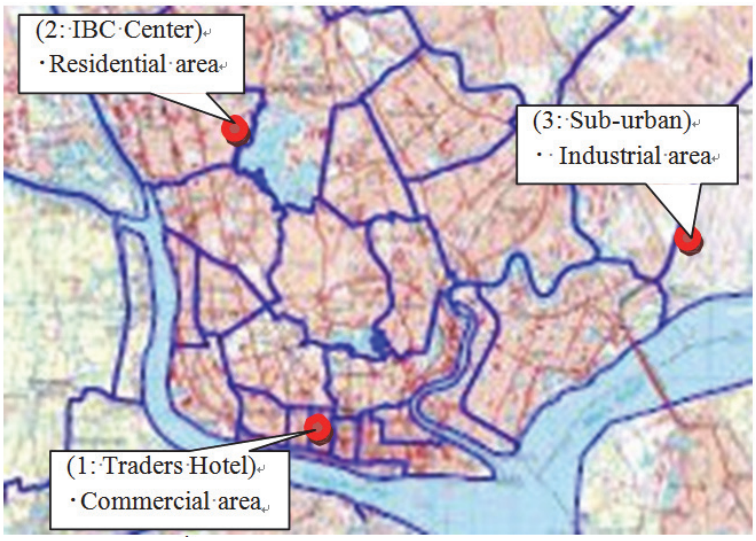
2) Air Quality

(1) Air quality data

In respect to ambient air quality, there is no air quality standard in Myanmar yet of its own. Therefore relevant guidelines (WHO Guideline, etc.) and standards are used to compare the findings.

Ambient air quality measurements were conducted in relevant areas which can represent commercial areas, residential areas and nearby industrial zone of Yangon city in 2007-2008 and sub-urban area east of the city (in Dagon Myo Thit – South) in 2010-2011. The measured air quality data are comprehensive and the monitoring results show air quality variations over the time.

Air quality monitoring was conducted in Nov 2008 in three selected stations in Yangon commercial, residential and near to industrial zone (Figure 3.1.3.2 and Table 3.1.3.2).These air quality monitoring was the first initiative of this sort in Myanmar. The 24 hours average concentrations of NO_2 and SO_2 levels in three selected sites are well below the WHO Guideline. The total suspended particulates (TSP) and the suspended particulate meter (PM_{10}) at the three sites are higher than the WHO Guidelines. The 24 hour average concentration of TSP and PM_{10} at the Industrial area showed higher values. The main factor for a high dust level is due to fugitive dust mainly from local industrial activities.



Source: SUDP, JICA (2013)

Figure 3.1.3.2 Stations of Air Quality Measurement

Table 3.1.3.2 Air Quality Results

Pollutant	Averaging time	Data	Station 1 (Commercial area)	Station 2 (Residential area)	Station 3 (Industrial area)	WHO Guidelines (24 hours)
			Unit: μg/m^3			
NO_2	24 hour	median	23.5	22.3	25.4	40
		min-max	19.2-24.2	21.8-23.8	16.6-26.7	(annual average)
SO_2	24 hour	median	0.95	1.24	0.25	20
		min-max	0.39-1.30	1.14-1.25	0-0.3	
TSPM	24 hour	median	152	111	178	100
		min-max	91-185	104-141	(149-238	
PM_{10}	24 hour	median	73.7	57.2	118	50
		min-max	49.0-92.6	53.7-85.0	106-186	

Source: Compiled from SUDP, JICA (2013)

(2) Existing situation of Air pollution

More than 25,000 vehicles have been added to the existing number of vehicles plying on the city roads in the first half of the year after the government approved the import permit in 2012. Therefore, air pollution and noise are major concerns due to the increasing number of vehicles as well as the traffic congestion.

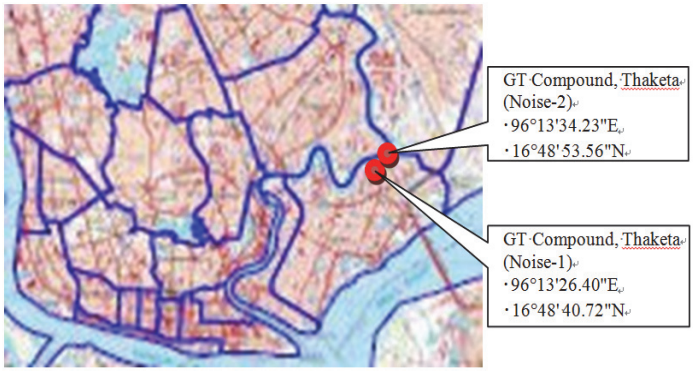
The polluted level is unknown because no monitoring data on air pollution and noise is available as described above, but there is a high possibility of serious environmental issues caused by air pollution and noise with rapid economic growth in the future.

Also, air pollution and noise from the industrial zones developed in the west and east suburbs of the city in the last two decades may cause environmental problem.

The open dumping system for solid waste disposal may cause air contamination by open burning of solid waste.

3) Ambient Noise

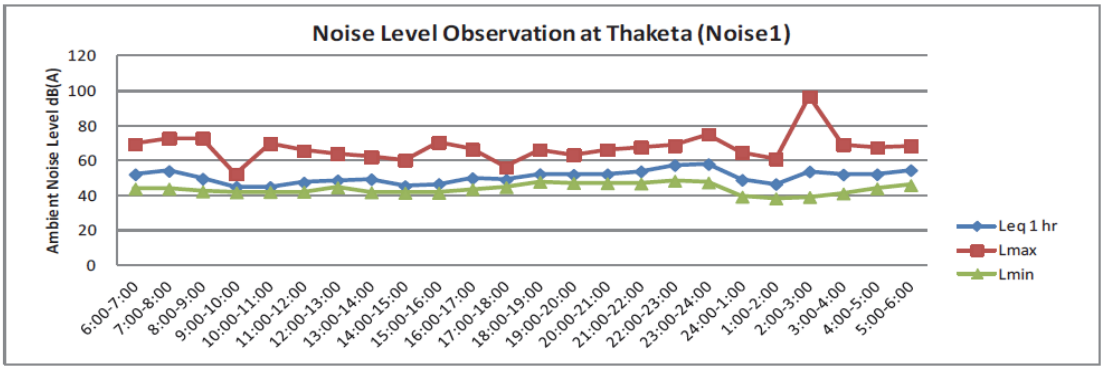
In respect of ambient noise levels, there is no noise levels standard in Myanmar yet of its own. Noise levels were measured at two locations within Yangon area (Figure 3.1.3.3). Noise levels were recorded for 24 hours and the noise levels were reported as L(max), L(min), Leq1hr for each of the two (2) locations. Result for one station is shown in Figure 3.1.3.3.



Source: SUDP, JICA (2013)

Figure 3.1.3.3 Ambient Noise Measurement Stations

The observations from noise level Leq1hr values of two (2) locations varied from 49 dB(A) to 51 dB(A). The noise levels Lmax values varied from 52 dB(A) to 97 dB(A) at the Noise Monitoring station 1 and the equivalent noise levels Lmax varied from 48 dB(A) to 78 dB(A) at Noise Monitoring station 2.



Source: SUDP, JICA (2013)

Figure 3.1.3.4 Noise Level Data at Thaketa Township (Monitoring Station 1)

4) Solid Waste

Solid waste in Yangon City comes from waste generators such as residents, business owners, and retailers. Waste is being collected by the Pollution Control and Cleansing Department (PCCD) of YCDC. It is then transported to seven final disposal sites (FDSs) including large scale FDS such as Htantabin FDS and Htawe Chaung FDS, operating as open dump sites. Therefore, there is a concern that untreated leachate may cause deterioration of ground water.

The waste collection system in Yangon City is a combination of primary waste collection method, i.e., temporary waste storage, and secondary waste collection. Supposedly, waste is transported directly to final disposal sites after the secondary waste collection. However, waste transportation is not always done immediately after the secondary collection, leaving the fully-loaded garbage trucks parked along the street even at the daytime. Wastes kept in trucks emit bad smell in the area.

Hazardous waste generated in the hospitals in Yangon City is separately collected by PCCD's compactor trucks and incinerated at the cemetery furnace located nearby Htantabin FDS.

However, hazardous wastes have not been regulated by a legislation in Myanmar. It is urgently required to establish a management system on hazardous waste based on appropriate law and/or regulations.

3.2 Current Policy, Legal and Institutional Framework

3.2.1 Legislation related to Environmental and Social Considerations

Major legislations relevant to environmental conservation are shown in Table 3.2.1.1.

Table 3.2.1.1 Laws and regulations relevant to Environment

	Name of Laws, rules etc.	Year
1. Constitution and Environmental Policy		
	Constitution of the Republic of the Union of Myanmar	2008
	Myanmar National Environmental Policy	1994
	National Sustainable Development Strategy 2009	2009
2. Environmental Conservation		
	Myanmar Environmental Conservation Law 2012	2012
	Environmental Impact Assessment Procedures (Draft) 2013	2013
3.Biodiversity and Natural Conservation		
	Wildlife Protection Act 1936	1936
	Myanmar Marine Fisheries Law 1990	1977
	Fresh Water Fisheries Law 1991	1991
	Forest Law 1992	1992
	Animal Health and Development Law 1993	1993
	Protection of Wildlife and Conservation of Natural Area Law 1994	1994
	Conservation of Water Resources and River Law 2006	2006
	National Biodiversity Strategy Action Plan in Myanmar 2012	2012
4. Urban Development and Management		
	The City of Rangoon Municipal Act 1922	1922
	Law Amending the City of Yangon Development Law 1996	1963
	City of Yangon Development Law 1990	1990
	The City of Yangon Municipal Amendment Act 1961	1922
5. Land Acquisition and resettlement		
	The Upper Burma Land and Revenue Regulation	1889
	The Land Acquisition Act 1894	1894
	Transfer of Immovable Property Restriction Act	1947
	Land Nationalization Act	1953
	Disposal of Land Tenancies Law	1963
	Transfer of Immovable Property Restriction Law	1987
	Farmland Law 2012	2012
	Farmland Rules 2012	2012
	Vacant, Fallow, Virgin Land Management Law 2012	2012
	Vacant, Fallow, Virgin Land Management Rules 2012	2012
6. Pollution Control and Occupational Health		
	Factory Act	1951
	Standing Order 2_95 Occupational Health Plan 1995	1963
	Standing Order 3_95 Water and Air Pollution Control Plan 1995	1963
	Occupational Safety and Health Law (Draft)	2012
	The Science and Technology Development Law 1994	1994
	Myanmar Mines Law 1994	1994

Source: YUTRA Project Team (2013)

3.2.2 Environmental Conservation Law, 2012

To establish sound environment policies, utilization of water, land, forests, mineral, marine resources and other natural resources for conservation of the environment and preventing its degradation, the National Environment Policy of Myanmar was proclaimed on 5 December 1994. Then the drafting of 'Myanmar Agenda 21' followed the Policy in 1997.

However, since then the progress in development of environmental policy has passed with rather slow step. In addition, the legal framework for environment protection has been indebted to sectorial laws and these laws do not possess holistic vision on environmental protection.

In order to solve the above situation the Environmental Conservation Law was established and enacted by the Union Hluttaw on 30th March 2012, and promulgated on 1st April 2012.

The Law consists of the objectives, formation of the environmental conservation committee, environmental conservation functions and powers of the Ministry of Environment Conservation and Forestry (MOECAF), environmental emergency, and so on.

Outline of Environmental Conservation Law is shown in Table 3.2.2.1.

Table 3.2.2.1 Outline of Environmental Conservation Law

Chapter	The Outline (Excerpt)
1) Title and Interpretation	This Law shall refer to as the Environmental Conservation Law.
2) Objectives	For implementation of Myanmar's National Environment Policy.
3) Organizing the Environment Conservation Committee	1) The Union government shall organize an Environment Conservation Committee, Republic of the Union of Myanmar, assigning the Union Minister of the Ministry of Environment as the Chairman and shall constitute appropriate members. 2) In organizing the committee, the Vice-chairman, Secretary, and Joint-Secretary shall be assigned and designated to serve the task.
4) Obligations and authoritative right of the Ministry on Environment Conservation	In order for the Ministry of Environment to implement environment conservation effectively, the State, at the expense of budget fund under the head income of other sources, shall allocate fund in the State account on Environment Conservation in accordance with the Financial Rules and Regulations.
5) Emergency Condition on Environment	The Committee, upon notice of an emergency condition that is occurring or may possibly occur across the nation or in certain region or state or in certain territory shall notify the occurrence and submit the matter immediately to the Union government.
6) Environment Quality and Specifications	The ministry under the agreement of the Union government and the committee, for the benefit of the public in accordance with the development of science and technology, or with the requirement of work may make amendments on the environment quality specifications in compliance with time and place.
7) Environmental Conservation	Under this item the following issues on environmental conservation were discussed: a) Using chemicals which may vividly jeopardize environment; b) Transporting polluted materials, hazardous materials, keeping under storage, application, processing and discarding at the industries; c) Discarding materials produced from metals, industrial mineral ores, raw materials, gem extraction, and processing; d) Discarding filthy, dirty, and wastage matters. e) Cleansing and processing; f) Implementation of development and construction; and g) Implementation of other required environmental pollution.
8) City Locality Environment Management	In taking up measures for City Locality Environment Management in accordance with the instructions and guidelines given by the committee, the ministry shall confer to government departments concerned, government organizations, private organizations, and private individuals on the matters requiring advice

Chapter	The Outline (Excerpt)
9) Conservation of Natural Resources and Cultural Heritage	Under the existing law, the ministry shall cooperate with government departments concerned and government organizations on matters relating with prescribed cultural heritage; regions existing such heritage; cultural/monumental buildings and perpetuation of natural land and territories.
10) Advance Permit Issue	The ministry with the approval of the Union government may prescribe works requiring advance permit application that may jeopardize or endanger the environment quality, or work sites or factories and workshops.
11) Insurance	Party holding advance permit shall have to provide an insurance in accordance with the nature of work, worksite, factory or workshop under existing law to cover any accident jeopardizing the environment.
12) Restrictions	1) No party shall enter and execute the worksites, factory or workshops which require to apply advance permit in accordance with this law. 2) No party shall violate any restriction provided under the Rules Notification, Orders, Directives, Board, Transport of Sales on certain products or materials which may jeopardize the environment and prohibited by the ministry.
13) Penalties and Punishments	If any party is find convicted of committing violation of Rules, Notifications, Orders, Directives or any restrictions provided in the procedures, corresponding punishment of imprisonment not more than one year or an appropriate fine or both maybe imposed.
14) General	Government department concerned and government organization having the right to issue license, permit, co-registration on those works, worksite, factory, or workshop, shall issue permit to those works holding advance permit.

Source: Environmental Conservation Law, 2012

The summary of the objectives are as follows:

(i) To implement the Myanmar National Environment Policy;

(ii) To provide the basic principles and give guidance on the systematic integration of environmental conservation matters in a sustainable development process;

(iii) To promote a good and clean environment and to conserve the natural and cultural heritage for the benefit of both present and future generations;

(iv) To reclaim the ecosystems that are at the early stages of degradation as soon as possible;

(v) To manage the prevention of natural resources degradation and to enable its sustainable use;

(vi) To implement the promotion of public understanding and dissemination of educational program on environmental awareness;

(vii) To promote the international, regional, and bilateral cooperation in environmental affairs; and

(viii) To enable the cooperation among government departments, government organizations, international organizations, non-governmental organizations, and individuals in matters of environmental conservation.

It is noteworthy that Myanmar laws do not contain any descriptions related to the system of environmental impact assessment (EIA) for development projects as well as to SEA at present. Moreover, the systems of public involvement in the decision-making process are not also prescribed in the law. This is considered as a significant gap between the Myanmar

laws and JICA Guidelines.

In addition, compared with national level legislation, Yangon City does not have particular provisions or ordinances for environmental conservation.

3.2.3 Regulations for Environmental Impact Assessment (EIA)

1) Existing situation of EIA regulations in Myanmar

At present, in the case of official development scheme by the foreign public sector including foreign donors, the approval for the project implementation is attained after several processes as follows (See Figure 3.2.3.1):

(i) At first, the project proponent shall submit project proposal documents together with a feasibility study report including the results of Environmental Impact Assessment (EIA)/Social Impact Assessment (SIA) to the Foreign Economic Relations Department (FERD) of Ministry of National Planning and Economic Development (MNPED).

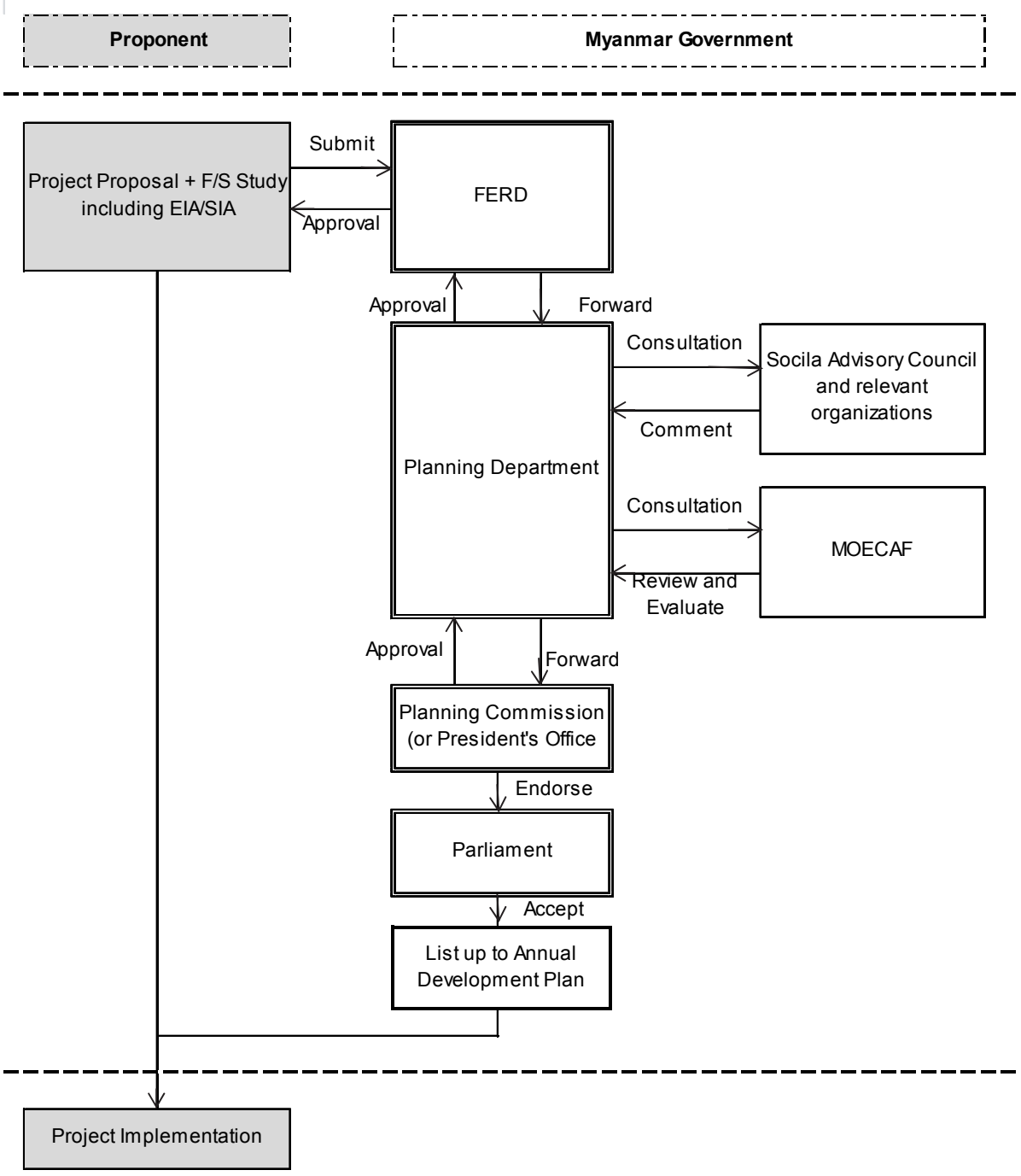
(ii) After examining all the required documents by FERD, the documents are forwarded to the Planning Department of MNPED.

(iii) The Planning Department consults with the Social Advisory Council and other relevant organizations as well as MOECAF for examination in detail the documents. In this process MOECAF reviews and evaluates the results of EIA/SIA in terms of environmental and social considerations.

(iv) After all the above organizations approved the submitted documents, the Planning Department forwards the documents together with the results of the above examination and evaluation to the Planning Commission (or the President's Office).

(v) After the approved of the documents, the Planning Commission will endorse them together with its recommendation to the Parliament.

(vi) In the Parliament, after acceptance of the project approval, the project will be registered into the national annual project list without which no project is able to be conducted in the target year.



Source: YUTRA Project Team (2013)

Figure 3.2.3.1 Existing Procedures of Project and Environment Approval

However, Article 7 of the Environmental Conservation Law stipulates that the Ministry of Environment, Conservation and Forestry (MOECAF) has responsibility for laying down and carrying out of a system of EIA and SIA as to whether or not a project or activity to be undertaken by any government department, organization or person may cause a significant impact on the environment.

The above law, however, does not stipulate the detail procedures to be taken for conducting environmental impact assessment. With regard to this, MOECAF has been working for the drafting of the "Environmental Conservation Rules" in which "Environmental Impact Assessment Procedures" (hereafter, "the EIA procedures") shall be stipulated. As of January 2013, the EIA Procedures has been drafted and waiting for further brush up and official enactment. The draft of the EIA procedures stipulates that MOECAF shall be the Executing Agency for the purpose of the rules stipulated in the document.

2) Outline of EIA Procedures

The EIA Procedures are composed of 7 chapters and 22 articles with appendices as shown in Table 3.2.3.1.

Table 3.2.3.1 Outline of EIA Procedures (Draft)

Chapter/Article	Major points
I Title and Definition	
Article 1	The Procedure is called as EIA Rule.
Article 2	The definition of the expressions in the Rule.
II Establishment of Environmental Impact Assessment process	
Article 3	Any project or business or activity undertaken in Myanmar by any ministry, government department, organization, corporation, local government, which likely to have significant impact on environment, is required to undertake EIA.
Article 4	MOECAF is the Executive Agency for the purpose of the Rule.
	EIA Committee shall be established and the committee will give environmental approval with the recommendation of MOECAF.
	Any projects which require IEE or EIA shall not be issued a permit by the MIC or any relevant authority without written approval of MOECAF.
	For projects involving facilities which already exist or under construction, the owner will undertake environmental/social compliance audit to identify concerns related to impacts on involuntary resettlement and indigenous peoples, and take appropriate actions.
Article 5	a) The powers and functions of the MOECAF under the Procedure are as follows: (1) to identify project screening criteria (2) to approve guidelines for IEE or EIA (3) to review and approve IEE/EIA report (4) to evaluate Environmental Management Plan (EMP) (5) to monitor and enforce implementation of the EMP (6) Others
	b) The functions and duties of the EIA Committee under the Procedure are: (1) to recommend approval of project screening criteria to MOECAF (2) to recommend approval of IEE/EIA report to MOECAF (3) to recommend approval of the EMP to MOECAF
Article 6	MOECAF shall arrange, as it deems necessary, for public participation of civil society and relevant agencies in the conduct of IEE/EIA and in the implementation of EMP
III Screening	
Article 7	The project shall present the project proposal for screening to MOECAF.
Article 8	Schedule I and II are defined as the criteria for conduct of IEE/EIA.
Article 9	Schedule III is also defined as sensitive areas where no project shall be conducted.

IV Scoping	
Article 12	All proponents for the projects that are required to carry out a full EIA, either by virtue of Schedule II or III or by order of the MOECAF shall conduct scoping process.
V Investigation	
Article 13	Project proponent shall carry out a full analysis and investigation of all the potential environmental impacts, both adverse and beneficial of the proposed project.
VI Reporting, review and approval	
Article 14	Project proponent required to carry out EIA shall prepare EIA report in the format defined by MOECAF.
Article 15	Upon receipt of the IEE/EIA report including EMP,MOECAF shall invite the relevant agencies, institutions, civil society organizations, and project-affected persons to provide comments and suggestions on the report.
Article 16	MOECAF shall approve or refuse the IEE/EIA report as a basis for environmental clearance on the recommendation of EIA Committee.
VII Monitoring	
Article 18	MOECAF shall carry out monitoring of the implementation of the approved EMP by the project proponent.

Source: Compiled from Environmental Impact Assessment Procedures (Draft)

3) IEE/EIA required projects

Lists of projects, which are required of IEE/EIA are provided in Schedule I and II of the EIA Procedures.

(1) Schedule I projects

All projects that are likely to have some adverse environmental impacts, but of lesser degree and/or significance than those of Schedule II projects, an Initial Environmental Examination (IEE) is required to determine whether or not significant environmental impacts warranting an EIA (full EIA) are likely. If the EIA is not required, the report of the IEE is regarded as the final environmental assessment report.

(2) Schedule II projects

All projects that are likely to have potential for significant adverse environmental impacts, an EIA (full) is required to address such significant impacts.

Lists of IEE/EIA required projects related to transport development are shown in Table 3.2.3.2.

Table 3.2.3.2 List of IEE/EIA required Transport Project of Infrastructure Development

Purpose and type of project	Project feature (size, etc.)
(I) IEE required project (Schedule I)	
1) River Training Works	All projects
2) Construction of Bridges	more than 50 feet and less than 200 feet
3) Port Development	All projects
(II) EIA (full EIA) required project (Schedule II)	
1) Construction of Highways and fly-over	all projects if recommended by IEE
2) Ports Development	all projects if recommended by IEE
3) Construction of Subways	all projects if recommended by IEE
4) Construction of Bridges	more than 200 feet
5) Construction of Shipyards	dead weight tonnages greater than 5,000 tons
6) Construction of Airports	airstrips of 8,200 feet (2,500 meters) or longer
7) Construction of Railways including Construction of new routes	all projects if recommended by IEE

Note: Project activities other than new construction such as rehabilitation, extension and/or improvement are not clearly stipulated.

Source: Compiled from Environmental Impact Assessment Procedures (Draft, 2013)

(3) Schedule III

In addition, Schedule III identifies environmentally, ecologically and socio-culturally sensitive areas which should not be included in any development project and a reasonable distance should be ensured from such areas so as not to cause any permanent damage or result in any adverse environmental, ecological or social impacts. (Table 3.2.3.3)

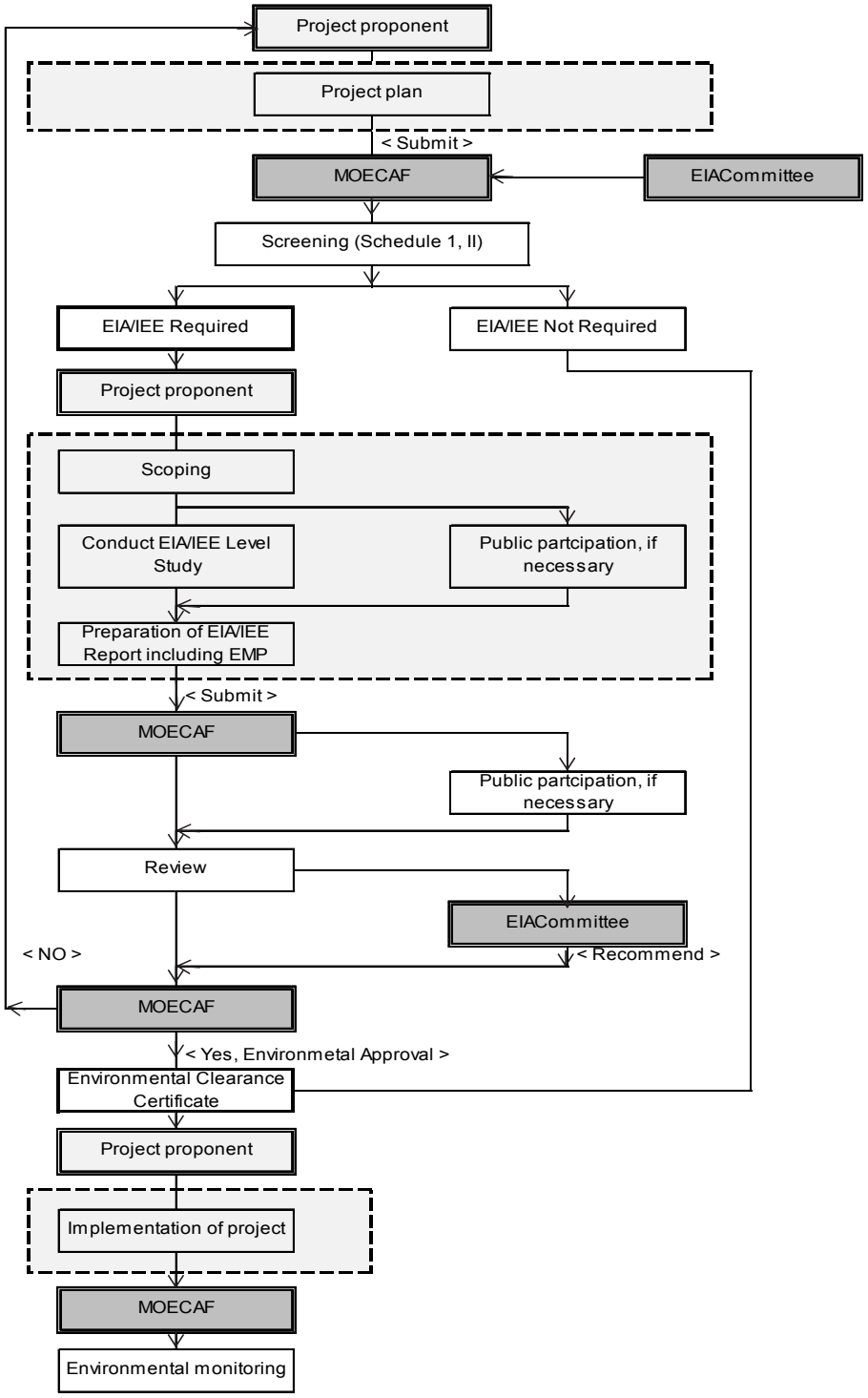
Table 3.2.3.3 Environmentally, Ecologically and Socio-cultural Sensitive Area (Schedule III)

No.	Sensitive Areas
1	Areas of unique historical, cultural, archaeological, scientific or geographical significance
2	Wetlands
3	Ecologically fragile area
4	National parks, wildlife sanctuaries and protected areas
5	Wilderness areas containing rare or endangered species of flora or fauna and their habitat
6	Areas susceptible to natural hazards
7	Major sources of public drinking water
8	Areas surrounding lakes and reservoirs
9	Resort areas and areas closed to oyster fishing and pearl farms areas
10	Flooded of flood plain on other or other hazardous zones

Source: Environmental Impact Assessment Procedures (draft, 2013)

4) Processes of Environmental approval

Schematic processes of Environmental approval in the EIA Procedures are shown in Figure 3.2.3.2.



Note: MOECAF - Ministry of Environmental Conservation and Forests
Source: Enivironmental Impact Assessment Procedures (Draft, 2013)

Figure 3.2.3.2 Schematic Processes of Environmental Approval

5) Gaps of Environmental and Social Considerations between Myanmar legislation and JICA Guidelines

At present roles and importance of environmental and social considerations in the planning and implementation of projects are not necessarily recognized in Myanmar. To cope with this, the Environmental Conservation Law was just enacted in 2012 and EIA Procedures were proposed as described the above.

Regarding policies for environmental and social considerations, those of JICA guidelines are basically same as those of World Bank and ADB.

Table 3.2.3.4 shows results of comparison between the policies of Myanmar legislations including the EIA Procedures and those of JICA Guidelines. It is found that there are still considerable gaps between Myanmar legislations and JICA Guidelines.

Table 3.2.3.4 Gaps between the JICA Guidelines for Environmental and Social Considerations (JICA Guidelines) and Myanmar legislations

JICA Guidelines/WB OP4.12	Legislation of Myanmar	Gaps between JICA Guidelines/WB OP4.12 and Law of Myanmar
(1) **Underlying Principles**		
1. Environmental impacts that may be caused by projects must be accessed and examined in the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan.	Procedures (A 9,13)	Article 9 of the Procedures requires IEE or EIA for proposed projects based on types activities according to the defined thresholds.
		Article 13 of the Procedures stipulates to analyze feasible alternatives as well as mitigation measures. There is no description which stipulates the timing of above implementation.
2. Such examinations must be endeavored to include an analysis of environment and social costs and benefits in the most quantitative terms possible, as well as a qualitative analysis; these must be conducted in close harmony with the economic, financial, institutional, social and technical analyses of projects.	Procedures (A 13)	Article 13 of the Procedure stipulates to analyze feasible alternatives, mitigation measures as well as cost and benefit.
3. The findings of the examination of environmental and social considerations must include alternatives and mitigation measures, and must be recorded as separate documents or as a part of other documents. EIA reports must be produced for projects in which there is a reasonable expectation of particularly large adverse environmental impacts.	Procedures (A 9,13,14)	Article 9 of the Procedures requires IEE or EIA for proposed projects based on types to projects activities according to the defined thresholds. Article 13 of the Procedure stipulates to analyze feasible alternatives as well as mitigation measures.
		Article14 of the Procedures requires the preparation of EIA report for the EIA required project and preparation of EMP for IEE/EIA required project. On the other hand, there is no description so far which stipulates IEE report for IEE require project.
4. For projects that have a particularly high potential for adverse impacts or that are highly contentious, a committee of experts may be formed so that JICA may seed their opinions, in order to increase accountability.	Procedures (A 4)	Article 4 of the Procedures requires the establishment of EIA Committee composed of at least five persons with necessary expertise.
		The committee's duty is to recommend approval of the submitted IEE/EIA and EMP.
(2) Examination of Measures		
1. Multiple alternatives must be examined in order to avoid or minimize adverse impacts and to choose better project options in terms of environment and social considerations. In the examination of measures, priority is to be given to avoidance of environmental impacts; when this is not possible, minimization and reduction of impacts must be considered next. Compensation measures must be examined only when impacts cannot be avoided by any of the aforementioned measures.	Procedures (A 13)	Article 13 of the Procedures stipulates to investigate of all potential environmental impacts including an analysis of feasible alternatives and mitigation measures. Conduct of compensation measure is not stipulated in the Procedures.
2. Appropriate follow-up plan and system, such as monitoring plans and environmental management plants, must be prepared; the costs of implementing such plans and systems, and the financial methods to find such costs,	Procedures (A 13,14)	Article 13 of the Procedures stipulates to analyze feasible alternatives, mitigation measure as well as cost & benefit.

JICA Guidelines/WB OP4.12	Legislation of Myanmar	Gaps between JICA Guidelines/WB OP4.12 and Law of Myanmar
must be determined. Plans for projects with particularly large potential adverse impact must be accompanied by detailed environmental management plans.		Article 14 of the Procedures requires the preparation of EMP for IEE/EIA required project.
(3) Scope of Impacts to Be Assessed		
1. The impacts to be accessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accident, water usage, climate change, ecosystem, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood , utilization of land and local resources, social institution such as social capital and local decision-making institution, existing social infrastructure and services, vulnerable	Procedures (A 13)	The items of likely impacts are not clearly stated in the Procedures. Article 13 of the Procedures prescribes that a project proponent shall carry out a full analysis and investigation of all the potential impacts, both adverse and beneficial, of the proposed projects.
2. In addition to the direct and immediate impacts of projects, their derivative, secondary, and cumulative impacts as well as the impacts of projects that are indivisible from the project are also to be examined and assessed to a reasonable extent. It is also desirable that the impacts that can occur at any time throughout the project cycle should be considered throughout the life cycle of the project.	None	No laws were identified, which mentioned assessment and examination of derivative, secondary, and cumulative impacts as well as the impacts of projects which are indivisible from the project in a reasonable extent.
(4) **Compliance with Laws, Standards, and Plans**		
1. Projects must comply with the laws, ordinances, and standards related to environmental and social considerations established by the governments that have jurisdiction over project sites (including both national and local governments). They must also conform to the environmental and social consideration policies and plans of the governments that have such jurisdiction.	The Environmental Conservation Law 2012 (A 28, 29)	No law directly prescribes that projects must comply with the laws, ordinances, and standards related to environmental and social considerations. Article 28 of The Environmental Conservation Law prescribes that “No one shall, without the prior permission, operate business, work-site or factory, workshop which is required to obtain the prior permission under this Law” Article 29 of the law stipulated that “No one shall violate any prohibition contained in the rules, notifications, orders, directives and procedures issued under this Law.”
2. Projects must, in principle, be undertaken outside of protected areas that are specifically designated by laws or ordinances for the conservation of nature or cultural heritage (excluding projects whose primary objectives	Procedures (A 8)	Schedule 3 stipulated by Article 8 of the Procedures prescribes that projects must, in principle, be undertaken outside of Environmentally, Ecologically and Socio-culturally Sensitive Area.

JICA Guidelines/WB OP4.12	Legislation of Myanmar	Gaps between JICA Guidelines/WB OP4.12 and Law of Myanmar
are to promote the protection or restoration of such areas). Projects are also not to impose significant adverse impacts on designated conservation areas.	The Protection and Preservation of Cultural Heritage Regions Law (Article 18)	This law stipulates that no person shall construct, extend, renovate a building or extend the boundary of ancient monumental zone or ancient site zone without prior permission granted under this law.
(5) **Social Acceptability**		
1. Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which they are planned. For projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans.	Procedures (A 6,15)	Article 6 of the Procedures stipulates that MOECAF shall arrange for public participation of civil society and relevant agencies in conduct of IEE/ EIA and EMP.
		Article 15 of the Procedures stipulates that MOECAF shall invite civil society organizations and affected persons to provide comments and suggestions on IEE/ EIA report.
2. Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, and the poor and ethnic minorities, all members of which are susceptible to environmental and social impacts and may have little access to decision-making processes within society.	Procedures (A 4)	Article 4 of the Procedures prescribes implementation of necessary actions for the project which potentially gives adverse impact on indigenous people and causes involuntary resettlement. However, the details of actions are not provided in the Procedures.
(6) **Ecosystem and Biota**		
1. Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests.	The Environmental Conservation Law 2012 (A 18)	The Environmental Conservation Law prescribes that relevant government departments/organizations shall carry out conservation, management, beneficial use, sustainable use and enhancement regional cooperation of environmental natural resources.
	The Forest Law 1992 (A 40)	Article 40 of the Forest Law (1992) prescribes that cause of any damage to reserved forest and its environment is prohibited and will be punished.
	The Protection of Wildlife and Conservation of Natural Areas Law 1994 (A 36)	Article 36 of The Protection of Wildlife and Conservation of Natural Areas Law prescribes that cause of any damage to protected areas is prohibited and will be punished.
2. Illegal logging of forests must be avoided. Project proponents etc. are encouraged to obtain certification by forest certification systems as a way to ensure the prevention of illegal logging	The Forest Law 1992 (A 17, 40)	The Law stipulates that forest produce may only be extracted after obtaining a permit.
(7) **Involuntary Resettlement**		

JICA Guidelines/WB OP4.12	Legislation of Myanmar	Gaps between JICA Guidelines/WB OP4.12 and Law of Myanmar
1. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected.	Procedures (A 4)	The Procedures prescribes implementation of necessary actions for the project which potentially gives impact on involuntary resettlement. However, the details of actions are not provided in the Procedures.
2. People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by project proponents etc. in a timely manner. Prior compensation, at full replacement cost, must be provided as much as possible. Host countries must make efforts to enable people affected by projects and to improve their standard of living, income opportunities, and production levels, or at least to restore these to pre-project levels. Measures to achieve this may include: providing land and monetary compensation for losses (to cover land and property losses), supporting means for an alternative sustainable livelihood, and providing the expenses necessary for the relocation and re-establishment of communities at resettlement sites.	Land Acquisition Act 1894 (A 3)	Article 3 of the Land Acquisition Act stipulates that a person who has right in land would be entitled to claim a compensation if the land were acquired under this Act.
	Farmland Rules 2012 (A 64)	Article 64 of Farmland Rules stipulates compensation in farmland acquisition for the interest of the State or public.
	Land Acquisition Act 1894 (A 23)	Article 23 of the Act stipulates that damages on standing crops and trees, on land, properties, incidental to relocate residence or business and losses of profits due to land acquisition are considered for compensation although it does not clearly state to support PAPs can improve or at least restore their standard of living. However, these laws do not clearly state any more details of compensation and supporting measures.
3. Appropriate participation by affected people and their communities must be promoted in the planning, implementation, and monitoring of resettlement action plans and measures to prevent the loss of their means of livelihood. In addition, appropriate and accessible grievance mechanisms must be established for the affected people and their communities.	Procedures (A 15)	Article 15 of the Procedures describes that relevant agencies, institutions, civil society organizations, and project-affected persons are invited as appropriate to provide comments and suggestions on the IEE/ EIA/ EMP reports. However, it does not describe resettlement action plan.
	Land Acquisition Act 1894 (A 5A, 18)	Article 5A of the Land Acquisition Act stipulates that any person whose land is affected (acquired) can claim the objection for the land acquisition within thirty
4. For projects that will result in large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. It is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP4.12, Annex A.	None	No laws were specifically mentioned about the requirement of resettlement action plans for large-scale involuntary resettlement.
		According to GAD of MOHA Land Acquisition and Resettlement Action Plan (LARAP) will be required for the large-scale developments and the GAD will approve it.
(8) Indigenous People		

JICA Guidelines/WB OP4.12	Legislation of Myanmar	Gaps between JICA Guidelines/WB OP4.12 and Law of Myanmar
1. Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures must be taken to minimize impacts and to compensate indigenous people for their losses.	Procedures (A 4)	The Procedures prescribes implementation of necessary actions for the project which potentially gives impacts on indigenous people without the details.
2. When projects may have adverse impacts on indigenous people, all of their rights in relation to land and resources must be respected in accordance with the spirit of relevant international declarations and treaties, including the United Nations Declaration on the Rights of indigenous Peoples. Efforts must be made to obtain the consent of indigenous peoples in a process of free, prior, and informed consultation.		
3. Measures for the affected indigenous peoples must be prepared as an indigenous peoples plan (which may constitute a part of other documents for environmental and social consideration) and must be made public in compliance with the relevant laws and ordinances of the host country. In preparing the indigenous peoples plan, consultations must be made with the affected indigenous peoples based on sufficient information made available to them in advance. When consultations are held, it is desirable that explanations be given in a form, manner, and language that are understandable to the people concerned. It is desirable that the indigenous peoples plan include the elements laid out in the World Bank Safeguard Policy, OP4.10, Annex B.		
(9) Monitoring		
1. After projects begin, project proponents etc. monitor whether any unforeseeable situations occur and whether the performance and effectiveness of mitigation measures are consistent with the assessment's prediction. They then take appropriate measures based on the results of such monitoring.	Procedures (A - 18)	The Procedures prescribes that a project proponent shall prepare and submit an EMP with the IEE/ EIA reports. The MOECAF shall carry out monitoring of the implementation of the approved EMP by the project proponent although there was little information regarding the method or terms of the monitoring conduction.
2. In cases where sufficient monitoring is deemed essential for appropriate environmental and social considerations, such as projects for which mitigation measures should be implemented while monitoring their effectiveness, project proponents etc. must ensure that project plans include feasible monitoring plans.	None	

JICA Guidelines/WB OP4.12	Legislation of Myanmar	Gaps between JICA Guidelines/WB OP4.12 and Law of Myanmar
3. Project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders.	None	No laws were identified, which stated that project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders.
(10) Others		
1. Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6)	Land Acquisition Act of 1894 (A 4)	Article 4 of the Act stipulates that a notification of land requirement for public purposes is published to start surveys and land marking although it does not state the details of surveys to establish eligibility through an initial baseline survey (including population census).
2. Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para.15)	Land Acquisition Act of 1894 (A 9)	Article 9 of the Act stipulates regarding occupier (if any) of land and all persons known or believed to have rights on lands are notified or invited for explanations although the eligibility is not clearly prescribed in the Act.
3. Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WBOP4.12 Para.11)	None	No law was identified on preference to land-based resettlement strategies for displaced persons.
4. Provide support for the transition period (between displacement and livelihoods are land-based. (WB OP4.12 Para 6)	None	No law was identified on the provision of support for the transition period.
5. Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line , landless, elderly women and children, ethnic minorities etc. (WB OP4.12Para.8)	None	No law was identified on particular attention to vulnerable groups.
6. For projects that entail land acquisition or involuntary resettlement for fewer than 200 people, abbreviated resettlement plan is to be prepared, (WB OP4.12 Para.25)	None	No law was identified on the criteria of preparing abbreviated resettlement plan.

Note: JICA - JICA Guidelines for Environmental and Social Considerations, WB - World Bank Safeguard Policy, Procedures - Environmental Assessment Procedures (Draft, 2013,by MOECAF), A - Article.

Source: JICA Guidelines for Environmental and Social Considerations (2010.4) and World Bank OP 4.12 and relevant Myanmar legislation

6) Environmental Quality Standards

In Article 10 of the Environmental Conservation Law, 2012, MOECAF may, with the approval of the Union Government and the Committee, stipulate the environmental quality standards for items such as surface water quality, underground water quality, air quality, noise and vibration etc., although the standards have yet been established until November 2013.

However, some emission and/or discharge standards and environmental standards have been established by other ministries and practically used standards and/or guidelines as references.

(1) Pollution control standards at generation source

The Private Industrial Enterprise Law (1990) stipulates that one of the basic principles of the law is to avoid or reduce to the usage of the technology which causes environmental pollution. In addition, the law also stipulates that one of the duties of Ministry of Industry (MOI) is to secure or not allow any pollution to cause any adverse effect on environment as well as health of residents and factory workers.

Standing Order 3/95, Water and Air Pollution Control Plan (MOI) stipulates that factories shall conduct monitoring of wastewater for items defined in the Order and emission and effluent standards as shown in Table 3.2.3.5 and Table 3.2.3.6.

Table 3.2.3.5 Emission Standards

Gas	mg/m^3	ppm
CO_2	9000	500
CO	55	50
H_2S	14	10
Ammonia	18	25
Benzene	30	10

Source: MOI Standing Order 2/95 Occupational Health Plan 1995

Table 3.2.3.6 Effluent Standard

Item	Threshold	Standard Value
BOD(5days at 20°C)	max	20ppm or more but not exceeding 60ppm,depending on geography of waste discharging point
Suspended solids	max	30 ppm
Dissolve solids	max	2000 ppm
pH Value	Between 5 and 9	
Permanganate value	max	60 ppm
Supplied (as H2S)	max	1 ppm
Cyanide (as HCN)	max	0.2 ppm
Oil and grease	max	5 ppm
Tar	none	
Formaldehyde	max	1 ppm
Phenols and cresols	max	1 ppm
Free chlorine	max	1 ppm
Zinc	max	5 ppm
Chromium	max	0.5 ppm
Arsenic	max	0.25 ppm
Copper	max	1.0 ppm
Mercury	max	0.005 ppm
Cadmium	max	0.03 ppm
Barium	max	1.0 ppm
Selenium	max	0.02 ppm
Lead	max	0.2 ppm
Nickel	max	0.2 ppm
Insecticides	none	
Radioactive materials	none	
Temperature	max	40° C
Color and Odor	Not objectionable when mixed in receiving water	

Source: MOI Standing Order 3/95: Water and Air Pollution Control Plan

(2) Regulation of wastewater discharge in YCDC area

Section 7 (7) of the YCDC Order No. 10/ 99 prohibits discharging of wastewater into common properties. Nobody shall be allowed to dispose and/ or flow sewage and wastewater from any activity, such as business, factory, into drainage, creeks and rivers without necessary treatment for compliance with standards, norms and criteria designated by the agency concerned. Effluent standards from factories and facilities are shown in Table 3.2.3.7.

Table 3.2.3.7 Effluent Standards for Wastewater from Factory and Facilities

	Item	Value
1	pH	6-9.6
2	BOD	20-60 ppm
3	COD	< 200 ppm
4	TS	up to 2000 ppm
5	SS	up to 500 ppm

Source: Proposed National Standard from Occupational Health Division, Department of Health under Ministry of Health

(3) Water Quality Standards

With regard to the water quality, however, the guidelines proposed in the workshops in 1990 and 2011 (Draft), and the World Health Organization (WHO) Guidelines were compared in Table 3.2.3.8. Compared with 1990, the values for 2011 tended to be closer to the WHO Guideline. However, for copper and iron, the values are less strict than in the WHO Guidelines.

Table 3.2.3.8 Water Quality Standard in Myanmar

No.	Parameters	Unit	Myanmar Standard		WHO Guideline
			1990	2011 (Draft)	
1	pH	-	6.5-9.2	6.5-8.5	Preferably<8.0
2	Turbidity	NTU	20	5	5
3	Colour	Pt-unit	6.5-9.2	15	15
4	Aluminum (Al)	mg/l	0.2	0.2	0.2
5	Arsenic (As)	mg/l	0.05	0.05	0.01
6	Calcium (Ca)	mg/l	75-200	100	-
7	Chloride (Cl)	mg/l	200-600	250	250
8	Copper (Cu)	mg/l	1.0	2.0	1.0
9	Cyanide (CN)	mg/l	0.05	0.07	0.07
10	Hardness	mg/l	500	500	-
11	Iron (Fe)	mg/l	0.5-1.5	1	0.3
12	Manganese (Mn)	mg/l	0.3	0.3(0.1)	0.1
13	Lead (Pb)	mg/l	0.05	0.01	0.01
14	Magnesium (Mg)	mg/l	30-150	500	-
15	Nitrate (NO_3)	mg/l	10(as N)	50	-
16	Sulfate	mg/l	400	250	250
17	Total dissolved	mg/l	1000	1000	1000
18	Zinc (Zn)	mg/l	5-15	3	3
19	Total Coliform	No/100ml	0	0	0
20	*E.Coli*	No/100ml	0	0	0

Source: The Study on the Improvement of Water Supply and Wastewater Treatment in Yangon (2012, METI, Japan)

7) Land acquisition and resettlement

(1) Legislation Related to Land Acquisition

The Land Acquisition Act 1894 promulgated in the British Colonial Era is even now the core law for land acquisition and resettlement in Myanmar. The contents of the Act are shown in Table 3.2.3.9. According to the State Constitution (2008), 'The Union is the ultimate owner of all lands and all natural resources above and below the ground, above and beneath the water and in the atmosphere in the Union'. Although the socialist system was abolished in 1988, the existing land law and directions are still in effect today without formal revision.

Table 3.2.3.9 Contents of Land Acquisition Act 1894

Part I	Preliminary
Part II	Acquisition
Part III	Reference to Court and Procedure Thereon
Part IV	Apportionment of Compensation
Part V	Payment
Part VI	Temporary Occupation of Land
Part VII	Acquisition of land for Companies
Part VIII	Miscellaneous

Source: Land Acquisition Act, 1894

There are many significant laws which govern land issues, land administration, and land ownership in Myanmar such as Land Nationalization Act (1953), Disposal of Tenancies Law(1963), Land Acquisition Act(1894), Forest Law(1992), Farm Land Law (2012), and so on (See Table 3.2.1.1).

(2) Types and Classes of Land

From an administrative point of view, land can be classified into the following eleven categories.

(i) **Freehold Land:** Freehold land can be interpreted as "ancestral land". It is transferable in accordance with the "Land Acquisition Act".

(ii) **Grant Land:** "Grant land" is owned by the government. Land of the government may be disposed by grant or lease to any person or entity for a stipulated period. The lease period could range from 10 years, to 30 years or even up to 90 years, etc.

(iii) **Agricultural Land:** "Agricultural land" is defined as "land being utilized or kept in possession for agriculture purposes". All agricultural lands became under exclusive state-ownership with the enactment of the "Land Nationalization Act" in 1953. Agricultural land is not transferable in accordance with the act.

(iv) **Garden Land:** "Garden land" is a kind of "agricultural land", but the type of crop(s) grown in the garden land is different from those usually grown in the agricultural land.

(v) Grazing Land: Grazing land is stipulated in the Nationalization Act (1953) as grazing of cattle and no revenue is expected from the levy.

(vi) Cultivable Land, Fallow Land, and Waste Land: This is a land which the right to cultivate/utilize may be granted by the government to state-owned economic organizations etc. A maximum period of 30 years may be granted to cultivate/utilize the land.

(vii) Forest Land: "Forest land" is declared and administered in accordance with the "Forest Law". Permission is required from the ministry in extracting timber, cutting fire-wood, producing charcoal, etc.

(viii) Town Land: In most cases it could be classified under either "freehold land" or "grant land". However, the land belongs to a specific categorization because the town is the owner of the land.

(ix) Village Land: Village land also belongs to a specific categorization like "town land" because the village is the owner of the land.

(x) Cantonments: "Cantonments" is a specific type of land acquired by the government for exclusive use by the military. The land will be acquired under the "Land Acquisition Act" and exempted from land tax.

(xi) Monastery Land: The land which the Ministry of Home Affairs may declare as "monastery land" and it is obtained based on the "Land Acquisition Act".

(3) Land acquisition process

According to the Land Acquisition Act 1984, land acquisition process are summarized to following 5 steps and shown in Figure 3.2.3.3.

(i) Preliminary investigation,

A notification is publicized in gazette and the substance of public notice is given at convenient places. Preliminary investigations are conducted, which include any surveys, digging/boring, delineation of the land boundaries.

(ii) Hearing of objections,

Objection to the land acquisition are collected in writing within 30 days. The Collector examines the objections and make consensus against the objections. If the Collector decides necessity, a report containing recommendations on the objections is submitted to the President of Union for the decision.

(iii) Declaration of intended acquisition,

The declaration of land acquisition is publicized in the Gazette, and stated at the district or other territorial division in which the land situates. The declaration includes the purposes, approximate area, location and plan.

(iv) Enquiry into measurements, value and claims, and award by the collector,

(iv-1) The Collector marks out and measures the land, and give the public notice at convenient places near the land. The notice is also provided to persons known or believed to be interested in the land.

(iv-2) Examination of Award (Area of Land and Compensation)

The Collector proceeds to inquire into objections to the measurement, the value of the land at the date of the publication of the notification, the respective eligibilities to claim the compensation and examines an award based on the area of the land, compensation including opinions of PAPs and the apportionment of compensation among PAPs.

The award is filed for conclusive evidence between the Collector and the persons interested in the land. The Collector immediately notices the awards to the persons who are not presented or their representatives when the award made.

The Collector makes any efforts to fix the enquiry.

(iv-3) Grievance

If deliberation reaches agreement, Award Committee issues the decision concerning type and amount of compensation. If not reach agreement, the deliberation is continued until reach agreement. If the affected people and Award Committee cannot conclude with the further deliberation meeting, GAD can intermediate between them.

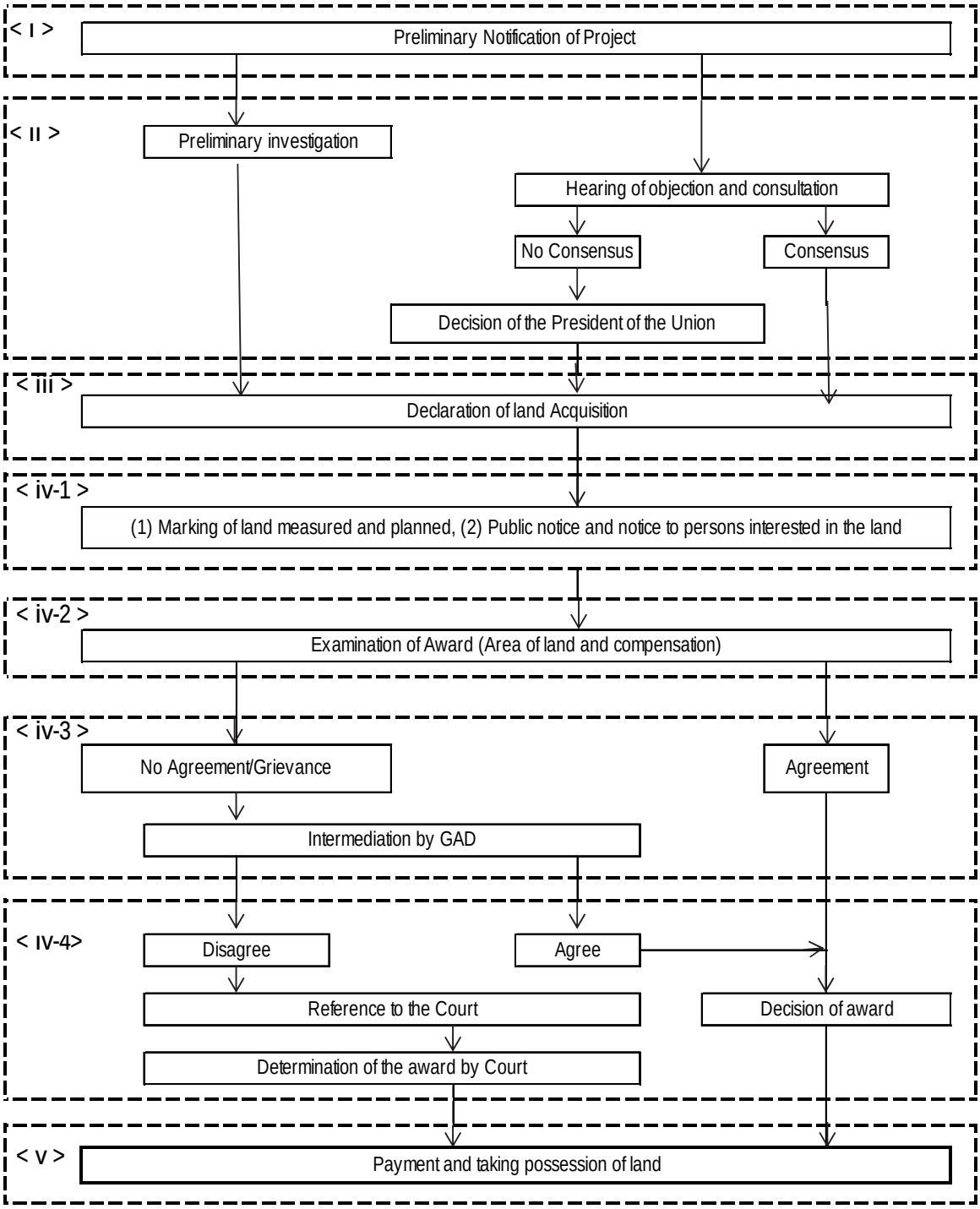
(iv-4) Reference to Court

Any person interested in the land who do not accept the award can required that the matter be referred by the Collector for the determination of the Court with written application, whether the objection to the measurement of the land, the amount of the compensation, the person to whom it is payable, or the apportionment of the compensation among the persons interested.

If the persons agree the compensation, the particular are specified in the award for the conclusive evidence. If any disputes arise, the Collector may refer the disputes to the decisions of the Court.

(v) Payment and Taking possession of land

The Collector pays compensation and takes possession of the land. The Collector gives the persons sufficient time to remove their property without inconvenience before taking possession.



Source: YUTRA Project Team (2013)

Figure 3.2.3.3 Flow of Land Acquisition under Myanmar Legislation

(4) Gaps of Involuntary Resettlement Policy between Myanmar Legislation and JICA Guidelines

Although Land Acquisition Act was promulgated in 1894, the Act may cover the fundamental policies of compensation for land acquisition in Myanmar.

Table 3.2.3.10 summarizes the results of comparison between the JICA Guidelines/the

World Bank's safeguard policies and Myanmar legislation on land acquisition and involuntary resettlement. There are found several gaps between them. For example, neither the avoidance and minimization of involuntary resettlement and loss of livelihood nor the requirement of preparation of Resettlement Action Plan is stated in any law. For the compensation only market value of the land is considered. No law is identified on the participation of project Affected Persons (PAPs) in public consultation in the land acquisition and resettlement procedures.

Table 3.2.3.10 Gaps of Involuntary Resettlement Policy between Myanmar Legislation and JICA Guidelines

No.	JICA Guidelines/World Bank	Laws of Myanmar	Gaps between JICA Guidelines/World Bank and Laws of Myanmar
1	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICAGL)	None	No law was identified
2	When population displacement is unavoidable , effective measures to minimize impact and to compensate for losses should be taken.(JICAGL)	Land Acquisition Act of 1894 (Article 3)	Article 3 of the Land Acquisition Act stipulates that a person who has right in land would be entitled to claim compensation if the land were acquired under this Act. However, it does not state effective measures to minimize impact.
		Farm Land Law of 2012 (Article 26)	Article 26 of the Farmland Law of2012 stipulates that suitable compensation and indemnity in farmland acquisition for the interest of the State or public would be taken.
		Farmland Rules of 2012 (Article 64)	Article 64 of the Farmland Rules of 2012 stipulates that the compensation in farmland for the interest of the State or public would be taken.
3	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.(JICAGL)	Land Acquisition Act of 1894 (Article 23)	Land Article 23 of the Act stipulates that damages on standing crops and trees, land, properties, incidentals to relocate residence or business and losses of profits due to land acquisition are considered for compensation although it does not clearly state to support PAPs can improve or at least restore their standards of living.
4	Compensation must be based on the fu11 replacement cost.as much as possible. (JICAGL)	Land Acquisition Act of 1894 (Article 23)	Article 23 of the Act stipulates that "the market value of the land at the date of the publication of the notification" is considered, although it does not state "the full replacement cost."
5	Compensation and other kinds of assistance must be provided prior to displacement. (JICAGL)	Land Acquisition Act of 1894 (Article 23)	Article 23 of the Act stipulates that damages on standing crops and trees, on land, properties, incidentals to relocate residence or business and

No.	JICA Guidelines/World Bank	Laws of Myanmar	Gaps between JICA Guidelines/World Bank and Laws of Myanmar
			losses of profits due to land acquisition.
6	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. (JICAGL)	None	No law specifica1ly mentions the requirement of resettlement action plans for large-scale involuntary resettlement.
7	In preparing a resett1ement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. (JICAGL)	None	Almost same as the JICAGL
8	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. (JICAGL)	None	Almost same as the JICAGL
9	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans. (JICAGL)	None	Almost same as the JICAGL
10	Appropriate and accessible grievance mechanism must be established for the affected people and their communities. (JICAGL)	Land Acquisition Act of 1894 (Article 5A, 18)	Article 5A of the Land Acquisition Act stipulates that any person whose land is affected (acquired) can object to the land acquisition within thirty days of the notification. Besides, Article 18 stipulates that any PAP who has not accepted the award can refer to the Court for determination.
11	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits (WBOP4.12 Para.6)	Land Acquisition Act of 1894 (Article 4)	Article 4 of the Act stipulates that a notification of land requirement for public purposes is published to start surveys and land marking although it does not state the details of surveys to establish eligibility through an initial baseline survey (including population census).
12	Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal right to the land they occupying. (WB OP4.12 Para.11)	Land Acquisition Act of 1894 (Article 9)	Article 9 of the Act stipulates regarding occupier (if any) of land and all persons known or believed to have rights on lands are notified or invited for explanations although the eligibility is not clearly prescribed in the Act.
13	Preference should be given to land-based resettlement strategies for displaced persons whose livelihood are land-based. (WB OP 4.12 Para.11)	None	No law was identified on preference to land-based resettlement strategies for displaced person.

No.	JICA Guidelines/World Bank	Laws of Myanmar	Gaps between JICA Guidelines/World Bank and Laws of Myanmar
14	Provide support for the transition period (between displacement and livelihood restoration). (WB OP 4.12 Para.6)	None	No law was identified on the provision of support for the transition period.
15	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities, etc. (WB OP4.12 Para.8)	None	No law was identified on particular attention to vulnerable groups.
16	For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared. (WB OP 4.12 Para. 25)	None	No law was identified on the criteria of abbreviated resettlement plan.

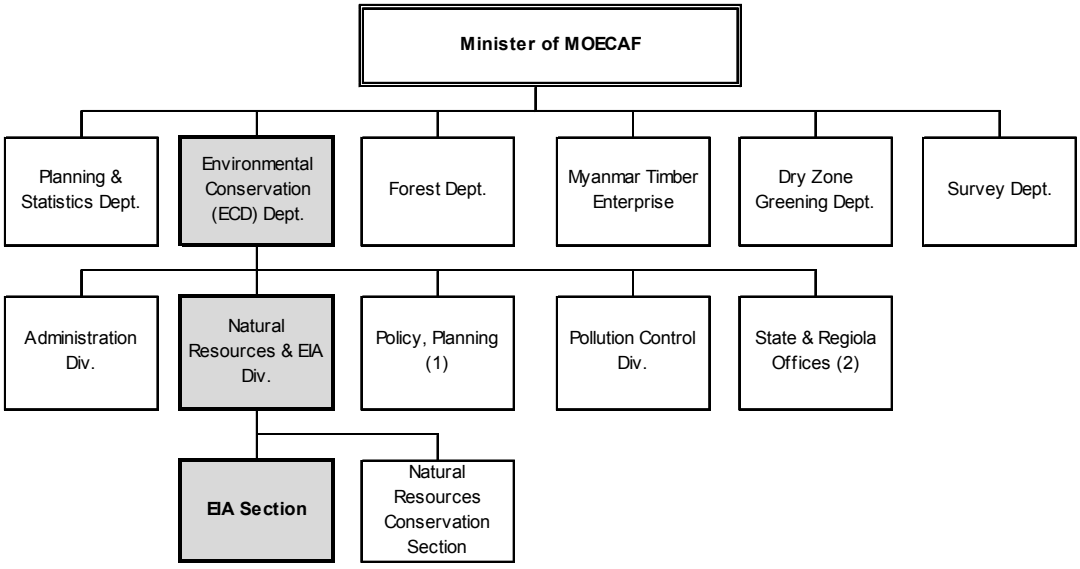
Source: Land related laws of Myanmar and JICA Guidelines (2010.4) and World Bank OP 4.12.

3.2.4 Institutional Framework

1) Institutional framework for environmental conservation

The Ministry of Forest was re-named as the Ministry of Environmental Conservation and Forestry (MOECAF) on September 6th 2011 in order to undertake both environmental and forest conservation and management more effectively. It is after about 90 years from 1923, when the Ministry of the same name was firstly formed.

MOECAF consists of six departments as shown in Figure 3.2.4.1. In MOECAF Environmental Conservation Department (ECD) is responsible for environmental affairs including EIA. ECD has four divisions with state and regional offices.



Note: (1) Policy, Planning & International Relations, Research and Extension Division, (2) State & Regional Offices (Yangon, Mandalay, Sagaing, Bago, Taninthari)
Source: Edited from documents by MOECAF

Figure 3.2.4.1 Organization Chart of MOECAF

Among them EIA Section has following duties and responsibilities:

- To develop EIA procedure and regulations to avoid, minimize and/or mitigate adverse environmental impacts,
- To monitor the implementation of environmental conservation,
- To review EIA reports for development projects.

2) Institutional Framework for Land acquisition and Resettlement

Agencies responsible for land acquisition differ from those of management of land acquisition as shown in Table 3.2.4.1.

Table 3.2.4.1 Responsible Agencies for Land Acquisition

Land		City Development Committee (CDC)	MOAI	MOECAF (Forest Dept.)	GAD (Ministry of Home Affairs)
1	Yangon, Nay Pyi Taw and Mandalay Cities	X			X
2	Farmland, vacant, fallow and virgin land		X		X
3	Forest lands			X	
4	Other town and village lands				X

Source: YUTRA Project Team (2013)

Role and function of organizations for implementing land acquisition are shown in Table 3.2.4.2.

Table 3.2.4.2 Role and Function of Organization for Implementing Land Acquisition

Organization	Role and Function
Land Administration Department (LAD)	1) For non-agricultural land, LAD at township level investigates land use, area size, landownership and tenant, and prepares necessary documents and maps for land acquisition. 2) The LAD routinely handles transfer of land titles or subdivisions of plots, etc. and prepares land lease certificates.
Settlement and Land Record Department (SLRD)	1) For agricultural lands, the SLRD under the MOAI at township level investigates area size and land ownership, prepares necessary documents and maps for land acquisition. 2) The SLRD surveys market prices of lands, buildings, crops and trees for compensation.
Award Committee	The Award Committee chaired by the respective Township Administrators is established to examine the award (entitlement, amount of compensation).
District Administrator	The District Administrator issues land lease grant for land not exceeding one (1) acre (The Lower Burma Town and Village Lands Manual, 1899).
General Administration Department (GAD), Ministry of Home Affairs (MOHA)	The GAD issues land lease grant for land exceeding five (5) acres (The Lower Burma Town and Village Lands Manual, 1899)

Source: YUTRA Project Team (2013)

3.3 Preparation of SEA Procedures

3.3.1 Strategic Environmental Assessment in Comprehensive Urban Transport Plan of the Greater Yangon

1) Background and Definition

The Environmental Impact Assessment (EIA) is widely recognized and utilized to be a useful tool to help the decision to implement or give permission to any individual project, by establishing necessary legislation and rules in many countries including Myanmar. But the environmental impact of policies, plans and programs of national or regional level was not subject to the traditional EIA scheme. Moreover the specifications of every project have already been developed when subject to the EIA, hence the range of alternatives to be taken is limited to “tactic” level such as to select other means to implement within the defined cadre of the project, to arrange countermeasures to relieve any negative impacts or to stop the implementation itself, which has been pointed out as a problem of EIA of individual project level. Therefore a comprehensive though conceptual approach to assess the environmental impact in early stage of planning or at upper level of policy development has been required, enabling even to change the policy framework and select drastic alternatives. The Strategic Environmental Assessment (SEA) has thus been developed as a system of incorporating “strategic” environmental and social considerations into policies, plans and programs of national, regional or sector level, providing necessary alternatives or decisions at upper level of policy making.

2) Components of SEA

In general the chief components of SEA are listed below:

(i) Complementary evaluation to the project level EIA.

(ii) Impact assessment to help the decision-making at the upper level of policy development;

(iii) Comprehensive assessment with integrated evaluation by environmental and social considerations as well as economic, financial and technical feasibility or political integrity factors at policy, plan and program level;

(iv) Consideration of alternatives;

(v) Public participation and information disclosure at the earlier stages;

(vi) Assessment of accumulated impacts beyond one project, if sub-projects are involved;

(vii) Rough evaluation of environmental impact and the countermeasures to relieve it to reflect to the EIA of individual project.

3) Role of SEA at Administrative Decision Level

As mentioned above, SEA is applied to formulation of policies, plans and programs at a higher administrative level of national, regional, sector and sub-sector. Necessary environmental and social considerations in relation to policies and plans are shown in Table 3.3.1.1.

Table 3.3.1.1 Development Plan and SEA/EIA

Development Plan			SEA/EIA	Environmental and Social Considerations (Transport Sector)
Level		Policy, Plan, Program, Project etc.		
1	National Level	National Policy, Strategy, Plan etc.	SEA	National Transport Policy, National Environmental Policy etc.
2	Regional Level	Regional development policy, master plan for several regions and cities	SEA	Regional level SEA -Regional environmental management policy, plan
3	Sector level	Master plan of nationwide and/or urban transport sector, etc.	SEA	Sector level SEA -Evaluation of policy, plan and/or program for nationwide and/or urban transport master plan
4	Selection of prioritized plan or project	Alternative transport plans and projects (road, railway, inland waterway, bridge, etc.)	SEA/EIA*	SEA/EIA* of plan and/or project alternatives - Evaluation of development plans/projects for road, railway, inland waterway, bridge, etc.
5	Implementation of project	Specific project (Feasibility Study) with pre-determined site and process etc.	EIA*	EIA* of projects for development for road, railway, bridge, etc.

Note: * EIA – including IEE level study.
Source: YUTRA Project Team

4) SEA Defined in JICA Guidelines

In JICA Guidelines, the following definition and explanation are given:

- 1.3 Definitions 7: A “strategic environmental assessment” is an assessment that is implemented at the policy, planning, and program levels, but not at project-level EIA;
- 1.4 “Measures for environmental and social considerations must be implemented from an early stage to a monitoring stage”: JICA applies SEA when conducting master plan studies and encourages project proponents to ensure environment and social considerations from the early stage to the monitoring stage.

However, there is no further detailed description of SEA as to the contents and methodology in the JICA Guidelines.

3.3.2 SEA in YUTRA

1) SEA Application to YUTRA

The master plan to be formulated by YUTRA is the road map for the sustainable urban transport development of Yangon. Thus it is imperative to reach a wide consensus among different stakeholders. For this objective, this project intends to adopt the SEA methodology based on the JICA Guidelines. SEA will be applied at the IEE level in the process of master plan formulation and selection of priority projects.

In addition, stakeholder meetings will be held when necessary. For the stakeholder meetings, workshops and seminars, citizen should preferably be invited as participants, although this is subject to the decision of the Yangon Region Government.

2) Methodology of Prioritization in Master Plan

A SEA will be applied as a systematic process for comprehensively evaluation, at earlier stage in the planning process, several alternative options for the overall development projects, thereby ensuring a full integration of the relevant environmental and social considerations as well as economic, engineering and financial aspects of the proposed Master Plan. A typical procedure of SEA in a Master Plan is shown in Figure 3.3.2.1 .

(i) Collection of baseline data and information: Baseline data and information should be collected for both anticipated activities due to plans and/or projects, and environmental and social considerations of targeted areas.

(ii) Identification of evaluation factors

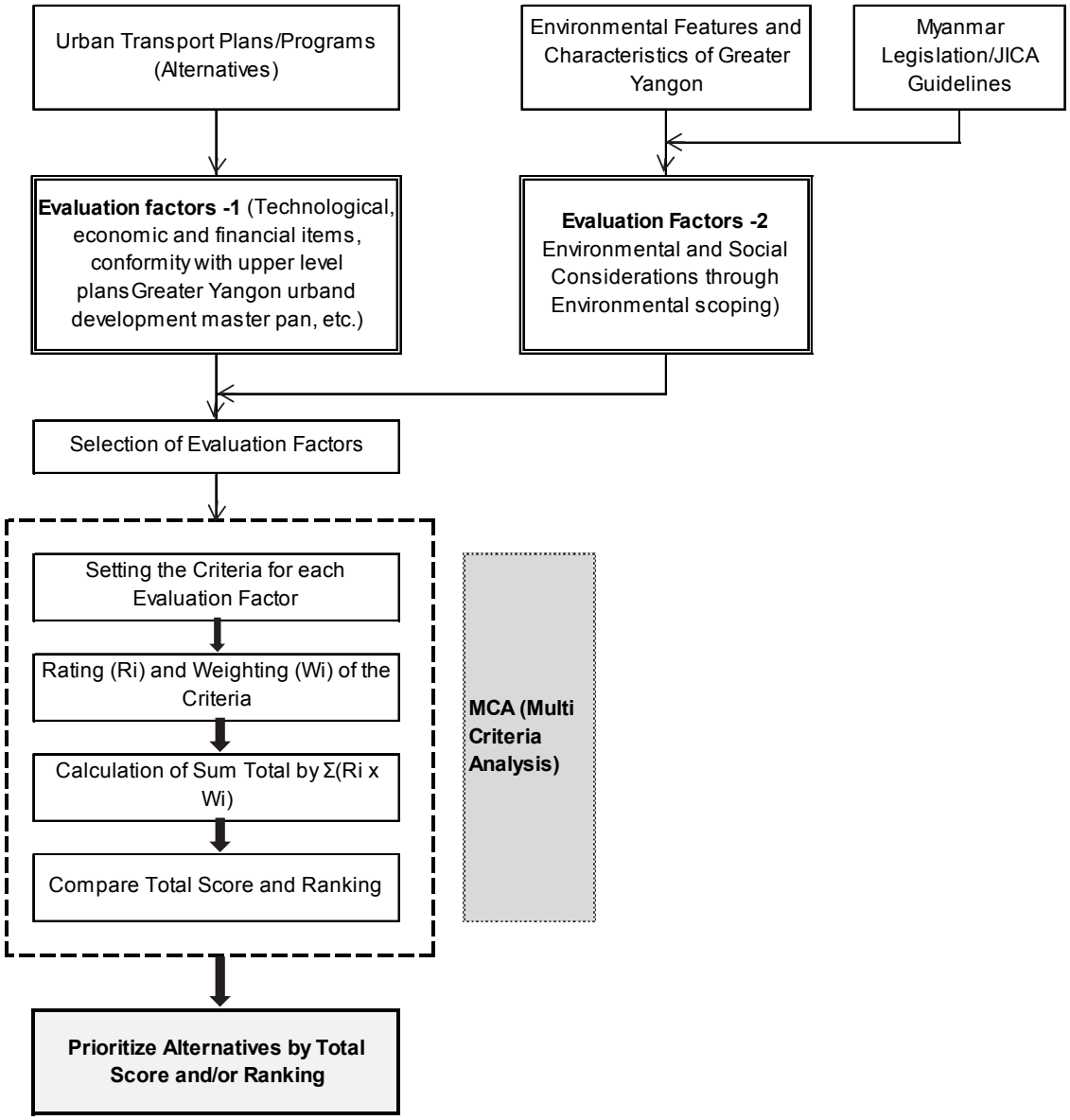
(iii) Setting the criteria for each evaluation factor

(iv) Rating and weighting of the criteria

(v) Calculation of total evaluation score: To reflect the significance of the evaluations, the total evaluation score will be calculated taking both rating and weights into account.

(vi) Comparison of total score and ranking: Ranking alternative plans/projects by comparing total score. Then prioritized plan/project will be selected referring to total score and/or ranking.

(vii) Qualitative evaluation will be added if necessary instead of the comparison of total score and ranking.



Source: YUTRA Project Team (2013)

Figure 3.3.2.1 Procedures of Prioritizing Candidate Projects in SEA

4 CONDUCT OF CAPACITY DEVELOPMENT

4.1 Overall Program of Capacity Development

The Working Group (WG) composed of various members of related organizations of the Yangon Region Government was established for this project. For the WG members and counterpart personnel, a series of capacity development activities was conducted such as workshops, lectures, seminars and on-the-job training. This may be considered as a preparatory stage for the government to establish a new organization capable of transport planning.

The outline and schedule of capacity development activities conducted in this project is presented in Table 4.1.1 and Figure 4.1.1.

During the course of these capacity development activities, desirable institutional setup will be discussed regarding the new organization in charge of urban transport capable of planning, implementation, operation and management of all urban transport modes.

Table 4.1.1 Outline of Capacity Development Activities in YUTRA

Activity	Contents
1st Workshop	Objectives, methodology and contents of the transport/traffic surveys conducted in this project
Lectures/OJT related to surveys	Detailed explanation of the transport/traffic surveys conducted in this project
2nd Workshop	Analysis and identification of urban transportation issues based on the result of surveys
Lectures/OJT related to urban transport issues	Detailed explanation of urban transport issues based on the result of surveys. Some exercises are included.
Study tour to Indonesia	Various aspects of urban transport administration including transport infrastructure, institutional system, transport planning, maintenance, traffic management, role of ODA (particularly from JICA) and so on were studied in Indonesia. The impact of the delay in introducing BRT was studied as well.
Lectures/OJT related to Pilot Project	Planning, design, implementation and assessment of the Pilot Project were explained in detail. OJT is included.
3rd Workshop	Demand forecast and the master plan
Lectures/OJT related to demand forecast and the master plan	Detailed explanation of demand forecast and the master plan
Seminar	Output of the project

Source: YUTRA Project Team

Note: “Lectures/OJT related to demand forecast and the master plan” and “seminar” will be conducted in the second stage of YUTRA as scheduled (Refer to Figure 4.1.1)

Task	2013			2014	
	1 2 3 4	5 6 7 8	9 10 11 12	1 2 3 4	5 6 7 8
1st Workshop	▲				
Lectures and OJT related to surveys	▬	▬			
2nd Workshop			▲		
Lectures and OJT related to urban transport issues		▬	▬		
Study tour to Indonesia		▲			
Lectures and OJT related to Pilot Project			▬		
3rd Workshop			▲		
Lectures and OJT related to demand forecast and the master plan			▬	▬	▬
Seminar					▲

Source: YUTRA Project Team

Note: “Lectures/OJT related to demand forecast and the master plan” and “seminar” will be conducted in the second stage of YUTRA as scheduled.

Figure 4.1.1 Schedule of Capacity Development in YUTRA

Member of the Counterpart Team is listed in Table 4.1.2. Capacity Development program was conducted for mainly these C/P members as trainees.

Table 4.1.2 Counterpart Staff

Name	Position	Agency
1. Mr. Lian Sian Mung	Assistant Manager (Traffic)	Myanmar Port Authority
2. Mr. Zaw Thet Aung	Assistant Manager (Delta Region)	Inland Water Transport
3. Mr. Khine Myint	Sub-Assistant Engineer (2)	Department of Development Affairs, Yangon Region
4. Mr. Moe Thiha Kyaw	Police Lieutenant	Traffic Police Office, Yangon Region
5. Mr. Htet Ye’ Paing	Senior Clerk	Transport Planning Department, Yangon Region
6. Mr. Thein Han Oo	Executive Engineer	Road Transport Administration Department, Yangon Region
7. Mr. Moe Kyaw	Assistant Manager	Myanmar Railways
8. Mrs. Myint Myint Sein	Executive Engineer	Public Works, Yangon Region
9. Mr. Nyan Thar	Executive Engineer	Engineering Department (Road and Bridges), Yangon City Development Committee (YCDC)

4.2 Workshop and Seminar

1) First Workshop on Transport Surveys

The First Workshop was organized on 11 March 2013 at meeting room of Yangon Station. The following presentation was made by the member of YUTRA Project Team to discuss outline of the YUTRA project, capacity development program and transport/traffic surveys to be conducted in YUTRA. 48 persons from the national government, the Yangon Region Government and academic organizations were participated.

(1) Outline of the YUTRA Project

(2) Outline of the Capacity Development

(3) Outline of Transport/Traffic Surveys

(4) Progress of the On-going Traffic Surveys

2) Second Workshop on Urban Transport Issues

The Second Workshop was held on 22 October 2013 at meeting room of Yangon Station. The workshop focused on discussing the urban transport issues including results of transport/ traffic surveys, public transport network and services (bus and railway), road network, traffic management and these conceptual plans in Yangon. In addition the short-term countermeasures related to traffic congestion will be discussed from the viewpoint of traffic management particularly. Therefore, the following presentations were made by the member of YUTRA Project Team. 47 persons from the national government, the Yangon Region Government and academic organizations were attended.

(1) Key Findings of YUTRA Transport /Traffic Surveys

(2) Methodology of Transport Demand Forecasting

(3) Understanding Public Bus Transport Issues and Underlying Causes

(4) Short-term Improvement Program for Congestion Mitigation

(5) Road Network Alternatives

(6) Railway Network Alternatives

(7) Schedule of Master Plan Preparation

3) Third Workshop on Demand Forecast and Transport Master Plan

The Third Workshop was organized on 19 December 2013 at meeting room of Yangon Station. The workshop focuses on the future traffic demand forecast and the contents of comprehensive urban transport plan. For this, the following presentations were made by the member of YUTRA Project Team. There were almost 20 participants invited from the national government, the Yangon Region Government and academic organizations, etc.

(1) Pilot Project

(2) Transport Demand Forecast

(3) Land Use and Transport Integration

(4) Public Transport Development

(5) Road Network Development

(6) Traffic Management

(7) Project Evaluation

(8) Implementation and Institutional Reform

4) Seminar

Seminar will be held for dissemination of the overall output of YUTRA Project sometime in August 2014. The participants will be from the related agencies, stakeholders and media. The venue will be a seminar room in a hotel of Yangon and the number of participants will be around 200.

4.3 Training Program in the 3rd Country (Indonesia)

1) Background and Objective

A training program in a third country was conducted visiting to major cities of Jakarta and Bandung in Indonesia. The participants are the key persons and the staffs of Yangon Region Government. The study tour in a foreign country of the operation and management of urban transport is a good practical lesson for the staff of Yangon Region Government. The program was implemented in June 2013 for 12 days.

Followings are the objectives:

(1) To acquire knowledge and experience required for the implementation of the comprehensive urban transport master plan up to 2035. The main subjects to learn are technical and financial issues and institutional arrangement inherent to urban transport.

(2) To understand the actual cases of traffic management and control.

2) City to Visit

Jakarta is a huge city with a population of 9.59 million, and the area is 656 km2. JABODETABEK, or Jakarta Metropolitan Area, is an area of 6,581 km2 with a population of 27.94 million. This city has experienced also a rapid motorization. It has caused deterioration of public transport service: obsolete bus vehicles, improper service such as refusal of student passengers by bus drivers, poor security and so on. It has resulted in the low share of public transport mode. The recent modal share is 53% for motorcycle, 20% for other private vehicles and 27% for public transport. The biggest issue in transport is a chronic traffic congestion. The central government and the JABODETABEK have focused on the improvement of quality of service of railway and bus, and re-networking of BRT.

In Jakarta, MRT has been proposed since 1990s, but it was never implemented. Instead, Trans Jakarta, the first BRT in Indonesia, was started in 2004. Although the timing was too late, its role is getting more and more important in the public transport system of Jakarta. This situation must be a very practical lesson to find the suitable urban transport plan and management system for Yangon, since the population of Yangon will exceed 9 million in 2035 and the similar situation may occur.

3) Participants

The list of participants is shown in the table below. 10 persons are attended in this program.

Table 4.3.1 List of Participants for Training Program in Indonesia

No.	Name	Position	Department	Name of Ministry
1	Mr. Tun Aung Thin (Team Leader)	General Manager (Lower Myanmar)	Myanma Railways	Ministry of Rail Transportation
2	Mr. Moe Kyaw	Assistant Manager		
3	Mr. Aye Thant	Director	Transport Planning Department	
4	Mr. Htet Ye' Paing	Senior Clerk		
5	Mr. Thein Han Oo	Executive Engineer	Road Transport Administration Department	
6	Mr. Khine Myint	Senior Assistant Engineer (2)	Yangon Region Development Affairs	Yangon Region Development Committee
7	Mr. Nyan Thar	Executive Engineer	Engineering Department (Road & Bridges), YCDC	
8	Mr. Zaw Thet Aung	Assistant Manager (Delta Region)	Inland Water Transport	Ministry of Transport
9	Mr Lian Sian Mung	Assistant Manager (Traffic)	Myanmar Port Authority	
10	Mr. Moe Thiha Kyaw	Police Lieutenant	Traffic Police Office	Ministry of Home Affairs

4) Schedule

The actual schedule is shown in the table below.

Table 4.3.2 Schedule of Training Program in Indonesia

Date	Day		Organization to Visit	Contents	
18 June	Tue.			*Yangon to Jakarta*	Jakarta
19 June	Wed.	AM	Clay Hotel lobby	• Orientation for the Training Program	Jakarta
			JICA Indonesia Office	• History of Jakarta Development and JICA Projects	
		PM	[Field Survey] Port of Tanjung Priok	• Cargo Area of Tj.Priok Port	
20 June	Thu.	AM	Transportation Agency of DKI Jakarta Province Office	• Outline of Transportation System in DKI Jakarta	Jakarta
		PM	MOT – Directorate General of Railway (DGR) and Directorate General of Land Transportation (DGLT)	• Railway Operation and Management • Outline of Urban Transportation System, Policy, and Implementation in Indonesia	
21 June	Fri.	AM	PT. Mass Rapid Transit (MRT) Office	• Jakarta MRT Plan and Current Progress	Jakarta
		PM	TransJakarta Office	• Management, Operation, and Detail Plan of BRT	
			[Field Survey] TransJakarta	• Blok M – Tosari Shelter	
22 June	Sat.	AM	Free time for review/ preparation of presentation	-	Jakarta
23 June	Sun.			*Jakarta to Bandon (By bus)*	Bandung
24 June	Mon.	AM	Planning and Development Agency (BAPPEDA) of Bandung City Office, and Transportation Agency of Bandung City Office	• Bandung City Planning and Urban Transport Policy • Outline of Public Transport Operation in Bandung (Bandung BRT)	Bandung
		PM	*[Sight Seeing] Saung Mang Udjo* (Traditional Art Performance)	-	
25 June	Tue.	AM	[Field survey] Bandung Station and BRT Trans Bandung	• Railway and Bandung Station	Jakarta
		PM		*Bandon to Jakarta (By train)*	
26 June	Wed.	AM	Port Authority of Tanjung Priok, Ministry of Transportation	• Outline of Tanjong Priok Port	Jakarta
			[Field survey] Cargo and Passenger area in Tj.Priok port	• Passenger terminal and container area	
		PM	Oriental Consultant CO. LTD,.	• Introduction of Revised SITRAMP and current issue of transportation in Jakarta	
27 June	Thu.	AM	Traffic Police and Traffic Control Center	• Traffic management (traffic signal control, regulation of illegal parking, etc.)	Jakarta
		PM	Free time for review/ preparation of presentation	-	
28 June	Fri.	AM	Presentation and Debriefing for trainees/ Training Assessment	• Review of the program and Discussion • Presentation and Discussion	Jakarta
		PM	[Sightseeing] Monas	-	
29 June	Sat.			*Jakarta to Yangon*	-

Source: YUTRA Project Team

5) Results

Trainees learned BRT system, railway operation and management, Jakarta MRT Plan and so on through the training program. Jakarta, however, still has tackled heavy traffic congestion and issues, trainees were able to see urban transportation issues to be considered in the near future and understand importance of urban transport master plan in Yangon. Figure 4.3.1 shows the actual lectures in Jakarta.

Every trainee took part in each lectures earnestly. The lectures were given in English and most trainee were able to understand English well. They had review meetings every night to share what they learned from the lectures. Some trainees were not good at English but they could help each other through the review meeting.

The debriefing for trainees and training assessment meeting were held at JICA Myanmar on 4th July 2013. The team leader of the trainees, Mr. Tun Aung Thin, General Manager of Myanma Railway, gave a presentation which summarized what they learned from the training program. He mentioned that the training program was success and they could get a lot of experiences regarding transportation knowledge and it was very useful for making implementation of urban transportation master plan in Yangon.


Figure 4.3.1 Lectures in Jakarta

4.4 Lectures and OJT

As shown earlier, the capacity development activities conducted in this project are three workshops, a seminar, lectures/exercises and a study tour to a third country.

As for lectures/exercises, each of them was held for around 2hours. With use of PowerPoint presentation, the lecturer only to teach unilaterally but to test the participants with question and answer sessions coupled with exercises. It is closely related with their daily works (On-the-Job Training, OJT).

Basically the lectures were conducted in accordance with the schedule as shown in Figure 4.1.1 but actual schedule was adjusted depending on the availability of YUTRA Project Team members and progress of the Project.

Table 4.4.1 shows the actual contents of Lectures/OJT conducted in the first stage of the Project. Total 36 lectures and OJT were conducted with participation of WG members.

Table 4.4.1 List of Lectures/Trainings Conducted in YUTRA

No	Date	Subject	Lectured by	Theme
1	8 Mar. 2013	Introduction of Transport Planning	Masujima	1
2	13 Mar. 2013	Site Visit (Railway Passenger OD Interview Survey)		1
3	15 Mar. 2013	Site Visit (Ferry Passenger OD Interview Survey)		1
4	18 Mar. 2013	Database for Urban Transport Planning	Masujima	2
5	29 Mar. 2013	Traffic Flow Fundamentals	Matsuoka	2
6	3 Apr. 2013	Traffic Signal Basics	Matsuoka	2
7	5 Apr. 2013	Bus Rapid Transit -World-wide Experience-	Matsuoka	2
8	8 Apr. 2013	TransJakart Busway	Shoyama	2
9	3 May 2013	The Survey Program For The National Transport Development Plan in Myanmar (Outline)	Shibata	1
10	6 May 2013	The Survey Program For The National Transport Development Plan in Myanmar (Future Socio-economic Framework(Draft))	Shibata	4
11	8 May 2013	Redesign of a Motorized Society -Role of New Technology in Public Transit Infrastructure-	Shibata	5
12	10 May 2013	Economic Analysis -Road Transport Project -	Shibata	5
13	13 May 2013	Person Trip Survey (1)	Sakai	1
14	15 May 2013	Traffic Count Survey	Sakai	1
15	17 May 2013	Person Trip Survey (2)	Sakai/Komori	1
16	27 May 2013	Training on GPS	Sakai/Komori	1
17	29 May 2013	Coding, Encoding and Error Check for PT Survey	Sakai/Komori	1
18	31 May 2013	ASEAN Strategic Transport Plan (ASTP) 2011-2015	Kudo	2
19	3 Jun. 2013	Explanation about Previous Survey	Sakai	1
20	5 Jun. 2013	Road-based Public Transportation Improvement Measures – Restructuring of Public Transportation Route Network	Masujima	5
21	7 Jun. 2013	Present Condition of Urban Transport in Jakarta	Sakai	2
22	12 Jun. 2013	Comparison of Bus Fares among South-East Asia Countries	Phyo	2
23	14 Jun. 2013	Explanation about Previous Survey	Komori	1
24	17 Jun. 2013	The Strategic Urban Development Plan of the Greater Yangon (SUDP)	Sakai	2
25	10 Jul. 2013	Urban Railway Development in Tokyo	Suzuki	2
26	26 Jul. 2013	Urban Transport Characteristic of Hanoi, Vietnam	Masujima	2
27	2 Aug. 2013	Urban Railway Planning	Nakamura	5
28	28 Aug. 2013	ITS- Intelligent Transportation Systems	Futose	5
29	4 Sep. 2013	Project for the Study on JABODETABEK Public Transportation Policy Implementation Strategy	Okamura	2
30	11 Sep. 2013	Traffic Demand Forecast	Okamura	4
31	25 Sep. 2013	Issues for On-Street Parking	Futose	2
32	4 Nov. 2013	Railway Development Projects Implemented by Japanese ODA	Suzuki	2
33	11 Nov. 2013	Financial Planning	Esguerra	5
34	13 Nov. 2013	Transport Impact Assessment	Esguerra	5
35	2 Dec. 2013	Pilot Project	Matsuoka	3
36	9 Dec. 2013	Site Visit: (Pilot Project)	Matsuoka	3

Source: YUTRA Project Team
Note: Theme 1: Transport/Traffic Surveys, Theme 2: Analysis of Urban Transportation Issues, Theme 3: Pilot Project, Theme 4: Traffic Demand Forecast, Theme 5: Urban Transport Planning

5 Pilot Project

5.1 Introduction

Although there are more than 100 traffic signals in Yangon, all of them are old and obsolete with very limited functionalities. As a result, traffic police is required to stay at intersection 24 hours a day and 7 days a week to manually operate the signal. Even great effort is paid by the traffic police to operate the signal manually, signal operation is inefficient and often causes congestion unnecessarily.

A pilot project of new signal installation and associated works at a selected intersection is planned, implemented and evaluated to demonstrate the effectiveness of the latest traffic management technologies including advanced signal control method.

5.1.1 Objectives

The objectives of the pilot project are to:

- Demonstrate that traffic condition can be improved through the introduction of traffic management measures with sophisticated signal and vehicle detector.
- Gain knowledge and experience in traffic signal design, implementation and evaluation that can be applied to other intersections.
- Strengthen the capacity in traffic management in general and traffic signal design and operation in particular of the counterpart agencies.

It is emphasized that traffic signal is a device that controls vehicle and pedestrian movements at intersection. Its efficiency depends not only on hardware but also on the phase design and timing parameter set, with which traffic signal operates. Pilot project will be a showcase of how traffic operation can be improved with latest traffic management technologies and know-hows.

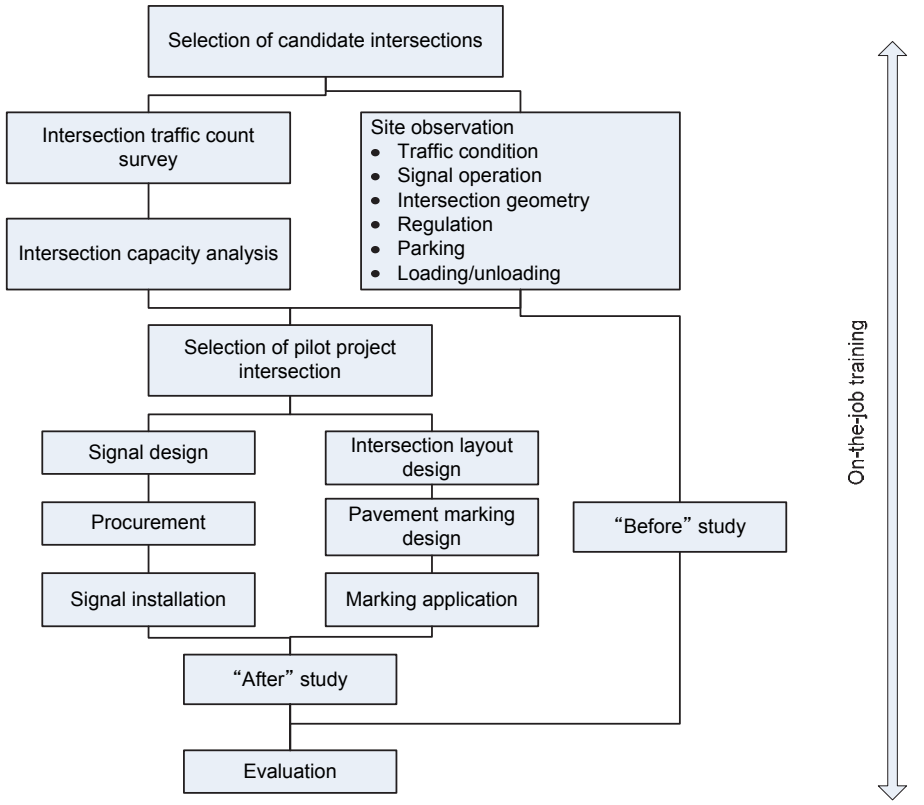
5.1.2 Procedure

The pilot project will be carried out according to the procedure enumerated below and presented in Figure 5.1.2.1.

- Intersections of major roads where traffic volume is high and congestion is often observed are selected as candidate intersection for pilot project.
- Intersection turning movement count survey is conducted at candidate intersections to gather turning movement count data (traffic volume).
- Intersection capacity analysis is carried out to calculate the saturation level that represents ratio of traffic volume against intersection capacity.
- At the same time, site observation is made to understand the site condition including intersection geometry, traffic condition, signal operation, driver's behaviour, parking, pedestrian movement and other factors that would affect the traffic operation at the intersection.
- Based on the traffic count data, results of capacity analysis and site observation, pilot

project intersection is selected.

- Improvement works are designed for the intersection selected. The improvement work consists of signal design and intersection layout design.
- A contractor for pilot project is selected through competitive selection procedure. The contractor is responsible for supply and installation of equipment, supervision of installation work and operation and maintenance training.
- Besides signal installation, intersection geometry and pavement markings are reviewed and necessary improvement works will be carried out.
- Before-and-after survey is conducted before and after the improvement works to evaluate the improvement made by the new signal installation and other works.
- Throughout these processes, on-the-training is conducted for the counterpart to make them familiar with the traffic management improvement.



Source: YUTRA Project Team

Figure 5.1.2.1 Pilot Project Procedure

5.2 Selection of Pilot Project Intersection

5.2.1 Intersection Traffic Count Survey

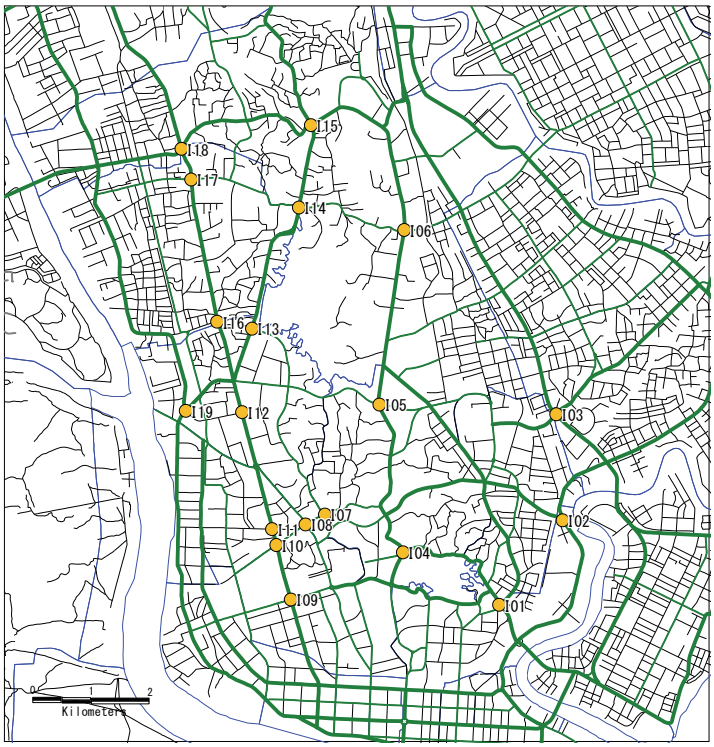
A total of 19 intersections listed below and shown on the map were selected as candidate intersection for pilot project. These intersections were selected through the hearing of the

counterpart staff and site observation. They are considered as congested intersection and traffic management problem of one kind or another exists. Intersection directional traffic count survey was conducted at these intersections to understand traffic condition and help identify traffic management issues.

Table 5.2.1.1 Traffic Count Survey Intersections

No.	Road Across the Intersection
I01	Ba Nyar Dala Rd, Mill Rd, 119 St
I02	Thamain Bayan Rd, Thanthumar Rd
I03	Lay Daunt Kan Rd, Waizayadar Rd
I04	Ko Min Ko Chin Rd, Nat Mauk St, Bahan St, Kyar Taw Ya St
I05	Kabar Aye Pagoda Rd, University Avenue Rd, New University Avenue Rd
I06	Kabar Aye Pagoda Rd, Parami Rd
I07	Inya Rd, Dhama Zedi Rd, Shwe Gon Taing St
I18	U Wisara Rd, Dhama Zedi Rd
I09	Pyay Rd, Ahone Rd
I10	Pyay Rd, Dhama zedi Rd
I11	Pyay Rd, Bargayar Rd
I12	Pyay Rd, Narnattaw St
I13	Pyay Rd, Inya Rd, One local road
I14	Pyay Rd, Parami Rd
I15	Pyay Rd, Kabar Aye Pagoda Rd, Kyaik Wine Pagoda Rd
I16	Yangon – Insein Rd, Ywar Ma Kyaung Rd, One local road
I17	Yangon – Insein Rd, Prami Rd
I18	Yangon – Insein Rd, Kyaik Wine Pagoda Rd, Thamine Buteryon Rd
I19	Bayint Nuang Rd ,Hledan Rd, Narnattaw St, Sayar San St

Source: YUTRA Project Team



Source: YUTRA Project Team

Figure 5.2.1.1 Traffic Counter Survey Intersections

5.2.2 Selection Criteria

Pilot project intersection is selected among the candidate intersections based on the criteria listed below.

- Intersection total traffic volume
- Level of saturation
- Left turn traffic volume
- Traffic obstacles at and around intersection
- Inadequateness of existing signal operation
- Traffic accident

Description of these criteria is given below.

1) Intersection total traffic volume

Intersection with relatively large traffic volume will be selected as pilot project intersection because there will be more beneficiaries of traffic condition improvement. Table below shows the 16-hour (06:00-22:00) traffic volume in PCU (passenger car unit) of the survey intersections. Intersections with the 16-hour traffic of more than 80,000 PCU are marked with shade. Four intersections have total traffic volume (PCU) of more than 80,000 PCU for 16 hours.

Table 5.2.2.1 16-hour Traffic Volume

No.		16-hour total traffic volume (PCU)
I01	Ba Nyar Dala Rd, Mill Rd, 119 St	52,794
I02	Thamain Bayan Rd, Thanthumar Rd	55,833
I03	Lay Daunt Kan Rd, Waizayadar Rd	82,024
I04	Ko Min Ko Chin Rd, Nat Mauk St, Bahan St, Kyar Taw Ya St	61,156
I05	Kabar Aye Pagoda Rd, University Avenue Rd, New University Avenue Rd	79,275
I06	Kabar Aye Pagoda Rd, Parami Rd	81,939
I07	Inya Rd, Dhama Zedi Rd, Shwe Gon Taing St	64,626
I18	U Wisara Rd, Dhama Zedi Rd	77,468
I09	Pyay Rd, Ahone Rd	83,363
I10	Pyay Rd, Dhama zedi Rd	65,712
I11	Pyay Rd, Bargayar Rd	68,826
I12	Pyay Rd, Narnattaw St	59,828
I13	Pyay Rd, Inya Rd, One local road	65,789
I14	Pyay Rd, Parami Rd	79,339
I15	Pyay Rd, Kabar Aye Pagoda Rd, Kyaik Wine Pagoda Rd	97,618
I16	Yangon – Insein Rd, Ywar Ma Kyaung Rd, One local road	51,255
I17	Yangon – Insein Rd, Prami Rd	67,919
I18	Yangon – Insein Rd, Kyaik Wine Pagoda Rd, Thamine Buteryon Rd	61,208
I19	Bayint Nuang Rd ,Hledan Rd, Narnattaw St, Sayar San St	74,217

Source: YUTRA Project Team

2) Level of saturation

Congestion occurs when traffic demand reaches or exceeds intersection capacity. Thus large traffic volume does not necessarily means that an intersection is congested. Intersection capacity analysis was conducted for these intersections to estimate level of saturation. Higher saturation level means that the intersection is more congested. The analysis considers intersection capacity estimated based on the intersection geometry and directional traffic volume obtained by intersection traffic volume count survey. Current signal operation is not taken into account in the capacity analysis.

The results are shown in the table below for the AM and PM peak hours. Peak hour is defined as the hour during which the total intersection traffic volume is highest in the morning and afternoon, respectively. Saturation level of more than 0.85 is marked with shade in the table. Eight intersections out of the total 19 intersections are identified as

intersection with high saturation level.

Table 5.2.2.2 Saturation Level

No.	Name	AM		PM	
		Time	V/C	Time	V/C
1	Ba Nyar Dala Rd, Mill Rd, 119 St	11:00-12:00	0.72	12:00-13:00	0.72
2	Thamain Bayan Rd, Thanthumar Rd	10:00-11:00	0.79	16:00-17:00	0.83
3	Lay Daunt Kan Rd, Waizayadar Rd	09:00-10:00	0.98	15:00-16:00	0.86
4	Ko Min Ko Chin Rd, Nat Mauk St, Bahan St, Kyar Taw Ya St	11:00-12:00	0.94	13:00-14:00	0.76
5	Kabar Aye Pagoda Rd, University Avenue Rd, New University Avenue Rd	11:00-12:00	0.77	16:00-17:00	0.83
6	Kabar Aye Pagoda Rd, Parami Rd	10:00-11:00	0.91	15:00-16:00	0.85
7	Inya Rd, Dhama Zedi Rd, Shwe Gon Taing St	10:00-11:00	0.81	18:00-19:00	0.65
8	U Wisara Rd, Dhama Zedi Rd	10:00-11:00	0.78	17:00-18:00	0.71
9	Pyay Rd, Ahone Rd	09:00-10:00	0.90	13:00-14:00	0.90
10	Pyay Rd, Dhama zedi Rd	09:00-10:00	0.67	14:00-15:00	0.77
11	Pyay Rd, Bargayar Rd	10:00-11:00	0.86	17:00-18:00	0.95
12	Pyay Rd, Narnattaw St	08:00-09:00	0.72	14:00-15:00	0.74
13	Pyay Rd, Inya Rd, One local road	10:00-11:00	0.61	14:00-15:00	0.58
14	Pyay Rd, Parami Rd	11:00-12:00	0.93	13:00-14:00	0.77
15	Pyay Rd, Kabar Aye Pagoda Rd, Kyaik Wine Pagoda Rd	09:00-10:00	0.84	16:00-17:00	0.97
16	Yangon – Insein Rd, Ywar Ma Kyaung Rd, One local road	11:00-12:00	0.71	14:00-15:00	0.80
17	Yangon – Insein Rd, Prami Rd	10:00-11:00	0.72	15:00-16:00	0.97
18	Yangon – Insein Rd, Kyaik Wine Pagoda Rd, Thamine Buteryon Rd	10:00-11:00	0.65	15:00-16:00	0.62
19	Bayint Nuang Rd ,Hledan Rd, Narnattaw St, Sayar San St	10:00-11:00	0.69	14:00-15:00	0.82

Source: YUTRA Project Team

3) Left turn traffic volume

Intersection with higher left turn volume is more difficult to handle and requires sophisticated signal control as left turn traffic intersects with through traffic from the opposing approach. The intersections with high left turn ratio during AM and PM peak hours are listed below. Four intersections are identified as intersection with high left turn volume ratio during peak hours.

Table 5.2.2.3 Left Turn Traffic Volume Ratio

ID	Name	AM				PM			
		N	E	S	W	N	E	S	W
1	Ba Nyar Dala Rd, Mill Rd, 119 St	0.40	0.12	0.10	0.14	0.47	0.12	0.09	0.12
2	Thamain Bayan Rd, Thanthumar Rd	0.48	0.55	na	na	0.51	0.49	na	na
3	Lay Daunt Kan Rd, Waizayadar Rd	0.07	0.27	0.31	0.25	0.12	0.21	0.31	0.15
4	Ko Min Ko Chin Rd, Nat Mauk St, Bahan St, Kyar Taw Ya St	0.16	0.72	0.17	0.04	0.18	0.63	0.12	0.06
5	Kabar Aye Pagoda Rd, University Avenue Rd, New University Avenue Rd	0.04	0.28	0.13	0.58	0.04	0.20	0.11	0.61
6	Kabar Aye Pagoda Rd, Parami Rd	0.20	0.25	0.23	0.09	0.19	0.20	0.26	0.04
7	Inya Rd, Dhama Zedi Rd, Shwe Gon Taing St	0.05	na	0.36	0.26	0.02	na	0.21	0.27
8	U Wisara Rd, Dhama Zedi Rd	0.29	0.12	0.36	0.03	0.09	0.13	0.29	0.04
9	Pyay Rd, Ahone Rd	0.27	0.17	0.02	0.16	0.27	0.17	0.02	0.16
10	Pyay Rd, Dhama zedi Rd	0.09	0.33	0.08	0.15	0.12	0.43	0.15	0.29
11	Pyay Rd, Bargayar Rd	0.14	0.28	0.21	0.24	0.12	0.21	0.28	0.45
12	Pyay Rd, Narnattaw St	na	na	0.28	0.79	na	na	0.31	0.78
13	Pyay Rd, Inya Rd, One local road	0.28	0.11	na	na	0.38	0.10	na	na
14	Pyay Rd, Parami Rd	0.15	0.31	0.14	0.14	0.13	0.30	0.11	0.16
15	Pyay Rd, Kabar Aye Pagoda Rd, Kyaik Wine Pagoda Rd	0.32	0.18	0.11	0.17	0.51	0.10	0.14	0.16
16	Yangon – Insein Rd, Ywar Ma Kyaung Rd, One local road	na	0.18	0.20	0.83	na	0.31	0.15	0.84
17	Yangon – Insein Rd, Prami Rd	0.14	0.27	0.15	0.08	0.15	0.28	0.10	0.08
18	Yangon – Insein Rd, Kyaik Wine Pagoda Rd, Thamine Buteryon Rd	0.24	0.17	0.24	0.13	0.18	0.24	0.18	0.12
19	Bayint Nuang Rd ,Hledan Rd, Narnattaw St, Sayar San St	0.03	0.27	0.15	0.82	0.03	0.31	0.14	0.84

Source: YUTRA Project Team

Notes: N, E, S, and W denote north, east, south and west approaches, respectively.
For left turn without conflicting movement from the opposite approach, “na” is shown.

4) Traffic obstacles at and around intersection

If congestion is caused by traffic management issues other than traffic signal, replacement of signal will bring about little improvement. Examples of other traffic management issues are:

- Jaywalking and sidewalk vendors that interfere with the vehicle flow. Example is found at No. 01 Ba Nyar Dala Road, Mill Road, 119 St.

- On-going road construction, pavement and drainage works. Example is found at intersection of No. 03 Lay Daunt Kan Road, Waizayadar Road.
- Loading and unloading of bus near intersection. Example is found at No. 11 Pyay Rd, Bargayar Rd and No. 18 Yangon – Insein Rd, Kyaik Wine Pagoda Rd, Thamine Buteryon Rd.
- Parking near the intersection reduces intersection capacity and disturbs smooth flow of traffic. The case is found at No. 06 Kabar Aye Pagoda Rd, Parami Road.

These intersections are not suitable for pilot project as improvement made by new signal and other physical measures would be lessened by the activities around the intersections.

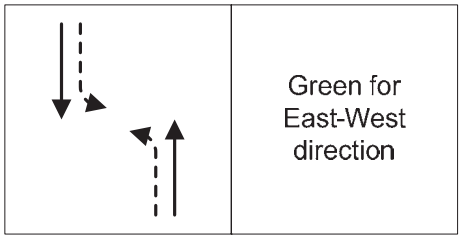
5) Inadequateness of existing signal operation

If current signal operation is not efficient, there is room for improvement. Observation is made on the existing signal operation to find out whether improvement with new signal is possible or not.

For this purpose, operation of the existing signals was observed. Traffic signals at the candidate intersections operate with one of the three phase sequences shown below. Discussion on signal phase is made on north-south direction only for simplicity.

(1) Permissive Left Turn

Green signal (full ball) is indicated simultaneously to two opposing approaches. No left turn phase is provided and left turn is made through filtering (permissive left turn) when there is a gap in the opposing through traffic flow. Permissive left turn is shown in broken line in the phase diagram below.

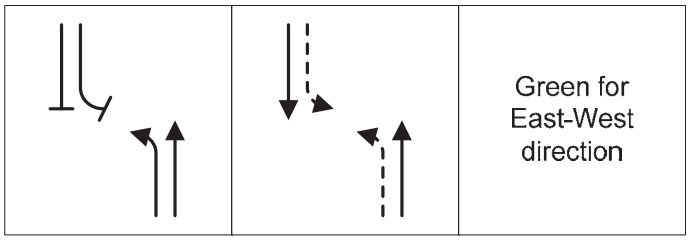


Source: YUTRA Project Team

Figure 5.2.2.1 Permissive Left Turn

(2) Protected Left Turn (one approach) followed by Permissive Left Turn

Green full ball signal is shown to only one approach to allow both through and left turn followed by simultaneous green full ball to both approaches.

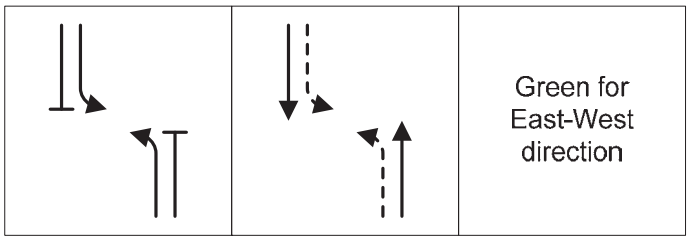


Source: YUTRA Project Team

Figure 5.2.2.2 Protected Left Turn (one approach) followed by Permissive Left Turn

(3) Protected Left Turn (both approaches) followed by Permissive Left Turn

Left turn arrow is provided simultaneously to two opposing approaches to provide protected left turn followed by full ball green signal for both approaches.



Source: YUTRA Project Team

Figure 5.2.2.3 Protected Left Turn (both approaches) followed by Permissive Left Turn

In the current signal design, if protected left turn is adopted, it is always followed by permissive left turn as left turn is controlled by the green arrow only and no yellow arrow and red allow signal are used.

It was found through observation that phase sequence and signal duration do not fit the traffic demand and there is large amount of loss in the signal operation. It is not possible, however, to clearly identify the degree of inadequateness due to manual operation of the signal.

In addition to the signal operation above, the following tendencies were observed with regard to signal operation:

- As the timing parameter set in the existing signal is not adjusted to the prevailing traffic, or signal is too obsolete and timing is not adjustable, signal is operated by traffic police most of the time.
- Regardless of the phase sequence types described above, yellow clearance time is often used to clear left turn vehicles to compensate for insufficient left turn green arrow signal when signal is operated manually.
- At some intersections, for example No. 15, traffic demand is not balanced between two opposing approaches while green signal of same duration is applied resulting in inefficient signal operation.
- Cycle time is longer than required creating green time loss. This is especially true when signal is operated manually.

In summary, signal operation is not well tuned for the traffic flow pattern and there is large room for improvement.

6) Traffic accident

Data of accident prone locations for the last five years were reviewed. However, no specific intersection was identified as accident prone intersection. Thus, accident data is not considered in the selection of pilot project intersection.

5.2.3 Intersection Selected for Pilot Project

Based on the discussion above, intersection of No. 15 Pyay Road, Kabar Aye Pagoda Road, Kyaik Wine Pagoda Road is selected for pilot project intersection. The reasons are summarized below.

- Large traffic volume and existence of congestion.
- High improvement potential with new signal and new pavement marking layout.
- Good pavement condition.
- Almost no disturbance by parking, loading/unloading, jaywalking and other roadside activities.

A photo of 8-mile intersection is shown below. In the photo, Pyay Road runs from bottom-left corner to top-right corner, Kyaik Wine Pagoda Road is a leg toward top-left corner and Kabaraye Pagoda Road is on the opposite side toward bottom-right corner.

Source: YUTRA Project Team

Figure 5.2.3.1 Photo of 8-mile Intersection

5.3 Design of Pilot Project

5.3.1 Site Conditions

In order to prepare improvement works, site conditions must be properly reckoned. The existing site conditions including signal operation are first identified and improvement works are designed.

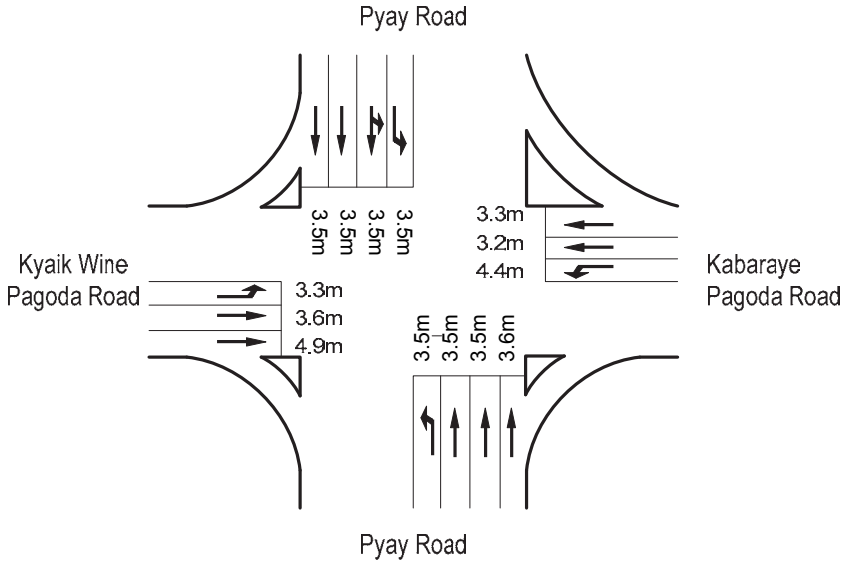
1) Site Conditions

(1) Intersection Geometry and Lane Capacity

The schematic diagram showing the existing layout and lane assignment of 8-mile intersection is presented below. The intersection is a four-leg intersection with corner island at all of four corners. Movement in all directions (left turn, through and right turn) is allowed from all approaches. Right turn is always allowed without signal control. The lane width is not consistent and width of left turn lane is too wide.

Each lane is dedicated to one movement except the second lane from the centre on the north approach, which is used as shared lane of through and left turn movements. Site observation revealed that the shared lane on the north approach does not function properly as the left turn movement and through movement take place at different signal phase and vehicle of one movement often blocks vehicle of another movement.

Pedestrian crossing is not provided to the intersection. Instead, zebra crossing is placed about 100 – 150 meter away from the intersection.

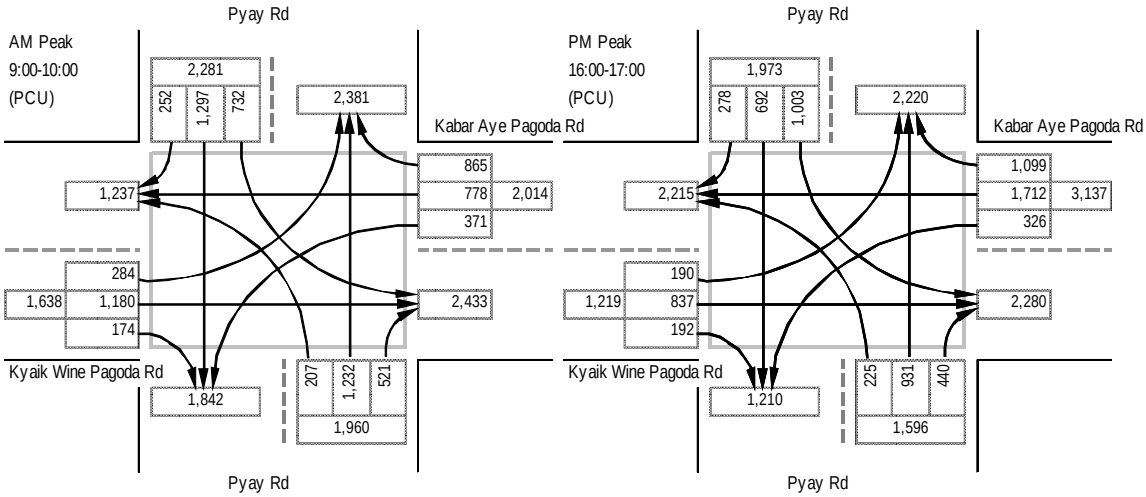


Source: YUTRA Project Team

Figure 5.3.1.1 Existing Lane Assignment of 8-mile Intersection

(2) Peak Hour Traffic

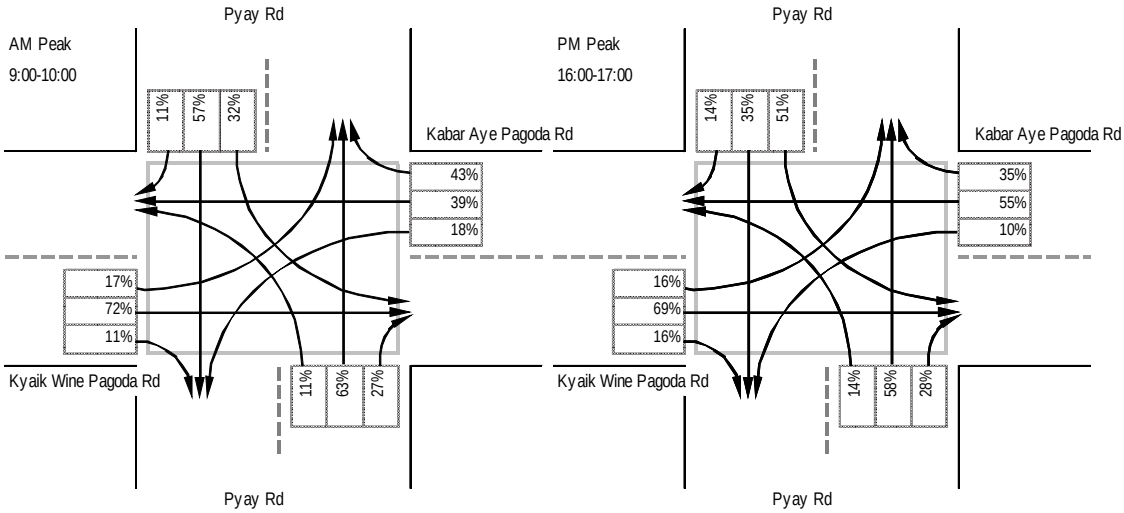
Intersection directional traffic volume survey at this intersection was conducted in February 2013. The peak hour traffic volume converted into passenger car unit (PCU) is shown below for morning (am) and afternoon (pm) peak hours. Normally traffic volume during peak hours is considered first in signal design as the signal operation during peak hour is more critical than during off-peak hours.



Source: YUTRA Project Team

Figure 5.3.1.2 Peak Hour Traffic (PCU)

The most prominent feature of the traffic movement at this intersection is large proportion of left turn traffic. The ratio of directional movements is shown in the figure below for the same AM and PM peak hour traffic. It is observed that more than half (51%) of vehicles make left turn from north approach during PM peak hour and left turn ratio is higher than 10% on all approaches.

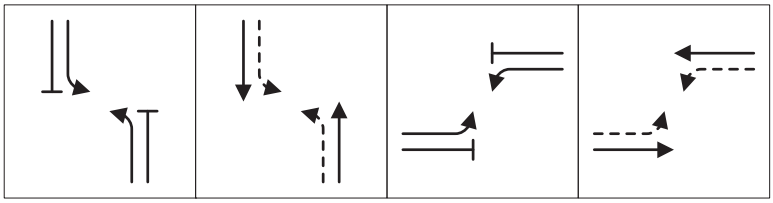


Source: YUTRA Project Team

Figure 5.3.1.3 Ratio of Directional Movement

(3) Existing Phase Sequence and Signal Timing

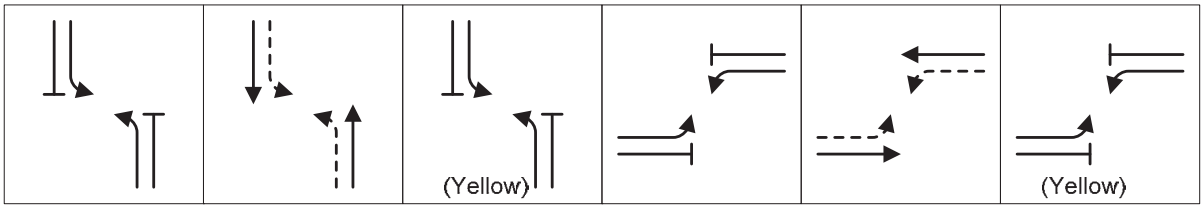
The existing phase sequence is shown below. Solid line in the phasing diagram indicates movement that has right-of-way. Broken line indicates permissive left turn without right-of-way meaning left turn is allowed if there is a gap of sufficient duration in the opposing through traffic flow. Left turn is discharged first from two facing approaches followed by through movement for north-south and east-west directions.



Source: YUTRA Project Team

Figure 5.3.1.4 Existing Phase Sequence

The traffic signal at 8-Mile Intersection is operated manually by traffic police most of the time. Due to arbitrary manual operation, the actual traffic movement is, however, different from the movement shown in the phase sequence diagram above. After the second phase (through for Pyay Road), yellow signal is indicated for a long time, during which left turn from Pyay Road, in particular from north approach is allowed to proceed. The same practice is applied to east-west direction too. Such abnormal operation is required to compensate for the insufficient green time for left turn traffic from the north approach.

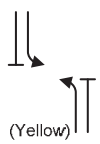
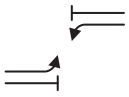
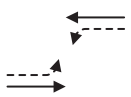
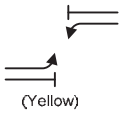


Source: YUTRA Project Team

Figure 5.3.1.5 Actual Traffic Movement under Existing Manual Signal Control

As a result of manual operation, duration of signal indication is not fixed and varies largely every cycle. The observation of the signal operation was made at site and average signal timing during peak hours was obtained. They are shown below. Cycle time varies between 200 and 300 second with the average of about 260 seconds.

Table 5.3.1.1 Existing Signal Timing Parameter (observed)

Phase	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Movement						
Duration (sec)	20	76	56	18	69	23
Split (%)	8%	29%	21%	7%	26%	9%

Source: YUTRA Project Team

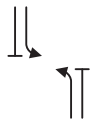
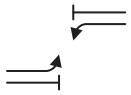
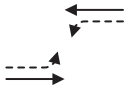
(4) Intersection Capacity Analysis

Intersection capacity analysis was conducted to evaluate the signal operation under the current phase sequence, timing parameter and traffic volume, and volume capacity ratio (V/C) was calculated.

The results are shown below. The V/C ratio shown in the table is the higher figure of the two movements in a phase. The same movement pattern (phases 1 and 3, and phases 4 and 6) are combined together in the intersection capacity analysis for simplicity.

The calculated volume capacity ratio indicates that the intersection is in an over-saturated condition and development of queue is unavoidable. In addition, the V/C ratio of north-south direction and east-west direction is at different level and differs largely due to the manual operation of the signal.

Table 5.3.1.2 Volume and V/C ratio for Option 1 (existing)

	Phase 1	Phase 2	Phase 3	Phase 4	Average
					
Split (%)	29	29	16	26	
V/C (am)	0.89	1.05	1.14	0.99	0.93
V/C (pm)	0.86	0.82	1.00	1.59	1.00

Source: YUTRA Project Team

5.3.2 Preparation of Improvement Plan

Improvement plan that will lessen the congestion at the intersection is prepared. The improvement plan addresses the two components of managing traffic at the intersection.

- Pavement marking design (lane assignment)
- Signal control

In the design, discussion focuses on the traffic and signal in north-south direction (Pyay Road) as Pyay Road carries more traffic than crossing roads and traffic congestion occurs most of the time. As a result of design, new phase sequence is proposed and introduced by the pilot project.

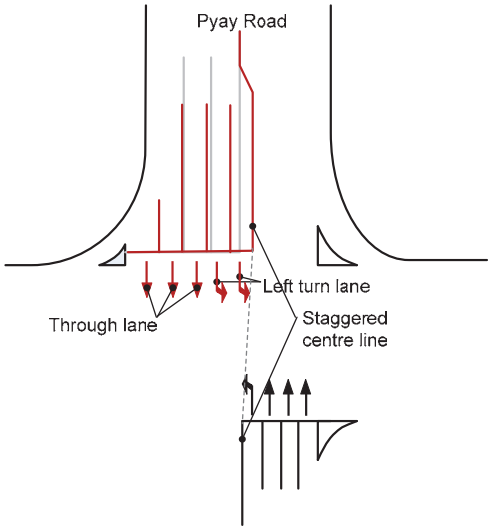
1) Pavement Marking Design

The existing pavement markings are reviewed in terms of traffic operation. In order to accommodate more left turning traffic, two left turn lanes are provided to north and east approach by modifying lane markings near intersection.

The north approach has four lanes in the existing intersection lane layout as shown in Figure 5.3.1.1. One of the lanes is a shared lane of through and left turn movements. As mentioned above, shared lane does not work properly. Through movement blocks left turn

movement during left turn phase, and vice versa.

The proposed lane assignment of the north approach is shown in Figure 5.3.2.1. The centre line is shifted toward east for about 60 meters from the stop line l and lane width is adjusted to accommodate five approach lanes, of which two lanes are dedicated left turn lane while remaining three lanes are for through traffic. As the left most lane on the opposing south approach is also a left turn lane, staggered layout of centre line will not cause any dangerous situation. The exit side of north leg has sufficient width for three lanes.



Source: YUTRA Project Team

Figure 5.3.2.1 Proposed Lane Assignment for North Approach

The similar modification is applied to the east approach. East approach has more left turn vehicles than west approach, and two left turn lanes are provided to the east aproach.

2) Signal Phase Sequence Options

Three phasing sequence options are considered for north-south direction at this intersection as shown below. Among these phase sequence options, the one that produces smallest saturation rate is the most suitable phase sequence in terms of efficiency.

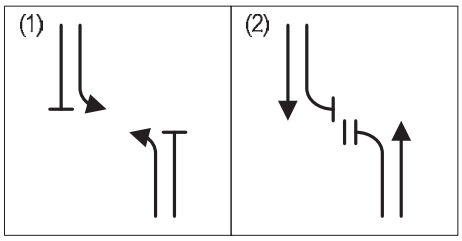
The following are noted in the phase sequence option:

- Only north-south direction is considered as congestion is currently heavier on north-south direction.
- Left turn is allowed only by protected phase and permissive left turn is not provided. The reason is that the intersection operates under near or over saturated condition so that permissive left turn is not only effective but also unsafe.
- Right turn movement is not considered in the analysis as it is free flow movement and allowed all the time.

Three phase options are examined below.

(1) Simultaneous left turn followed by simultaneous through

This sequence is similar to the phase sequence currently used. Difference is that only protected left turn is used and no permissive left turn is allowed in the second phase.

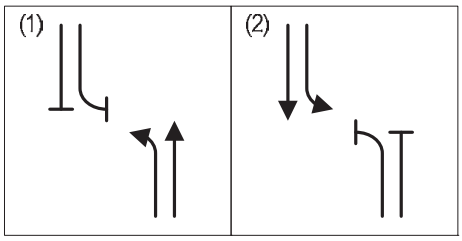


Source: YUTRA Project Team

Figure 5.3.2.2 Simultaneous Left Turn followed by Simultaneous Through

(2) Alternate approach

In this phase sequence, movements in all directions from an approach (from south approach in this case) are discharged first followed by all movements from the opposite approach.

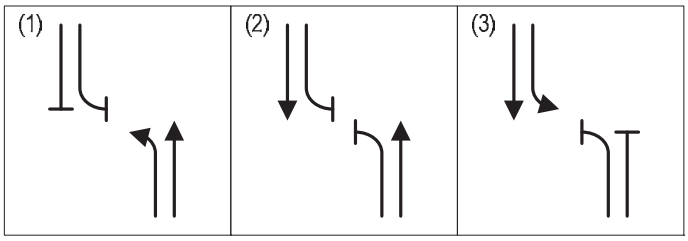


Source: YUTRA Project Team

Figure 5.3.2.3 Alternate Approach

(3) Lead/lag left turn

This phase sequence adopts overlapping phase. Green signal for through movement is shown in two successive phases (phases 1 and 2 for south approach and phases 2 and 3 for north approach) and left turn phase is shown in the first and third phase for south approach and north approach, respectively. This phase sequence is effective when the traffic volume of two opposing direction is not balanced.



Source: YUTRA Project Team

Figure 5.3.2.4 Lead/lag Left Turn

3) Intersection Capacity Analysis of Proposed Phase Sequence Options

The capacity analysis was conducted for the proposed phase sequence options (1), (2) and (3). Only the phase sequence of north-south direction is considered. The signal timing was adjusted so as to minimize the maximum V/C.

The calculated V/C ratio is shown in Table 5.3.2.1 for phase sequence options.

Table 5.3.2.1 Volume / Capacity Ratio and Critical Movements

Phase		North- South			East- West		Ave
	AM/PM	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	V/C
Existing	AM	0.89	1.05		1.14	0.99	0.93
	PM	0.86	0.82		1.00	1.59	1.00
Option (1)	AM	0.86	0.98		0.96	0.99	0.86
	PM	1.18	1.10		1.00	1.09	0.92
Option (2)	AM	0.98	0.92		0.96	0.99	0.90
	PM	1.10	1.18		1.00	1.09	0.92
Option (3)	AM	0.90	0.94	0.94	0.96	0.99	0.83
	PM	1.20	1.18	1.13	1.00	1.09	0.97

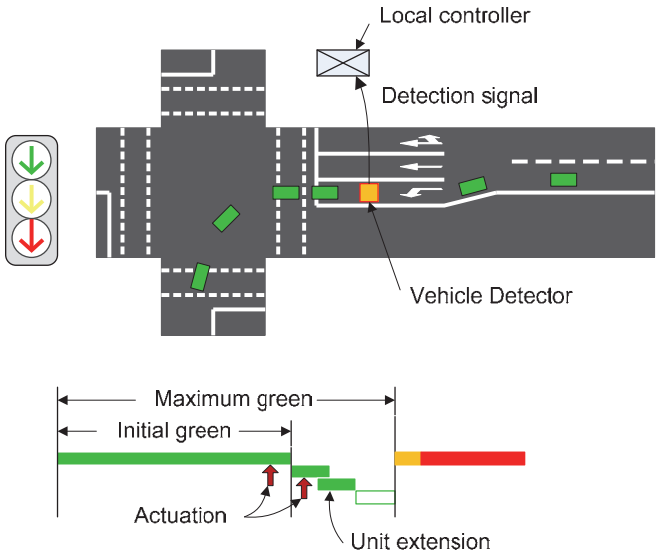
Source: YUTRA Project Team

The table above shows that V/C ratio exceeds 1.0 for many occasions. This means the intersection is over-saturated and queue is unavoidable during peak hour. Under such situation, different signal sequence will have little impact on the performance and the options shows almost same performance. Nonetheless, proposed options are better than the existing phase sequence. The selection of phase sequence will depend on other factors such as actuation control.

4) Actuation Control

Vehicle actuation is a real-time signal timing adjustment technique. A vehicle detector is installed at intersection approach on a specific lane to detect arrival of vehicle. Among the variations of actuation control, green extension control (gap out) is proposed for the pilot project intersection.

The figure below illustrates the operation principle of green extension control. Green time is adjusted every signal cycle depending on arrival of vehicle. For actuation phase, minimum green time is defined and displayed regardless of whether vehicle exists or not. If a new vehicle arrives at the intersection after expiry of initial green and detected by vehicle detector installed at suitable location, green time is extended for the duration of unit extension to allow the vehicle detected to go through the intersection without stopping. The extension is repeated as long as there is an arrival of new vehicle. But if the total green time reaches the pre-set maximum green time, green time is no longer extended. Instead green signal is given to other movement.



Source: YUTRA Project Team

Figure 5.3.2.5 Actuation Control (Green extension)

Actuation control makes signal operation more efficient as the green time is shown only for the period during which vehicle exists. It is effective for the movement like left turn, demand of which varies cycle by cycle. Waste of green time is thus eliminated.

For the pilot project, green extension is introduced for the left turn movement from north and south approaches considering the fluctuation of left turn volume.

There are various types of vehicle detector used for traffic signal control. Most common type is inductive loop detector, which uses loop wire embedded in the pavement at detection point to detect vehicle above it. Initial cost of loop type detector is relatively cheaper than other types of detector. But it often requires replacement of damaged loop wire as it is easily cut due to poor pavement, heavy vehicle and poor installation work.

Video type vehicle detector is emerging and used for the pilot project. Video vehicle detector captures the video image at detection area, processes it and identifies the vehicle. Merits of video detector are:

- Detector is not damaged by passage of vehicles as it is contactless type;
- One unit of detector can cover multiple lanes (up to four lanes), and
- Sensing area is flexible and can be defined by software.

5) Protected and permissive turn

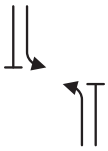
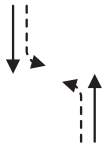
There are two types of turn movement, protected turn and permissive turn. The definition of these turn and example of signal indication are provided below. In protected left turn, there is no conflicting movements like through movement from the opposite approach. Under permissive left turn, left turn is allowed only when there is a gap of sufficient length to cross the conflicting movement. Protected turn is indicated by green arrow signal while permissive turn is allowed during full ball green signal.

Table 5.3.2.2 Definition of Protected and Permissive Turn

Protected turn	The left or right turns at a signalized intersection that are made by a vehicle during a time in the cycle where the vehicle has the right-of-way.
Permissive turn	A left or right turn at a signalized intersection that is made by a vehicle during a time in the cycle in which vehicle does not have the right-of-way.

Source: Highway Capacity Manual 2010

Currently, only green arrow signal is used for controlling left turn signal in Yangon and no yellow and red arrow signal is used. As a result, left turn control is always a combination of protected and permissive left turn as shown in the figure below. The difference of these two left turn schemes is not clearly understood by the road users as well as traffic enforcer.

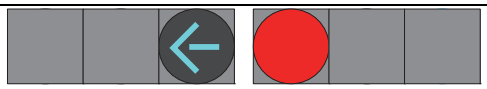
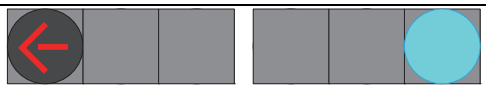
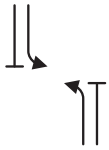
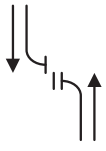
Phase	1	2
Left turn	Protected left turn	Permissive Left turn
Signal indication		
Movement		

Source: YUTRA Project Team

Figure 5.3.2.6 Protected Left Turn followed by Permissive Left Turn (existing signal)

Use of permissive left turn is not suggested at the pilot project intersection. The reason is that the opposing through movement is almost saturated and there is little possibility of a gap with sufficient length so that left turn through filtering is not possible. Under such circumstance, vehicle tends to make left turn at a short gap creating unsafe situation.

It is proposed to clearly distinguish protected and permissive turn by introducing yellow and red allow signals. The signal indication of the protected left turn only is shown below.

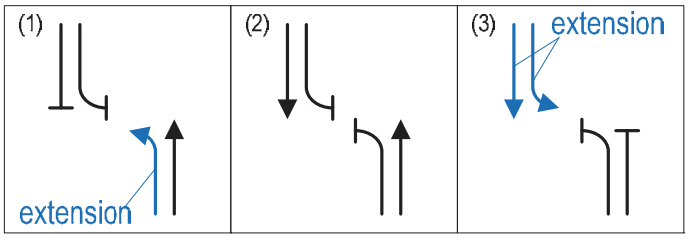
Phase	1	2
Left turn	Protected left turn	Through (and right) only
Signal indication		
Movement		

Source: YUTRA Project Team

Figure 5.3.2.7 Protected Left Turn followed by Through Movement (proposed)

6) Proposed Phase Sequence

The proposed three phase sequence options have almost similar performance in terms of volume capacity ratio. Considering actuation control, however, phase option (c) with actuation shown below is applied for the pilot project intersection as it can accommodate actuation control separately for north and south approaches.



Source: YUTRA Project Team

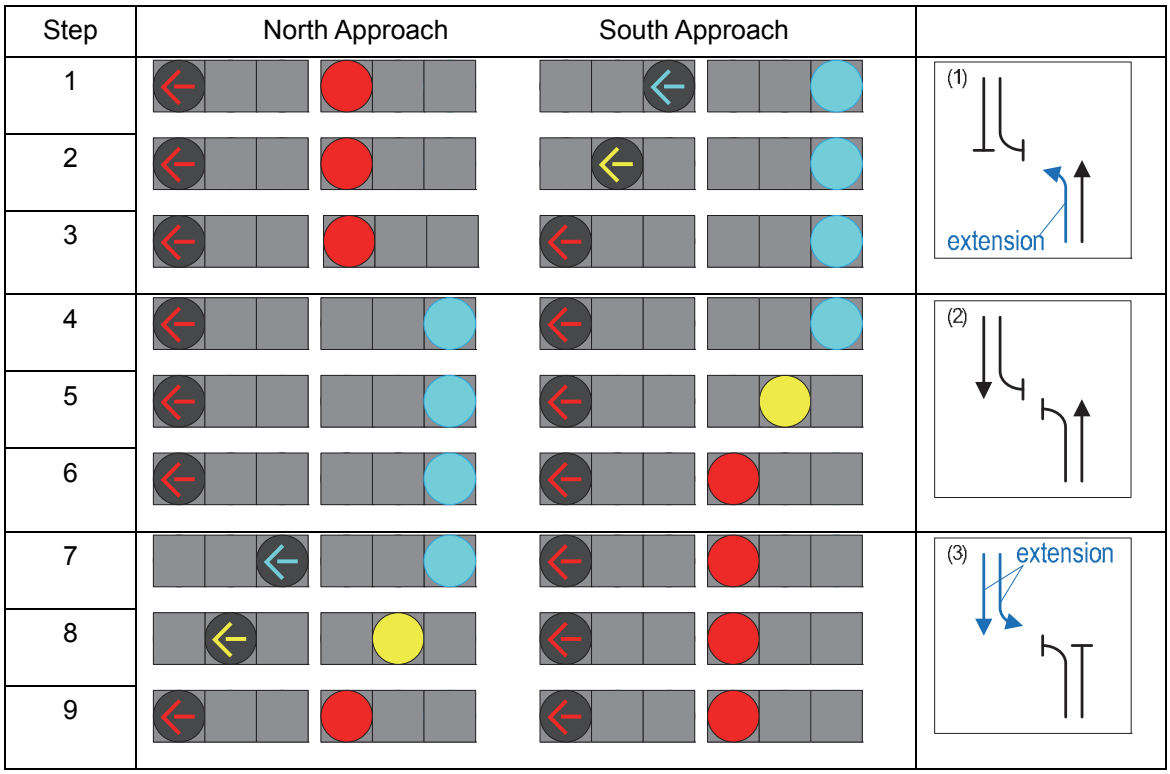
Figure 5.3.2.8 Recommended Phase Sequence

7) Lantern layout and display sequence

To help understand the signal operation at the pilot project intersection, step by step sequence of signal display is shown below for north-south and east-west direction.

(1) North-south direction

Signal lantern layout and its operation are shown below for the proposed phase sequences for north-south direction. 3-aspect arrow signal and 3-aspect full ball signal will be used to control left turn traffic and through traffic separately. The figure below indicates the proposed display sequence for north and south approaches.

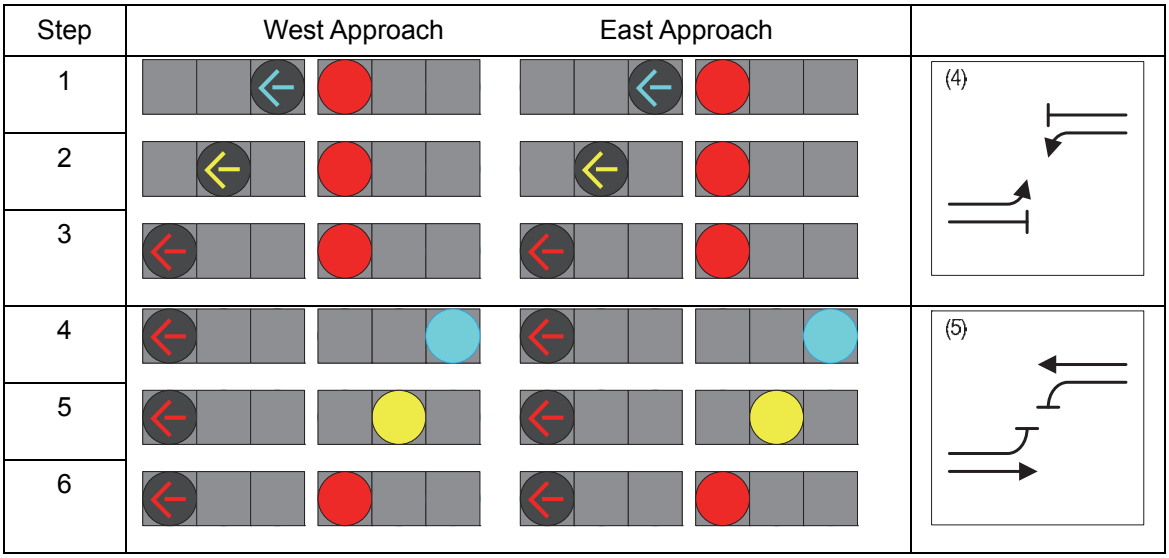


Source: YUTRA Project Team

Figure 5.3.2.9 Signal Lantern Indication for North-South Approaches

(2) East-west direction

For east-west direction, standard two phase sequence will be applied as shown below.



Source: YUTRA Project Team

Figure 5.3.2.10 Signal Lantern Indication for East-West Approaches

8) Other features of signal design

In the design of signal, the following features are provided to enhance the visibility and reliability of signal:

(1) Introduction of yellow arrow and red allow signals

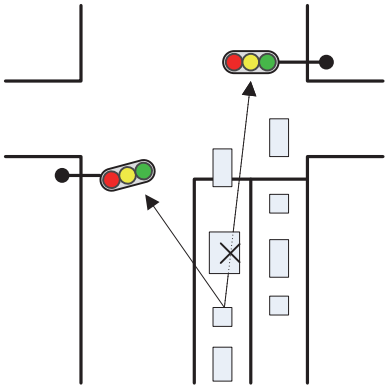
Previously, only green arrow signal was used in Yangon to control left turn. As a result, protected left turn and permissive left turn are mixed and not properly distinguished. In a new signal system, yellow and red arrow signals were introduced in addition to green arrow signal to control left turn traffic separately from through traffic.

Source: YUTRA Project Team

Figure 5.3.2.11 Introduction of Yellow and Red Arrow Signals

(2) Dual signal lantern layout

Two sets of signal lantern is provided to each movement to prevent the situation, in which signal is not visible to drivers due to high and large vehicles in front. Primary signal is provided at far side of intersection on the same side of movement, while secondary signal is provided at near side on the opposite side of movement as shown in the figure below.



Source: YUTRA Project Team

Figure 5.3.2.12 Dual Signal Lantern System

(3) Pan and tilt mechanism for signal lantern

Signal lantern must face the vehicles approaching to the intersection squarely for better visibility. To achieve this, pan and tilt mechanism is provided to the fitting metal. Panning is made by extending or collapsing the arm of fitting metal and tilting is made by fixing the lantern to the metal by loose bolt hole.

The photo below shows dual lantern system, pan and tilt mechanism and terminal box.

Source: YUTRA Project Team

Figure 5.3.2.13 Dual Lantern, Pan-tilt mechanism and Terminal Box

(4) Use of terminal box

Signal lantern cable is a cable that connects local controller and each signal lantern. The cable must be branched at each signal pole to connect signal lantern. The existing signal system adopts very rudimentary and makeshift method and cable is connected in the air and wrapped with vinyl tape. The practice is not only technically unacceptable but also causes danger of electric shock. Terminal box must be used and cable must be connected firmly at the terminal.

Existing Signal Cable Wiring

Use of Terminal Box

Source: YUTRA Project Team

Figure 5.3.2.14 Cable Connection at Terminal Box

5.3.3 Installation Work Design

1) Drawing for Improvement Works

Based on the lane layout and signal design described above, design of improvement work was carried out.

First of all, the existing signal equipment at the site was examined and the part of the existing signal system that can be used and does not require replacement was identified. The existing signal poles located at each corner island are found in good condition. Thus they are used for new signal lanterns. Except signal pole, local controller, existing signal lantern, and signal cable connecting local controller and signal lanterns need to be replaced.

Two options were considered with regard to the signal cable wiring between local controller and signal lanterns, overhead cable installation and underground cable installation. Overhead wiring is easier to install but susceptible to damage due to tall vehicles and other reasons as the cable is exposed in the air.

On the other hand, underground cable installation is sturdy and not affected by the external force as it is buried under the ground. It is also aesthetically better than overhead

method. Underground conduit installation work using horizontal boring method takes more time and costs higher, however. Open cut method that requires cutting of pavement, was not considered as it damages pavement.

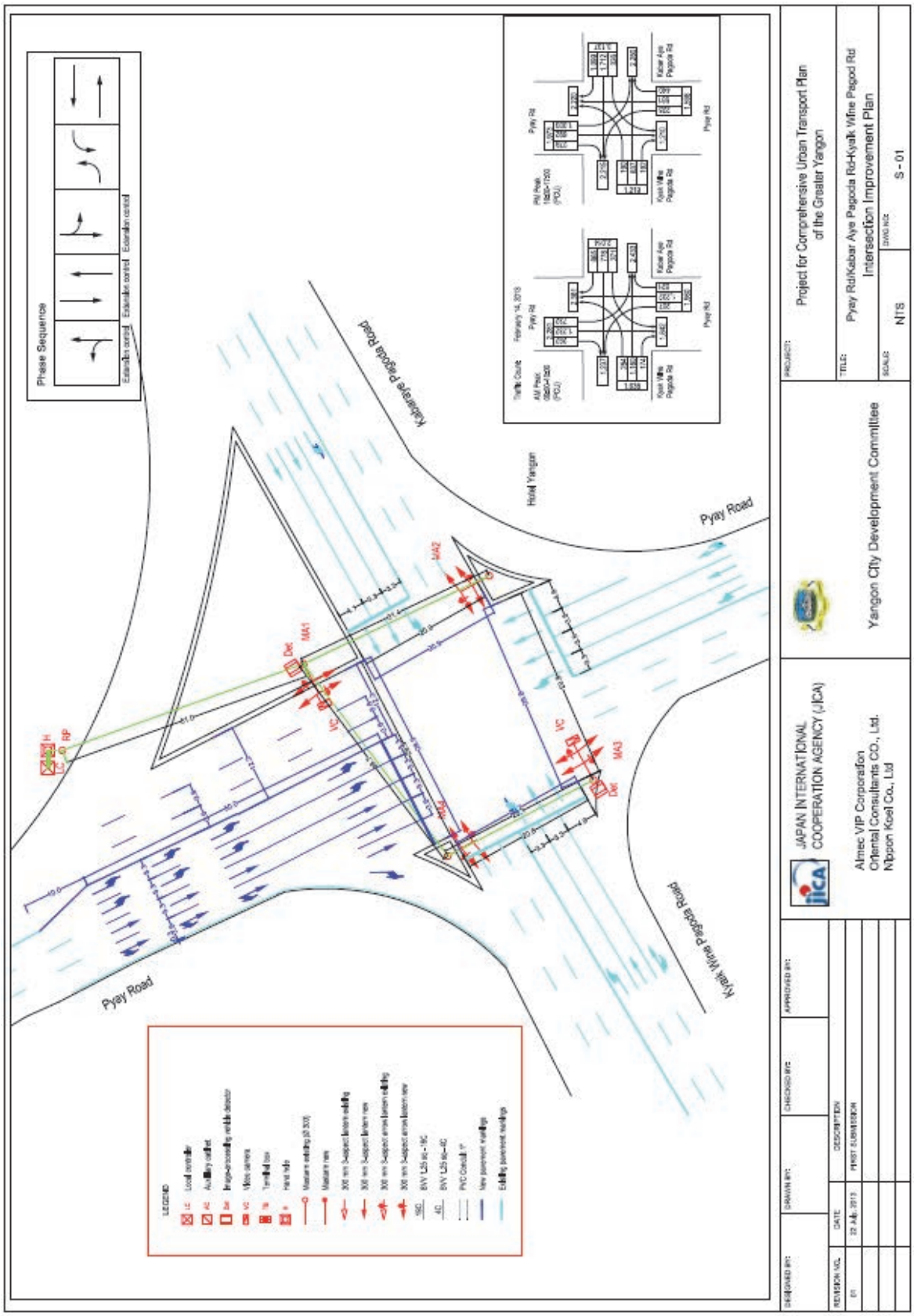
Consultation was made with YCDC as to the cable installation method. According to YCDC, horizontal boring method is commonly used in Yangon for signal installation work so that they have experience and capability. For this reason, underground cable installation is adopted.

As output of improvement work and signal design, two types of drawing are prepared as attached. One drawing shows a plain plan of intersection. Another drawing is a cable connection diagram. Plain plan shows the layout of signal equipment, phase sequence, peak hour traffic volume and pavement markings.

Cable connection diagram shows how signal equipment is connected each other together with the type of cable used.

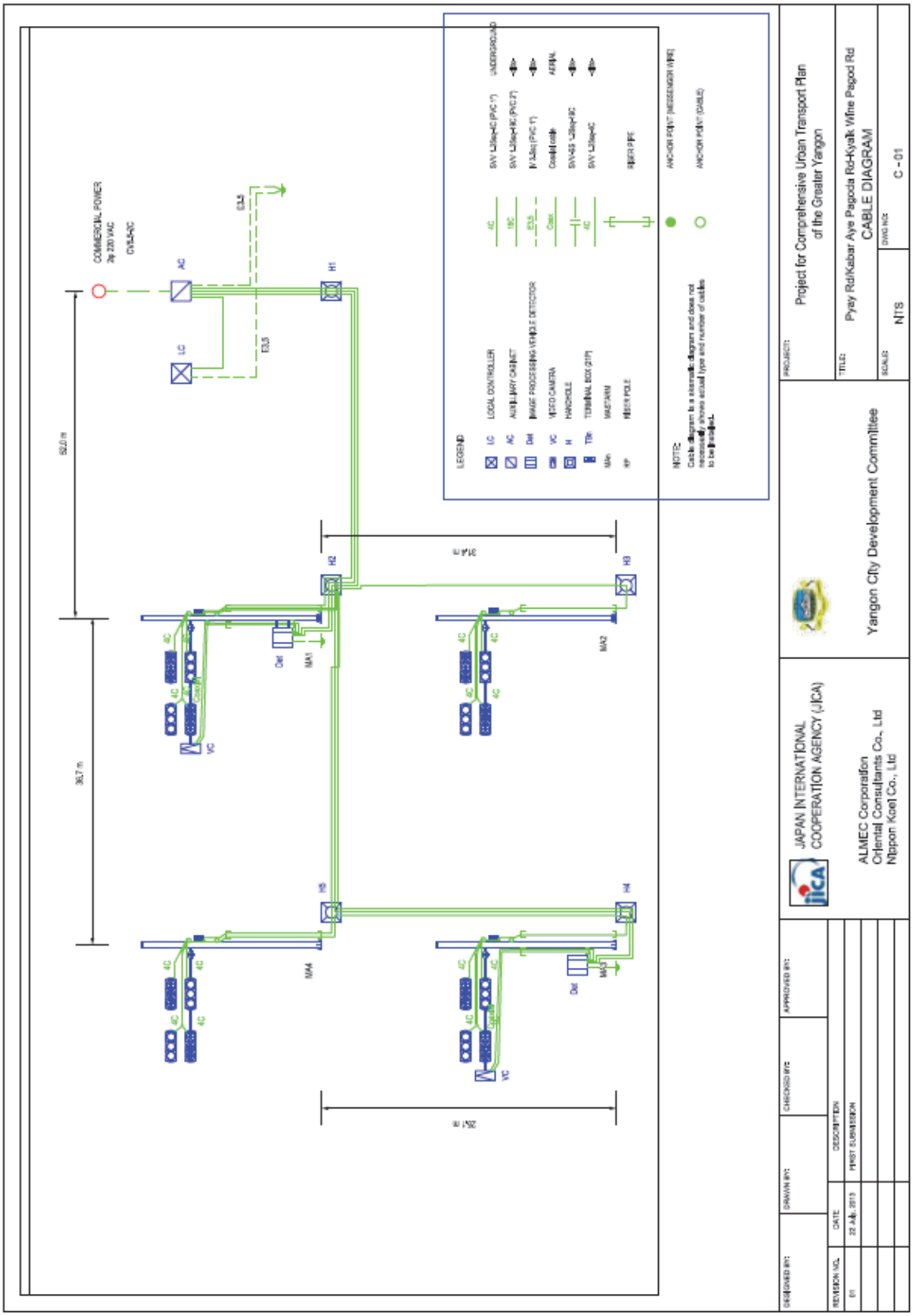
2) Technical Specifications

Technical specifications were prepared for the pilot project. It contains the requirements for local controller, signal lantern, video vehicle detector, pavement marking and general requirements. The document was part of the tender document for contractor selection.



Source: YUTRA Project Team

Figure 5.3.3.1 Improvement Work Design Drawing



Source: YUTRA Project Team

Figure 5.3.3.2 Cable Connection Diagram (Underground)

5.4 Implementation of Pilot Project

5.4.1 Procurement of contractor

Installation of new signal and related equipment, and application of pavement marking is undertaken by a contractor hired by YUTRA Project Team. The contractor is responsible for supply and installation of equipment, application of pavement markings, construction supervision and local counterpart training. The contractor is selected through a competitive bidding. YUTRA Project Team prepared bidding documents consisting of the documents listed below.

- Invitation for bidding
- Instruction to bidders
- Bill of quantities
- Technical specifications
- Drawings
- Forms
- Packing instructions
- Shipment instructions
- Instructions for dispatching installation work supervisor

The bidding is held in accordance with the relevant rules and regulations of JICA.

5.4.2 Equipment manufacturing, factory test and shipment

Local controller, video vehicle detector and signal lanterns are procured from a manufacturer in Japan. After these devices are manufactured, a factory test is held at the manufacturer's factory. Appearance, functional and environmental tests were conducted. No defects were found in the factory test.

The majority of equipment from Japan arrived in Yangon on 3 November, 2013. After custom clearance, the equipment was delivered to the YCDC's warehouse on 11 November, 2013.

5.4.3 Signal Installation Works

The pilot project requires civil and electrical works to install local controller, vehicle detector and signal lantern, and connecting them with cable. Types of work required are listed below.

- Underground conduit installation
- Manhole construction
- Local controller installation
- Video camera and controller installation
- Signal lantern mounting
- Signal and power cable installation

These works are undertaken by a local contractor hired by the pilot project contractor.

Prior to the start of work at site, the contractor had a meeting with the civil work contractor to confirm the location where underground conduit is installed and manhole is constructed.

Actual conduit installation work at the site started on 1 November, 2013 by digging holes at end of conduit section. It took about three weeks to complete underground conduit work and manhole.

5.4.4 Pavement marking work

In conjunction with new signal installation, layout of lanes on the northern approach must be modified. The existing lane lines and arrow symbols must be erased and new centre line, lane lines and arrow symbols must be marked on the movement at the specified location indicated on the design drawing (Figure 5.3.3.1).

5.4.5 Timing Parameter Adjustment

In order to maximize the efficiency of the new signal system, various signal control parameters must be set in the local controller properly. There are three sets of parameters to be defined, namely:

- Time-of-day control parameters
- Cycle length and split
- Actuation control parameters

1) Time-of-day (TOD) parameters

The local controller is capable of applying different cycle length and split based on the time-of-day and day-of-the-week that fit the traffic condition at the time and day. As traffic demand pattern differs on weekend and holidays, different timing parameter must be applied on these days. TOD parameters specify the time zone during which a specific signal control parameters are applied.

2) Cycle length and split

Cycle length and split (proportion of green time for specific movement against cycle length) are basic parameter of signal. These parameters must be specified for several signal control pattern sets. Normally, longer cycle length is applied for congested traffic condition and shorter cycle time for off-peak traffic.

3) Actuation control parameter

The new signal system has actuation control function. To operate the actuation control, minimum green time, unit extension and maximum green time must be defined and set in the local controller, in addition to the vehicle detector ID, from which vehicle detection signal is sent.

These parameters are prepared based on the traffic count data and set at the factory into the local controller before shipment. Once the local controller is installed and becomes operational at the site, fine tuning is required and the parameters are adjusted to actual traffic condition at the site.

5.4.6 Changeover to new signal

The new signal started its operation on Sunday, 8 December, 2013. Once the new signal was put into operation, no fall back to the old signal was made, and the old signal system (local controller, signal lanterns and signal cables) was removed.

Pavement marking works along the north approach were undertaken in the night of 4 December, 2013. Centre lane was shifted to accommodate five approach lanes for about 60 meters from stop line and the width of lanes along the north leg was adjusted.

5.5 Evaluation of Pilot Project

Effect of improvement works are evaluated in two ways, traffic simulation by computer and “before” and “after” survey. The results of the evaluation are presented in the following sections.

5.5.1 Traffic Simulation

1) Introduction

A computer simulation model is developed to evaluate the degree of improvement expected by the pilot project at 8-mile intersection by computer simulation. A microscopic simulation software called VisSim is used for simulation. The software emulates movement of individual vehicles on the road and traffic signal controlling them. Various performance indicators such as delay, number of stops, average speed, etc. are output by the software. In addition, movie showing the movement of the vehicles can be produced. By running the simulation software under “before” and “after” conditions, the improvement in the performance can be compared.

2) Outline of simulation

Simulation is conducted for “before” and “after” cases with the same traffic volume but different lane assignment and signal operation. The parameters used in the simulation are summarized below.

Table 5.5.1.1 Summary of Simulation Parameters

	Before case	After case
Intersection geometry	Existing condition	Same as “before” case
Lane assignment	Existing condition (4 lanes for north approach)	North approach has 5 lanes (a lane added by shifting centre line)
Signal phase sequence	Existing phase sequence (left turn allowed during yellow phase)	Proposed phase sequence with lead/lag left turn
Permissive left turn	Allowed (only green arrow signal used)	Not allowed (controlled by green, yellow and red arrow signals)
Signal timing	Existing (average of manual control observed)	Optimized by capacity analysis
Green extension	Not provided	Not used
Signal cycle length	250 sec.	150 sec.
Traffic volume	Peak hour traffic volume measured	Same as “before” case

Vehicle classification	14 vehicle types are simplified into 5 types	Same as “before” case

Source: YUTRA Project Team

Simulation is run for 25 minutes, which is least common multiple of two different signal cycle lengths for before and after cases. A snapshot of the movie produced by the simulation is shown below.

Source: YUTRA Project Team

Figure 5.5.1.1 Snapshot of Simulation Movie

3) Simulation results

The simulation results are summarized in Table 5.5.1.2. The total delay, average delay and number of stops are almost halved in “after” case. On the contrary, average speed is more than 50% increased.

Table 5.5.1.2 Summary of Simulation Results

Indicator		Before case	After case	Difference
Total delay	(hour)	575.25	293.828	-48.9%
Average delay per vehicle	(second)	316.36	163.617	-48.3%
Average number of stops	(number)	4.47	2.486	-44.4%
Average speed	(km/h)	17.41	26.34	+51.3%

Source: YUTRA Project Team

The simulation results indicate that the improvement works are very effective in improving traffic condition at 8-mile Intersection, even without large-scale capital-intensive works

such as road widening and flyover.

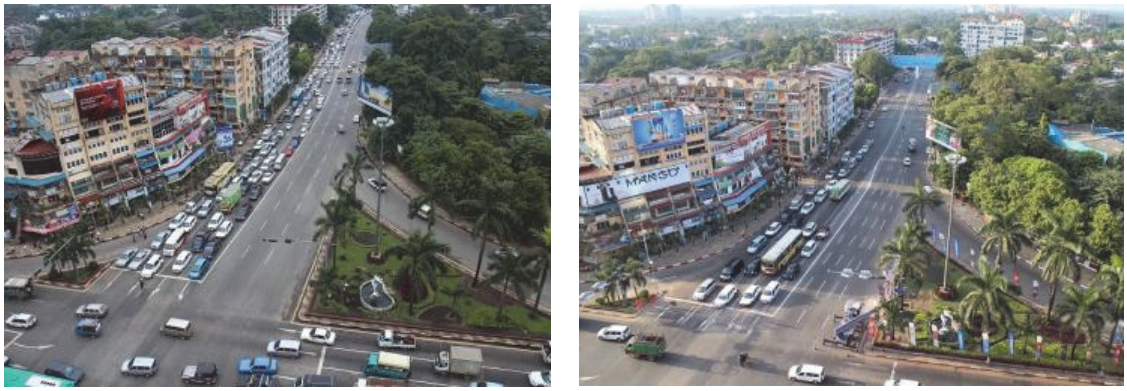
4) Notes on simulation model

Any simulation model has limitations to represent events in real world. In the case of the simulation for 8-mile Intersection, the followings are noted:

- The simulation model assumes behaviour of drivers consistent and typical. If drivers in real world are more aggressive or dull than assumed, the results would be slightly different.
- Five types of vehicles are used in the simulation. In real world, however, there are more vehicles types with different manoeuvrability. Traffic condition could not be exactly simulated.
- Simulation assumes that all drivers observe traffic rules and follow traffic signal and lane assignment. If drivers in real world do not abide by rules and regulations, the simulation does not represent the actual condition.
- Actuation control of signal is not implemented in the simulation.
- Notwithstanding the limitations mentioned above, the simulation is considered to be able to represent traffic conditions at the pilot intersection with reasonable accuracy. It is more so when relative difference is to be examined by the simulation.

5.5.2 Initial Observation

After lane marking was changed on the night of 4 December, 2013, initial observation was made on the next day. The shorter queue length is observed as expected. At this moment, operation of signal remains unchanged so that queue length on other approaches is almost same as before. The situation changed later as signal operation is adjusted in such a way that queue on all approaches is at the same level.



Before (25 Jun. 2013) **After (5 Dec.2013)**

Source: YUTRA Project Team

Figure 5.5.2.1 Queue on North Approach

On 6 December, 2013 YUTRA Project Team interviewed traffic policemen and asked their opinion on the new lane marking. They mentioned out the following points.

- In the previous lane marking, there were only 4 lanes; 2 for through traffic, 1 for

left-turn traffic and 1 for shared lane. In the shared lane, we often observed that left-turn traffic blocks through traffic and through traffic blocks left-turn traffic.

- In the new lane marking, there are 5 lanes; 3 for through traffic and 2 for left-turn traffic. Adding one more lane can accommodate more traffic. Separation of left-turn traffic and through traffic lane significantly reduces traffic congestion.
- In morning peak hour (around 8:30 am), even though same signal timing (90 second) is applied, queue length considerably becomes shorter than before.
- When we operate traffic signal manually, we feel that it is easier to control than the case of previous lane marking.

A week after the new signal was put into operation on 8 December, 2013, Assistant Chief Engineer and Assistant Engineer of YCDC, who were directly involved in the pilot project and monitored work progress and traffic condition at the site made the following observations:

- Queue length is same along Pyay Road and Kabaraye Pagoda Road. However, waiting time at intersection has become significantly shorter.
- Changing lane marking on Pyay Road is very effective especially giving two lanes for left-turn traffic.
- New Signal phasing is better than previous one because it can avoid conflict between through traffic and left-turn traffic.
- Most of the drivers now understand new signal indication.
- Bus stop near the intersection needs to relocate since it disturbs traffic flow.

5.5.3 "Before" and "After" Study

A "before" and "after" study is conducted at and around 8-mile Intersection. The objectives of the survey are to:

- Collect traffic operation data that enable evaluation and estimation of benefits brought about by the pilot project and
- Collect road user's opinion about traffic situation and related topics to understand road users' perception about traffic condition before and after the pilot project.

The study consists of three kinds of survey and video shooting. The surveys conducted are:

- Intersection queue length survey
- Intersection turning movement count survey
- Road user's opinion survey

Video shooting covering 8-mile intersection is made during the intersection queue length survey. The video is taken to analyse the signal operation and vehicle behaviour.

"Before" survey was conducted on 3 December, 2013 when no improvement work is done, while "after" survey was conducted on 26 December, 2013 after all improvement works

had been implemented.

1) Traffic signal operation during survey

Survey was conducted under the old signal during before survey and the new signal during after survey. No modification was made to the old signal for the purpose of the survey. New signal phase sequence and new signal timing specifically developed for 8-mile intersection were applied to the new signal prior to the after survey.

During the surveys, use of manual signal operation by traffic police was not restricted and left to the traffic police deployed at the intersection. The reason is that survey must be conducted under the same condition as daily operation. If manual operation of signal is not exceptional case, the survey must be conducted without restricting manual operation to collect the data under daily operation.

As Pyay Road is the access road to the airport, VIP operation is often required and signal is set to green for the VIP route manually. The operation is expected on survey days..

If signal operation is applied during the survey period, the performance of the manual signal operation as compared with the automatic operation can be evaluated by reviewing the queue length survey data.

2) Intersection queue length survey

Intersection queue length survey measures the length of waiting queue at intersection on all approaches. Queue length thus recorded is converted to the number of vehicles using average headway obtained at the site.

The surveyor records the queue length at each approach every 15 seconds. Queue is defined as row of vehicles stopping or moving at a speed of less than 5 km/h, little faster than walking speed. Queue length is measured by referring to the distance marker indicated on the curb along the approach. The length will be rounded to the nearest 10 meters. All approaches have two or more lanes and queue length may be different among the lanes. In this case, the longest queue among the multiple lanes will be recorded.

It is expected that there is a case of long queue extending from the intersection stop line and some vehicles in the queue are moving while vehicles behind them are stationary. In this case, the queue is considered continuous and queue length is defined as the end of vehicle stream either stopping of moving slowly.

The queue length is converted to number of waiting vehicles taking average headway and number of lanes into consideration. Average headway was measured at the site and set at 7.64 meter. Number of lanes is three lanes for north and east approach, and two lanes for west approach. The south approach has three lanes but as the inner most lane is the exclusive left turn lane and queue on that lane is always much shorter than other two lanes. Thus number of lanes on south approach was set to 2.5 lanes.

3) Intersection turning movement count survey

Intersection turning movement count survey is conducted to collect traffic volume by vehicle class in each direction at the intersection. There will be a total of 12 directional movements at the intersection. The survey is performed for 14 hours from 6:00 to 20:00.

The same classification as used in the previous survey conducted in February 2013 is applied and vehicles will be classified into 14 types.

4) Road user's opinion survey

Road user's opinion is collected through an interview survey before and after the pilot project. The survey asked how the road user thinks of the traffic condition at the pilot project intersection by "before" survey. The opinion of the road users is sought whether they have noticed new signal and any improvement of traffic condition after the pilot project.

The survey was conducted at four approaches to the intersection. A total of 743 samples and 738 samples were collected by "before" and "after" surveys, respectively..

5) Video shooting

Video covering the intersection area is taken on the same day of "before" and "after" survey during the period of intersection queue length survey. The video will be used to analyse performance of intersection including intersection saturation flow rate for different direction, and behaviour of vehicles.

A video camera is placed at the pent house floor of the hotel located at south-east corner of 8-mile intersection.

5.5.4 Study Results

In this section, overall comparison between "before" and "after" surveys is given first followed by the discussion on each survey result.

1) Total delay comparison

The table below summarizes the traffic volume and total queue length during three survey periods for "before" and "after" survey. Although, the traffic volume during "after" survey was slightly smaller than that during "before" survey, total queue expressed in the units of meter-minute is reduced by 25.9%.

Table 5.5.4.1 Comparison of traffic condition at "before" and "after" survey period

Time period	Volume (PCU)			Queue Length (meter-minute)		
	Before	After	A/B (%)	Before	After	A/B (%)
08:00-10:00	11,295	10,997	97.4	190,742	186,608	97.8
12:00-14:00	12,156	11,671	96.0	219,891	109,019	49.6
16:00-18:00	12,110	11,846	97.8	183,271	144,408	78.8
Total	35,561	34,514	97.1	593,903	440,034	74.1

Source: YUTRA Project Team

The performance improvement is not as large as expected by the simulation model. The model indicated delay reduction of nearly 48.3%, while reduction of delay measured by "before" and "after" surveys is average 26.4% for three survey periods as shown in the table.

Table 5.5.4.2 Average delay per vehicle

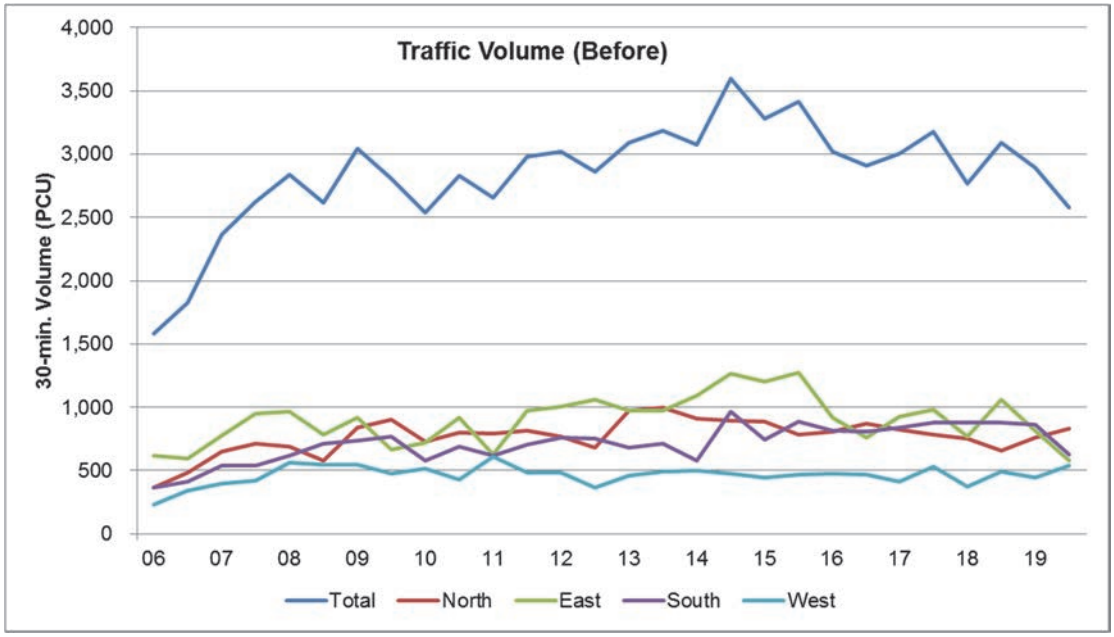
	Before (minute)	After (minute)	Reduction
Survey	5.9	4.3	26.4%
Simulation	5.3	2.7	48.3%

Source: YUTRA Project Team

As mentioned earlier, simulation model assumes standard and behavior for vehicles. The traffic flow is more homogenous. On the other hand, traffic condition and vehicle behavior in real world are more diverse and unpredictable. Smaller reduction rate can be attributed to these differences.

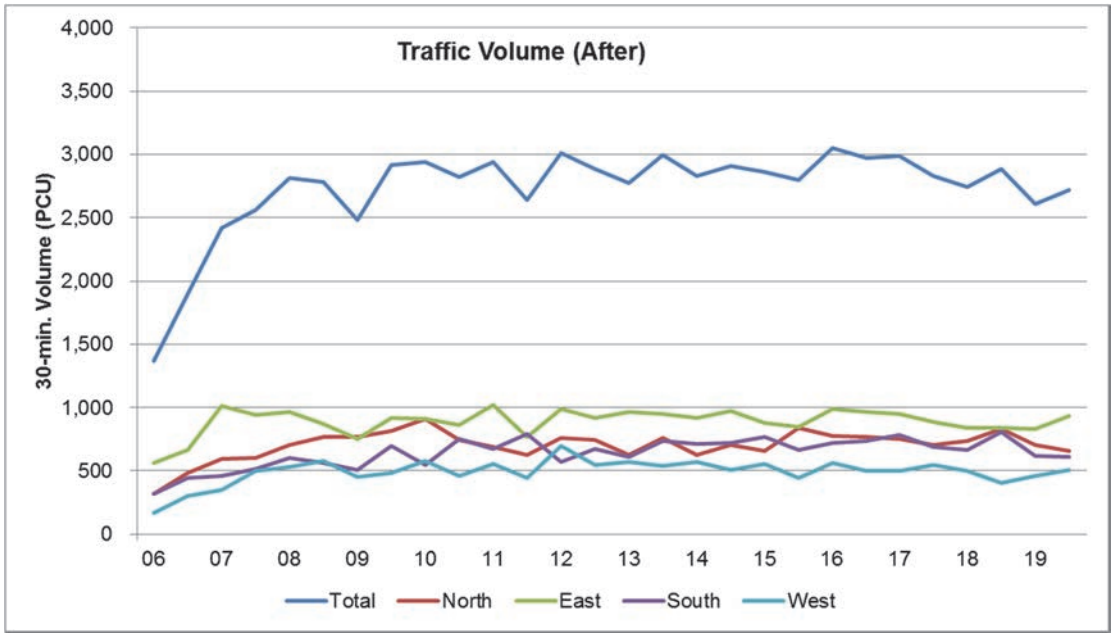
2) Traffic count survey

The results of traffic count survey are shown in Figure 5.5.4.1 below. The total traffic count in PCU for 14 hours (06:00 – 20:00) is 79,666 PCU for before survey and 76,455 PCU for after survey. The traffic volume of after survey is 4.0% less than before survey. For the survey periods (08:00-10:00, 12:00-14:00 and 16:00-18:00), the total volume during after survey is 2.9% fewer than that during before survey. These differences in traffic volume are considered insignificant from the viewpoint of congestion.



Source: YUTRA Project Team

Figure 5.5.4.1 Traffic Volume in PCU (Before)



Source: YUTRA Project Team

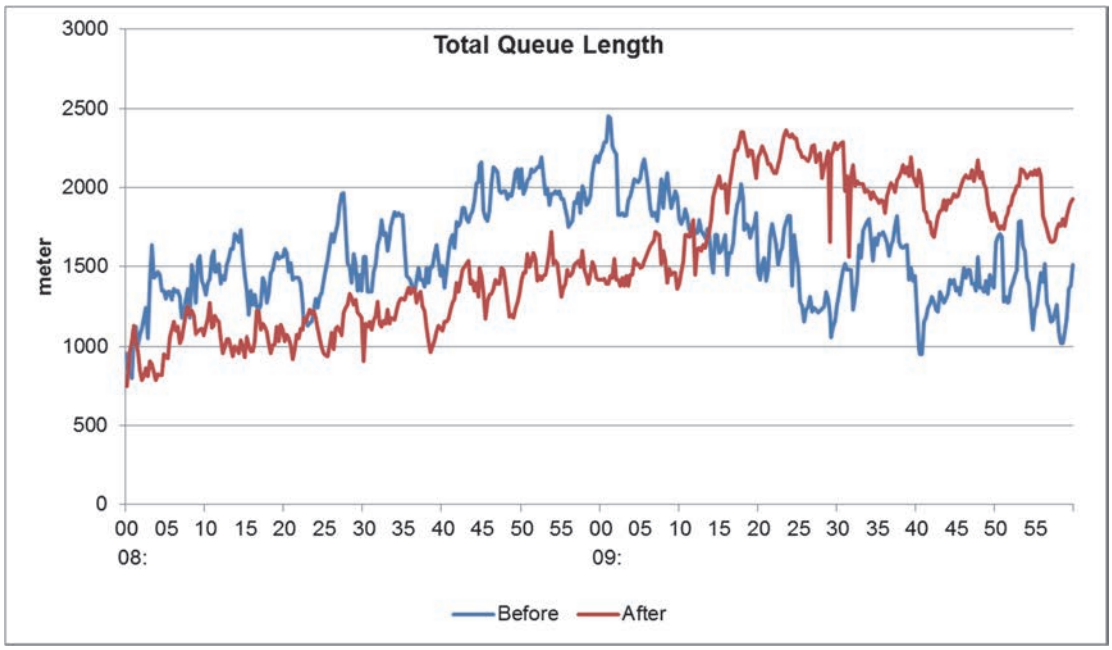
Figure 5.5.4.2 Traffic Volume in PCU (After)

3) Queue length survey

Queue length recorded by the survey is shown in Figure 5.5.4.3 and Figure 5.5.4.4.

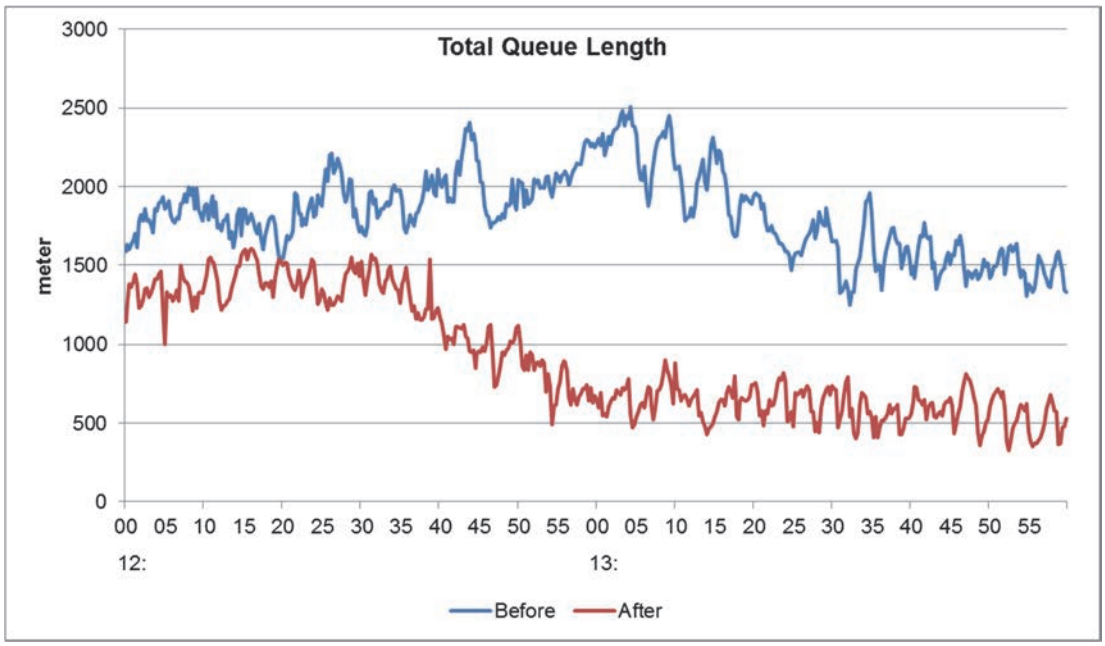
Figure 5.5.4.5 for the survey period of 08:00 – 10:00, 12:00 – 14:00 and 16:00 – 18:00, respectively. The figures show the sum of the queue length along four approaches. Performance of a signal cannot be evaluated by queue length of one approach only. Because signal operation is a zero sum game in which favorable operation for one movement results in adverse operation for conflicting movements. For this reason,

intersection total queue length is used as indicator of signal performance.



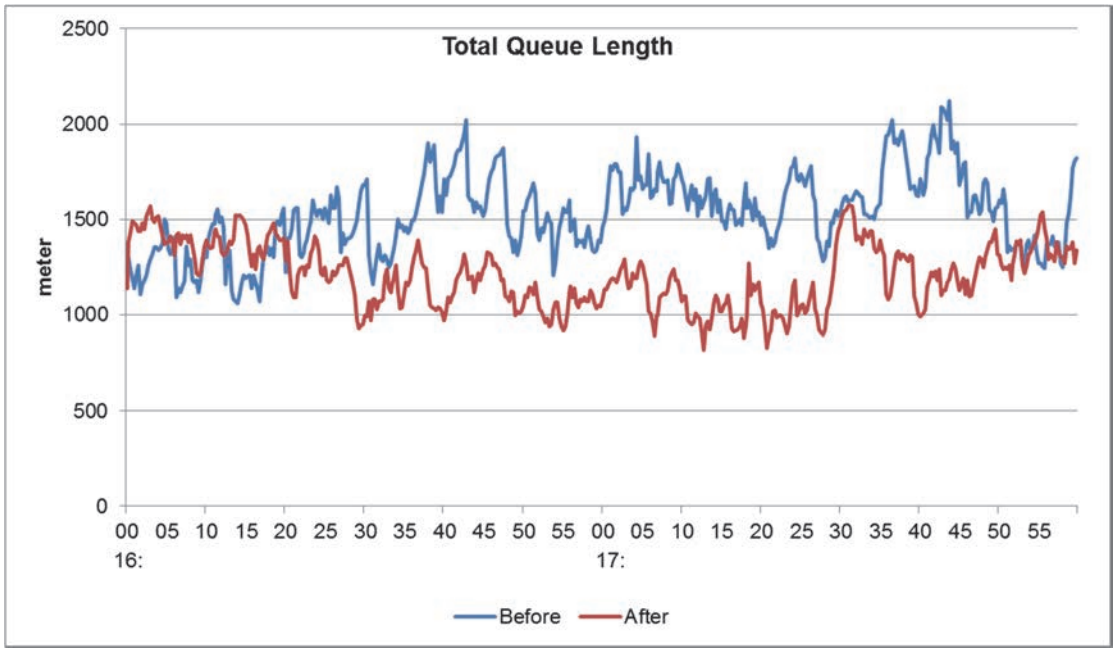
Source: YUTRA Project Team

Figure 5.5.4.3 Intersection Total Queue Length 08-10 (Before and After)



Source: YUTRA Project Team

Figure 5.5.4.4 Intersection Total Queue Length 12-14 (Before and After)



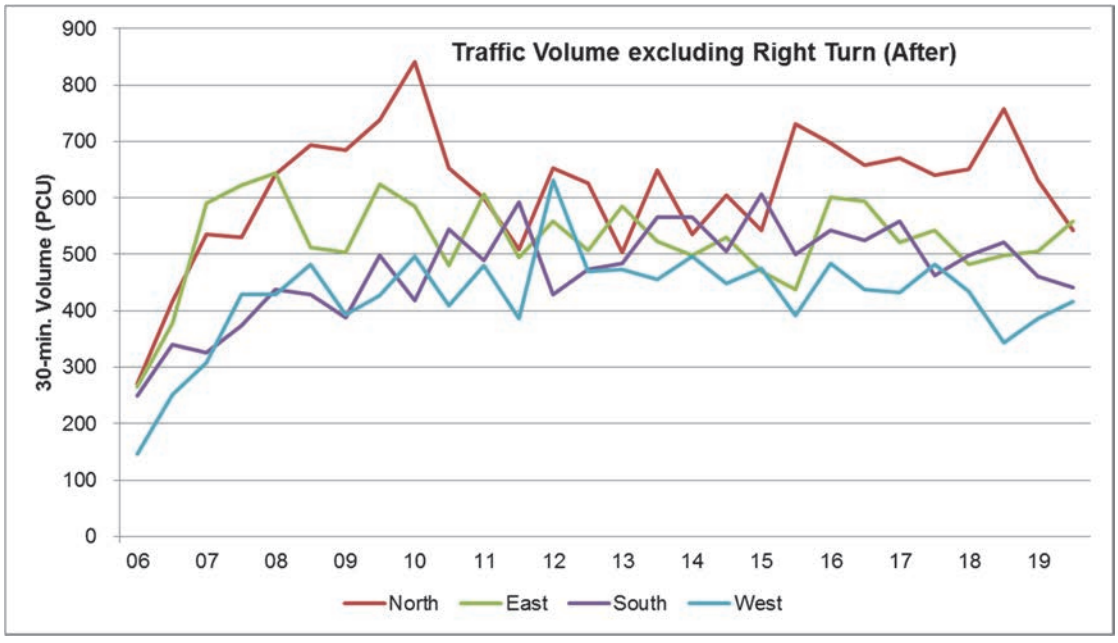
Source: YUTRA Project Team

Figure 5.5.4.5 Intersection Total Queue Length 16-18 (Before and After)

Queue length graphs show the shorter intersection total queue length during after survey except the time period of 09:15-10:00

In order to analyse the longer queue during “after” survey, traffic volume count data was checked and video shooting of intersection operation was reviewed.

Figure 5.5.4.6 shows the traffic count data during “after” survey of each approach excluding right turning traffic. At 8-mile Intersection, corner island is constructed at four corners and free flow right turn is provided to all approaches. Therefore, right turning traffic is not controlled by signal. For this reason, right turn traffic is not considered here.



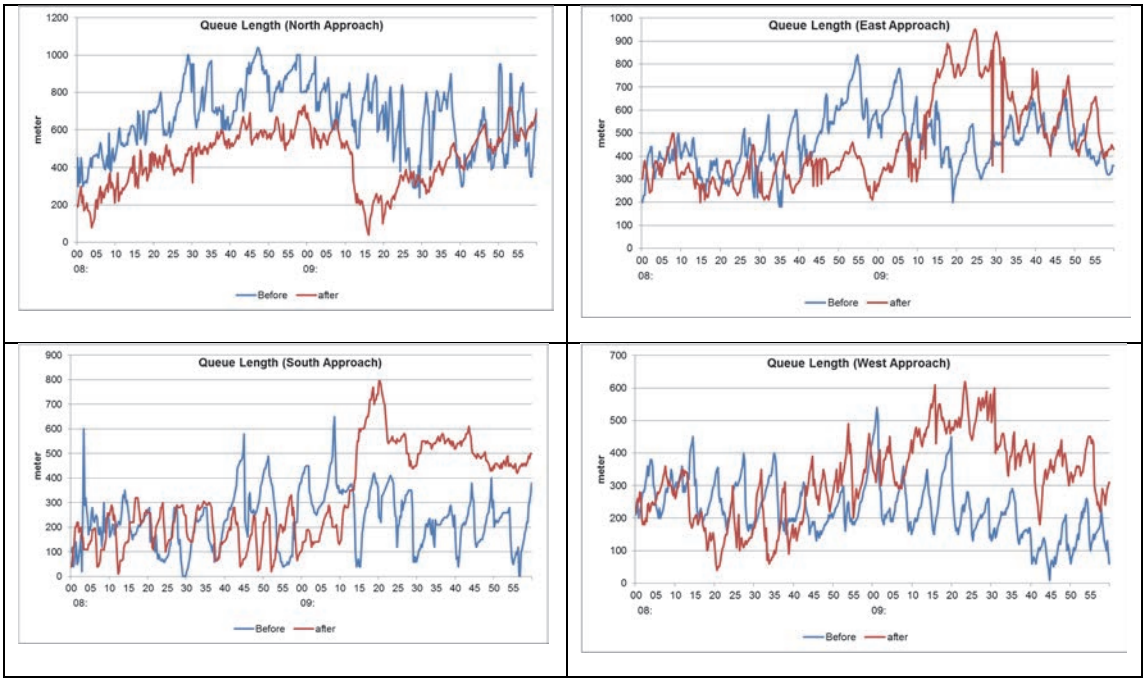
Source: YUTRA Project Team

Figure 5.5.4.6 Traffic Volume except Right Turn (After)

The traffic count graph shows a sharp rise in traffic volume on north approach between 9 to 10 o'clock. The video shows that the signal is operated manually during this period to cope with the sudden increase in traffic volume and longer green time is given to north approach.

Queue length data along each approach during morning period (08:00 – 10:00) below indicate that the queue on north approach became shorter at around 09:10 in spite of the increase in traffic demand. On the other hand, queue length of other three approaches (east, south and west) grew longer although the traffic demands remain almost same. Based on these data, it is judged that manual operation was too favourable to north approach by giving long green time causing longer queue on other approaches. As the queue on three approaches became longer, intersection total queue length during this period is longer during "after" study as compared with "before" survey.

It is noted that once queue becomes longer, it remains same if traffic volume is near to the capacity. Thus longer queue continued some time on the approaches except north.



Source: YUTRA Project Team

Figure 5.5.4.7 Queue Length along each approach (After) 08:00-10:00

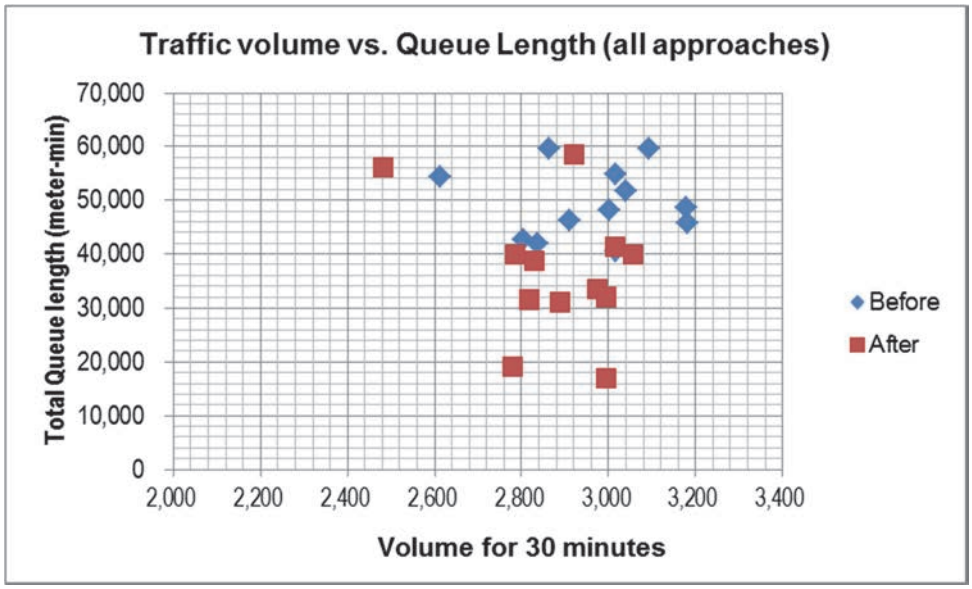
4) Traffic volume vs. queue length

In order to examine the relationship between traffic volume and queue length, their distribution is plotted as shown in Figure 5.5.4.8

The figure shows that there is no linear relationship between traffic volume and queue length. This is because queue length is the accumulation of difference between incoming flow and departing flow and the traffic volume shown in the graph is the departing traffic. As mentioned earlier, queue once created remains at same length if traffic is saturated.

The graph shows that the queue length during after study is always shorter than that

during before survey except two cases, which is discussed above. This fact also indicates that the congestion became less after the pilot project by keeping shorter queue length at same traffic volume.



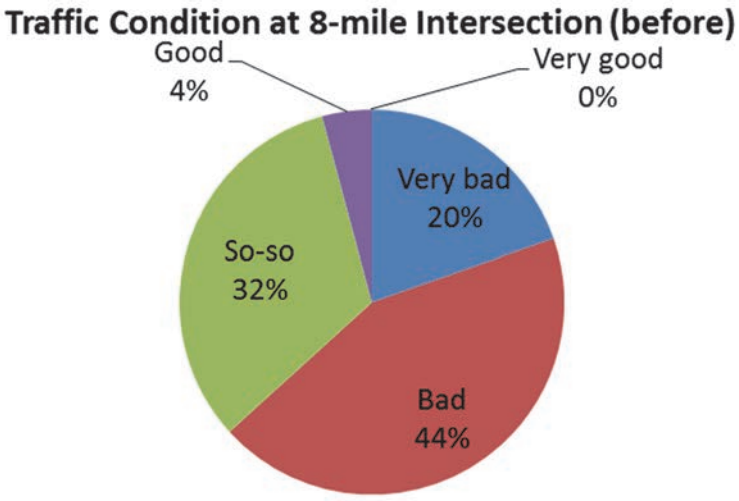
Source: YUTRA Project Team

Figure 5.5.4.8 Total Volume – Total Queue Length Relationship

5) Road User's Opinion

Road user interview survey was conducted before and after the pilot project. The survey results are briefly summarized below.

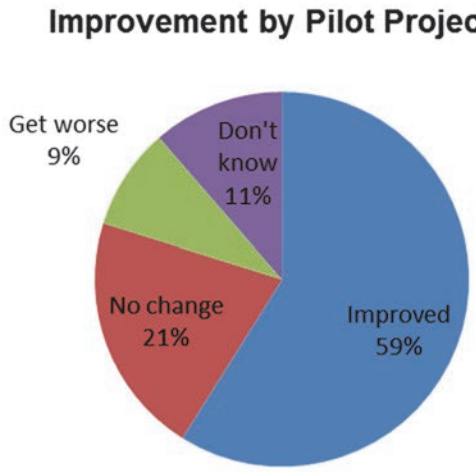
Perception of road users about the traffic condition at 8-mile intersection was asked before the new signal was installed. The results are shown below. Nearly 2/3 of the road users interviewed considered the traffic condition is bad or very bad and about 1/3 of users considered the traffic condition not bad and not good. Only 5% considers the traffic condition is good.



Source: YUTRA Project Team

Figure 5.5.4.9 Perception of Road Users on Traffic Condition

After the new signal was installed and other improvement measures were implemented, 59% of road users recognized that the traffic condition was improved, followed by 21% of drivers unchanged, 9% worse, and 11% don't know.



Source: YUTRA Project Team

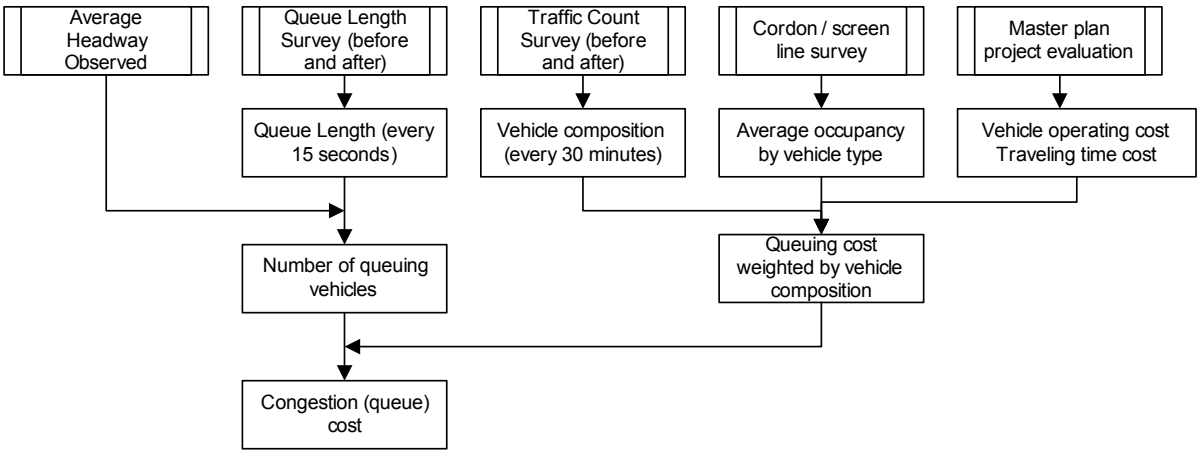
Figure 5.5.4.10 Improvement by Pilot Project

As to the new type of signal (combination of green, yellow and red arrow signals), majority (92.3%) of road users noticed them and 82.2% of the respondent said that they can easily understand the meaning of arrow signal as compared with 11.0%, who had difficulty in understanding the signal.

5.5.5 Economic Evaluation

1) Procedure

Economic evaluation procedure is schematically shown in Figure 5.5.5.1. The procedure is applied to both before and after survey. Then the congestion (queue) cost for two cases was compared and the difference is calculated as the amount of improvement.



Source: YUTRA Project Team

Figure 5.5.5.1 Evaluation Procedure

As shown in the figure, average occupancy (number of persons in a car) for each type of

vehicle collected by cordon / screen survey and the vehicle operating cost prepared for the evaluation of master plan projects was applied in the evaluation.

2) Vehicle operating cost

Vehicle operating cost for various types of vehicle defined as the cost to run 1000 km used in the study is shown below. The costs are same as the costs used for evaluation of major master plan projects. For the evaluation of pilot project, operating cost of the vehicle standing or moving slowly in a queue is used as vehicle operating cost. Thus the cost at the speed of 5 km/h is adopted.

Table 5.5.5.1 Vehicle Operating Cost (Kyat/1000 km)

km/h	MC	Car	HOV/Van	Mini bus	Std bus	S truck	Big truck
5	57,900	447,132	633,195	661,973	742,929	840,234	1,151,759
10	34,295	257,712	373,860	437,362	483,119	611,153	795,493
20	21,849	157,594	232,658	304,153	332,735	451,173	568,219
30	17,456	121,628	176,768	246,379	269,885	367,305	458,218
40	15,148	102,844	143,898	212,305	234,639	312,747	390,639
50	14,188	91,836	129,495	193,113	215,174	279,481	354,415
60	13,646	86,853	124,392	183,500	204,314	260,910	334,571

Source: YUTRA Project Team

The vehicle operating cost at 5 km/h is converted to the time cost as shown below.

Table 5.5.5.2 Vehicle Operating Cost at 5 km/h (Kyat/minute)

Type	MC	Car	HOV/Van	Mini bus	Std. bus	S truck	Big truck
Cost	4.8	37.3	52.8	55.2	61.9	70.0	96.0

Source: YUTRA Project Team

The traffic count survey classifies vehicles into 14 types. The operating cost of each type of vehicle is defined as shown below.

Table 5.5.5.3 Vehicle Operating Cost Adopted (Kyat/minute)

Class	2	3	4	5	6	7	8
Survey classification	Bicycle	MC	Car	Van	Taxi	Pas-Truck	Small-Bus
Type in Table 5.5.5.2	Bicycle	MC	Car	Van	Car	Mini-bus	Mini-bus
VOC (Kyat/min)	0	4.8	37.3	52.8	37.3	55.2	55.2

Class	9	10	11	12	13	14
Survey classification	Large-Bus	Pick-up	Med-Truck	Large-Truck	Trailer	Others
Type in Table 5.5.5.2	Std. bus	S truck	S truck	Big truck	Big truck	Car
VOC (Kyat/min)	61.9	70.0	70.0	96.0	96.0	37.3

Source: YUTRA Project Team

3) Person Travel Time Cost and Occupancy

Travel time cost of persons riding vehicle used in the feasibility study of master plan projects is shown below. No travel time cost is assumed for cargo truck and the cost of crew is included in the vehicle operating cost.

Table 5.5.5.4 Travel Time Cost (Kyat/minute)

Bicycle	MC	Car	Van	Taxi	Truck-bus	Small bus	Large bus
8.9	8.9	21.9	21.9	17.1	11.0	11.0	11.0

Source: YUTRA Project Team

Occupancy for different types of vehicle was surveyed in the cordon / screen surveys. As there is no consolidated occupancy data that represent the average occupancy for entire Yangon, average of cordon / screen survey was adopted as occupancy for the evaluation. They are shown below.

Table 5.5.5.5 Occupancy Measured by Cordon/Screen Line Survey

	2	3	4	5	6	7	8
Vehicle type	Bicycle	MC	Car	Van	Taxi	T-Bus	Small Bus
Occupancy	1.43	1.7	2.55	4.15	3	15.52	22.44

9	10	11	12	13	14
Large Bus	Pick-up	Medium Truck	Large Truck	Trailer	Others
39.95	2.96	3.73	2.5	2.45	3.99

Source: YUTRA Project Team

Based on person time cost and occupancy data for each these data, person travel time cost for various classes of vehicle is set as shown below. No cost is set for cargo vehicles.

Table 5.5.5.6 Travel Time Cost (Kyat/minute)

2	3	4	5	6	7	8	9
Bicycle	MC	Car	Van	Taxi	T-Bus	Small Bus	Small Bus
12.7	15.1	55.8	90.9	51.3	170..7	246.8	39.45

Source: YUTRA Project Team

4) Consolidated Vehicle and Person Cost

The consolidated vehicle operating cost and person time cost used for the evaluation of

the pilot project is shown below.

Table 5.5.5.7 Overall Cost (Kyat/minute)

	2	3	4	5	6	7	8
Type	Bicycle	MC	Car	Van	Taxi	Pas-Truck	Small-Bus
VOC	0	4.8	37.3	52.8	37.3	55.2	55.2
Person cost	12.7	15.1	55.8	90.9	51.3	170.7	246.8
Total	12.7	20.0	93.1	143.7	88.6	225.9	302.0

	9	10	11	12	13	14
Type	Large-Bus	Pick-up	Med-Truck	Large Truck	Trailer	Others
VOC	61.9	70.0	70.0	96.0	96.0	37.3
Person cost	439.5	0.0	0.0	0.0	0.0	0.0
Total	501.4	70.0	70.0	96.0	96.0	37.3

Source: YUTRA Project Team

5) Cost weighted by vehicle type

The cost of each vehicle type was consolidated into signal cost weighted by vehicle composition. As the unit time of traffic count survey is 30 minutes, the consolidated weighted cost was prepared for each 30 minute period for each approach.

6) Cost of congestion and cost effectiveness

For each 15 second interval, the queue length is multiplied by the consolidated weighted vehicle cost to arrive at congestion cost during 15 second period. Then the costs were summed up for queue length survey period (08:00-10:00, 12:00-14:00 and 16:00-18:00).

The congestion cost above was multiplied by the expansion factor obtained as the ratio of 14-hour traffic volume against the traffic volume during queue length survey. No queuing cost was considered before 06:00 and after 20:00. The table below summarizes the calculation.

Table 5.5.5.8 Calculation of Queuing Cost

	Before		After		Ratio
	Volume (PCU)	Queuing cost (Kyat)	Volume (PCU)	Queuing cost (Kyat)	
Total volume (06:00-20:00)	79,666		76,455		96.0%
Survey period (2 hours x 3)	35,561	27,880,355	34,514	20,049,276	97.1%
Expansion factor	2.24	62,459,333	2.22	44,412,917	

Source: YUTRA Project Team

The economic evaluation presented above estimates the congestion cost at 8-mile Intersection before the pilot project at 62.5 million Kyat a day. The congestion was eased by the improvement pilot project and the cost was reduced by 29 % or 18 million Kyat a day to 44.4 million Kyat. On the other hand, the cost of pilot project including equipment, materials and installation work of signal system and pavement marking, but excluding design work and construction supervision was about 100 million Kyat. Thus, the cost of pilot project is recovered in one week by the saving realized by the congestion reduction.

5.5.6 Lessons learned

Throughout the selection, design, and implementation process of pilot project, various lessons were learned as presented below. They are helpful hints for future traffic management projects in not only Myanmar but also in other countries where technical and social conditions are similar to Myanmar.

1) Selection of pilot project intersection

- Location of pilot project must be selected in an objective manner based on the criteria suitable for selecting the intersection that has high potential of improvement.
- Traffic management issues must be properly understood before designing the improvement measures so as to correctly address the problems.

2) Improvement measures

- The pilot project demonstrated that traffic condition can be improved by implementing various traffic management measures, which include installation of advanced traffic signal, application of vehicle actuated control, and modification of pavement markings.
- Pavement marking of suitable layout is very effective in streamlining the traffic flow, which resulted in increasing effective intersection capacity and reducing congestion.
- Site observation and road user interview survey showed that drivers easily understand and adapt to the new signal phasing (lead / lag phase) with very few

exceptions, who make left turn during inter-phase red signal.

- Drivers also easily understood and followed additional left turn lane provided to north and east approach to the intersection.
- Benefits of similar scale are expected, if the measures are applied to other intersections where traffic management problems exist.

3) Installation works

- Hole digging, underground conduit placing and on-site man-hole construction works were done manually by labourers without using any machine. Although the works are of acceptable quality. It takes long time to complete. Use of machine is required for better work quality and shorter work time.
- Two units of bucket truck owned by YCDC were very useful and helped shorten the construction period. If they were not available, the project would have taken much longer time.
- Consciousness of workers about quality work is poor and no attention is paid. In particular, civil works were sometimes done in a makeshift way.
- Consciousness about worker's safety and work area safety is also not sufficient and needs enhancement.
- Quality of pavement marking is not satisfactory due to dilapidated pavement marking equipment, which needs replacement. Preparation work for lane marking work on the pavement is not efficient.

4) Management and staff

- Project management capability of YCDC is worth praising. Arrangement of engineers, workers, bucket trucks, cargo trucks, pavement marking equipment was always timely and the installation work suffered no delay due to poor management.
- Potential of YCDC's engineers and technicians is high. They were quick to learn the work method, use of tools and procedure of signal equipment. With some more additional hand-on experience, they will be able to install traffic signal equipment by themselves.
- Traffic policemen deployed at 8-mile intersection were also quick to understand the manual operation method of new signal controller and became capable of operating signal manually in a short time.
- Traffic policemen sometimes operate signal manually due to passage of VIP vehicles or spontaneous large traffic demand. But the performance of signal under manual control is not necessarily efficient and balanced among approaches as evidenced by the too favourable allocation of green time to a specific approach during the "after" study of pilot project.

5) Cost-effectiveness

- The pilot project shows very high cost effectiveness of signal improvement and associated works. The total cost of the pilot project is at the level of US$ 100,000 excluding survey, design and construction supervision works. The cost can be

recovered in one week by the travel time saving realized by the project.

- The cost is much smaller than the cost of physical measures such as constructing flyover or widening road.

6 YUTRA DATABASE

6.1 Transport Database

YUTRA database is arranged according to Microsoft Office format and JICA STRADA format. There are 2 groups of transport database in YUTRA; transport survey database and demand forecast database. For details, refer to Appendix 3 of this report.

1) Transport Survey Database

The following transport surveys have been carried out in YUTRA study. Transport survey database is classified by the type of survey. Each includes survey form and compiled survey result. Transport survey database is prepared according to the Microsoft Office format; Excel, Word and PowerPoint.

- Person Trip Survey
- Cordon Line Survey
- Screen Line Survey
- Traffic Count Survey
- Ferry Passenger Survey
- Railway Passenger OD Survey
- Intersection Survey
- Truck OD Interview Survey
- Bus Passenger OD Interview Survey
- Parking Survey
- Travel Speed Survey

2) Demand Forecast Database

Demand forecast database is classified by data category.

- Transport Network by Year
- OD matrices by Year
- Assignment Parameter by Year
- Assignment Result by Case (Assignment case differs by Network and OD matrices used)
- Other miscellaneous

Demand forecast database is basically of JICA STRADA format below. Location data included in network and assignment result are of Longitude/Latitude projection.

- Traffic Zone (*.ZXY)
- Transport Network (*.INT)
- OD matrices (*.AOD)

- Assignment Parameter (*.PAR)
- Assignment Result (*.IRE)
- Other files for demand forecast (Excel; *.xlsx)

6.2 GIS Database

Map data is generally collected and arranged by GIS application. Map database of YUTRA study has been collected and arranged using popular application, ArcGIS. For details, refer to Appendix 3 of this report. GIS database is including GIS data below.

1) Administrative Boundary

- Township Boundary
- Ward Boundary
- Traffic Zone in YUTRA

2) Landuse

- Industrial Zone
- Government Area
- Commercial Area
- Residential Area
- Landmark
- Other Landuse

3) Natural Condition

- River and Water Bodies
- Vegetation

4) Public and Transport Facility

- Airport
- Railway
- Railway Station
- Public Utility
- Road (Highway, Primary Road and Secondary Road)
- Main Signalized Intersection
- Intra-city Bus Terminal
- Intercity Bus Terminal
- Jetty Location
- Ferry Terminal

- Other Public Facility

5) Transport Survey Location

See paragraph 6.1.2-1) above.

Appendix 1 SURVEY FORMS

1. Person Trip Survey

1.1. Form for Household Information

PT SURVEY

FORM 1: HOUSEHOLD INFORMATION

Survey Date					2013	Surveyor ID				Zone Code							
										HH Code							

A. Type of house	1. Apartment	2. high rise	3. Condo	4. Detached - Brick	5. Detached-timber	A
				6. Detached	7. Attached	8. Barracks	

Note: Fill up by Surveyor	B. How many person answer?	B

This section should ask household head or adult household member who age older than 18.

Q1	Name	

Q2	Address					
	No	Floor	Street	Word/village	Township	
	Q2A	Tel: No (Optional)				

If two separate income HHs live in one resident, survey only for one HH
If someone who stay for regular purpose (school or business) in same house, should include in survey list.

Q3	How many members are there in your household and staying together?				
		A. Under 5	B. Between 5 -18	C. Between 19 - 59	D. 60 and above
	Male				
	Female				

Q4	Household monthly Income (Kyat)				Q4
	1 No Income	6 100,001 – 150,000	11 500,001 – 600,000		
	2 Less than 25,000	7 150,001 – 200,000	12 600,001 – 700,000		
	3 2,500 – 50,000	8 200,001 – 300,000	13 700,001 – 800,000		
	4 50,001 – 75,000	9 300,001 – 400,000	14 800,001 – 900,000	16 1,000,000 above	
	5 75,001 – 100,000	10 400,001 – 500,000	15 900,001 – 1,000,000	17 Refuse	

Q5	How many motorized vehicles are owned by your household?				
	Type	A. Motorcycle	B. Passenger car	C. Truck/Bus	D. Other motorized vehicle
	No of unit owned				

Q6	Ownership of house and land			
	House	1. Own	2. Rent	3. Not sure
	Land	1. Own	2. Rent	3. Not sure

If 1 "Own", no need to ask for Q6B,Q6D			Kyat
Q6A		If Rent, monthly fee	Q6B
Q6C		If Rent, monthly fee	Q6D

Q7	Living area?	Q7	Square feet

Q8	Length of stay in current residence?				Q8
	1. Less than 1 year	2. Between 1 - 5 years	3. Between 6-10 years	4.More than 10 years	
	Note: If select "1", "2" & "3", should ask for Q9				

Q9	Previous Address			
		Word/village	Township	State/Region

Q9	Word code

1.2. Form for Household members information

FORM 2: HOUSEHOLD MEMBER INFORMATION

Survey Date | | | | | 2013 | Surveyor ID | | | |

Note: Fill up by Surveyor

Zone Code			
HH Code			
Member Code			
A Form 2	**1.** Refused	**2.** Answer	A
B. Form 3			B
C. How many trip he/she answer?			C

Ask all household member who over age of 5

Q1 Name | **Q2** Age

Q3 Gender: **1.** Male **2.** Female

Q4 Need assistance to travel? **1.** Yes **2.** No

Q3
Q4

Q5 Work Address | Ward/village | Township | Q5 Ward code

Q6 School Address | Ward/village | Township | Q6 Ward code

Q7 **Occupation**

Note: Ask for kind of work
Eg., selling goods

Q8 **Employment sector**

Note: Ask for work place and/or department
E.g., Cosmetic, Grocery store

Q7
Q8

Q9 **Personal Monthly income (Kyat)**

1 No income	**6** 100,001 – 125,000	**11** 225,001 – 250,000	
2 Less than 25,000	**7** 125,001 – 150,000	**12** 250,001 – 275,000	
3 25,001 – 50,000	**8** 150,001 – 175,000	**13** 275,001 – 300,000	
4 50,001 – 75,000	**9** 175,001 – 200,000	**14** 300,001 – 400,000	**16** 500,000 above
5 75,001 – 100,000	**10** 200,001 – 225,000	**15** 400,001 – 500,000	**17** Refused

Q9

Q10 What type is your working hour? **Only for interviewee who works**

1. Flexible | **2.** Fixed

Q10

Only 18 year and above to ask for Q11, Q12 & Q13

Q11 Do you use your own motorized vehicle for your personal activities?

1. Yes | **2.** No

Q11

Q12 **Do you think the number of the import of used vehicle should be limited (decrease)?**

1. Yes | **2.** No | **3.** Don't known

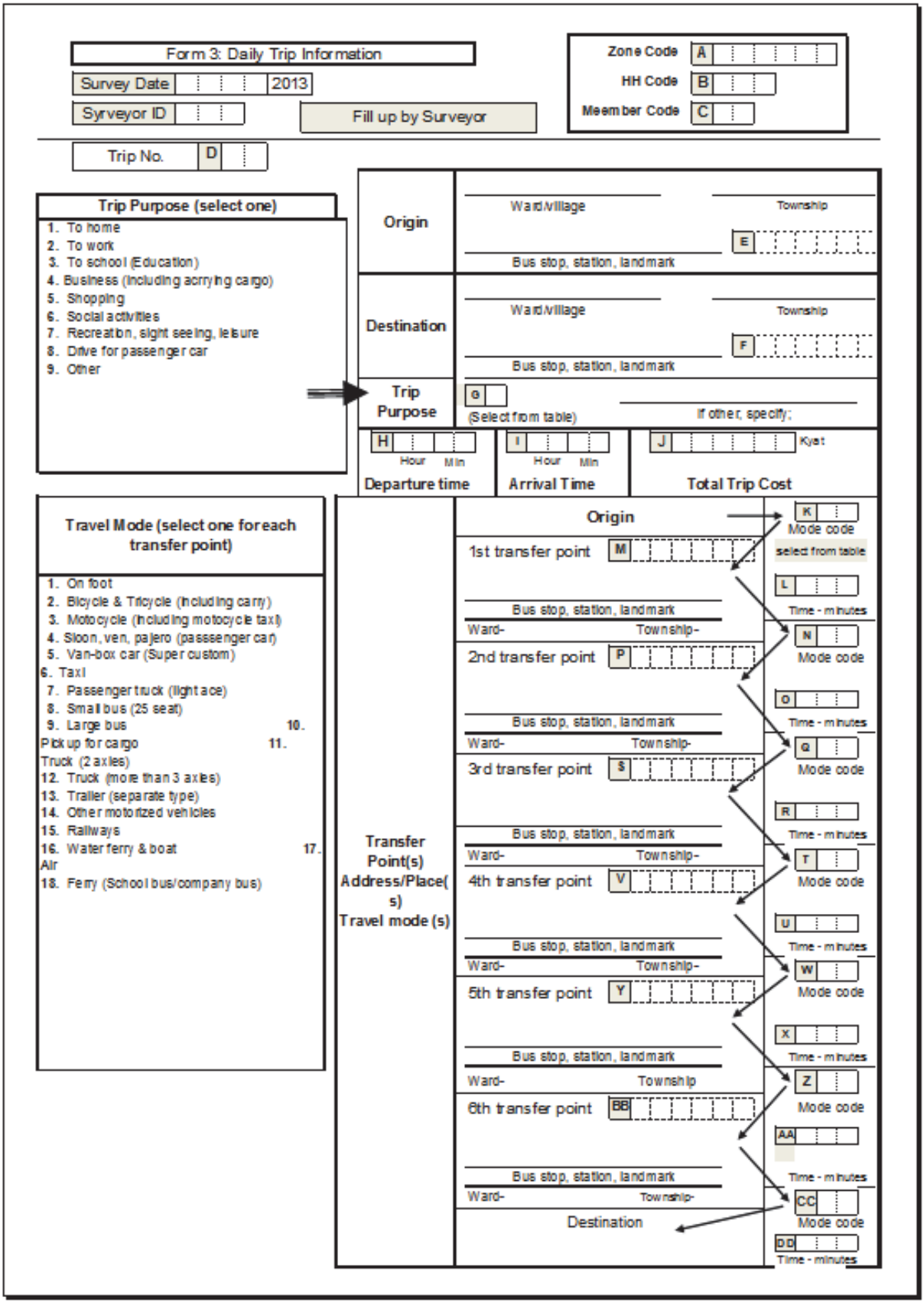
Q12

Q13 **Do you think the current limitation on the use of motorcycle in Yangon should be continued?**

1. Yes | **2.** No | **3.** Don't known

Q13

1.3. Form for Household members information



2. Cordon Survey

2.1. Form of Interview Survey

Cordon Line Survey for Interview

Survey Location :_____ ☐☐
Direction : 1. Inbound 2. Outbound ☐
Date(DD/MM/YY) :☐☐ / ☐☐ / ☐☐
Day : 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday ☐
Surveyor Name :_____ ☐☐
Code by :_____ ☐☐
Checked by :_____ ☐☐

	Sample 1	Sample 2
1. Interview time	☐☐ : ☐☐	☐☐ : ☐☐
2. Vehicle type	2. Bicycle & Tricycle (including taxi) 3. Motorcycle (including motorcycle taxi) 4. Passenger Car 5. Van (box car) 6. Taxi 7. Passenger Truck Type Bus 8. Small Bus 9. Large Bus 10. Pick Up for Cargo 11. Truck (2 axles) 12. Truck (more than 3 axles) 13. Trailer (separated type) 14. Other (Specify_____) ☐	2. Bicycle & Tricycle (including taxi) 3. Motorcycle (including motorcycle taxi) 4. Passenger Car 5. Van (box car) 6. Taxi 7. Passenger Truck Type Bus 8. Small Bus 9. Large Bus 10. Pick Up for Cargo 11. Truck (2 axles) 12. Truck (more than 3 axles) 13. Trailer (separated type) 14. Other (Specify_____) ☐
3. Where do you come from? (Origin)	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐
4. Where are you going to? (Destination)	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐
5.What is your purpose?	1.Go Home 2.Go to Work 3.Go to School 4.Business/Sales/Cargo carry 5.Shopping 6.Social activities 7.Sightseeing, Recreation, Leisure 8.Driver for passengers 9.Other ☐	1.Go Home 2.Go to Work 3.Go to School 4.Business/Sales/Cargo carry 5.Shopping 6.Social activities 7.Sightseeing, Recreation, Leisure 8.Driver for passengers 9.Other ☐
6. Number of passengers Including driver	☐☐☐	☐☐☐
Below questions are only for Truck		
7. Main items carried	1. Agricultural/Fishery Product, 2. Forestry Product (Including wood) 3. Mining Mineral Product 4. Oil/Gas/Gasoline/Water 5. Stone/Earth/Sand/Cement 6. Metal/Machinery/Automobile/Electric 7. Chemical Product (including Fertilizer) 8. Paper, Textile, Food Product 9. Daliy small commodity 10. Waste/Garbage 11. Others ☐ 12. No item	1. Agricultural/Fishery Product, 2. Forestry Product (Including wood) 3. Mining Mineral Product 4. Oil/Gas/Gasoline/Water 5. Stone/Earth/Sand/Cement 6. Metal/Machinery/Automobile/Electric 7. Chemical Product (including Fertilizer) 8. Paper, Textile, Food Product 9. Daliy small commodity 10. Waste/Garbage 11. Others ☐ 12. No item
8. Capacity of truck (Unit Ton)	☐☐☐	☐☐☐
9. Loaded ratio	0. Empty 1. 1/4 2. 1/2 3.3/4 4.Full 5.More than Full 6.Unknown ☐	0. Empty 1. 1/4 2. 1/2 3.3/4 4.Full 5.More than Full 6.Unknown ☐

2.2. Forms of Traffic Count Survey

2.2.1. Form of Traffic Count Survey (1)

Comprehensive Urban Transport Plan of the Greater Yangon Cordon Line Survey for Traffic Count

Form 1

Survey Site (Location)		Surveyor	
Survey Direction		Coded by	
Date(dd/mm/yy)		Checked by	
Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday			
Time 1/2 Hour Beginning (hh:mm)			

04 Passenger Car	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	
	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	
	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	
	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	
	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	
	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	
	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	
	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	
	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	
	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	
	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	
	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	
	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	
	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	
	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	
	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	
	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	
	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	
	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	
	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	
	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	
	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	
	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	
	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	
	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	
05.Van (box car)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	
Total number																										

02. Bicycle & Tricycle	1	2	3	4	5	6	7	8	9	10	03.Motorcycle	1	2	3	4	5	6	7	8	9	10	
	11	12	13	14	15	16	17	18	19	20		11	12	13	14	15	16	17	18	19	20	
	21	22	23	24	25	26	27	28	29	30		21	22	23	24	25	26	27	28	29	30	
	31	32	33	34	35	36	37	38	39	40		31	32	33	34	35	36	37	38	39	40	
	41	42	43	44	45	46	47	48	49	50		41	42	43	44	45	46	47	48	49	50	
Total number											Total number											

Comments (Any car accidents etc.)

2.2.2. Form of Traffic Count Survey (2)

Comprehensive Urban Transport Plan of the Greater Yangon Cordon Line Surveyfor Traffic Count

Form 2

Survey Site (Location)		**Surveyor**	
Survey Direction		**Coded by**	
Date(dd/mm/yy)		**Checked by**	
Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday			
Time 1/2 Hour Beginning (hh:mm)			

06.Taxi	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275
	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325
	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350
	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425
	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450
	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475
	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500
Total number																									
07.Passenger Truck	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
08.Small Bus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
09.Large Bus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
Total number																									

Comments (Any car accidents etc.)

2.2.3. Form of Traffic Count Survey (3)

Comprehensive Urban Transport Plan of the Greater Yangon Cordon Line Surveyfor Traffic Count

Form 3

Survey Site (Location)		Surveyor	
Survey Direction		Coded by	
Date(dd/mm/yy)		Checked by	
Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday			
Time 1/2 Hour Beginning (hh:mm)			

10.Pick Up for Cargo	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
11.Truck (2 axles)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
12.Truck (more than 3 axles)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
13.Trailer (separated type)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
14.Others	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									

Comments (Any car accidents etc.)

3. Screen Survey

3.1. Forms of Traffic Count Survey

3.1.1. Form of Traffic Count Survey (1)

Comprehensive Urban Transport Plan of the Greater Yangon
Screenline Survey (vehicular Traffic Count)

Form 1

Survey Site (Location)		**Surveyor**	
Survey Direction	**1. Inbound, 2.Outbound**	**Coded by**	
Date(dd/mm/yy)		**Checked by**	
Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday			
Time 1/2 Hour Beginning (hh:mm)			

04 Passenger Car	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275
	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325
	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350
	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425
	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450
	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475
	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500
	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525
	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550
	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575
	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600
	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625
	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650
	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675
	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700
	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725
	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750
Total number																									

05.Van (box car)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									

02. Bicycle & Tricycle	1	2	3	4	5	6	7	8	9	10	**03.Motorcycle**	1	2	3	4	5	6	7	8	9	10
	11	12	13	14	15	16	17	18	19	20		11	12	13	14	15	16	17	18	19	20
	21	22	23	24	25	26	27	28	29	30		21	22	23	24	25	26	27	28	29	30
	31	32	33	34	35	36	37	38	39	40		31	32	33	34	35	36	37	38	39	40
	41	42	43	44	45	46	47	48	49	50		41	42	43	44	45	46	47	48	49	50
Total number											**Total number**										

Comments (Any car accidents etc.)

3.1.2. Form of Traffic Count Survey (2)

Comprehensive Urban Transport Plan of the Greater Yangon Screenline Survey (vehicular Traffic Count)

Form 2

Survey Site (Location)		**Surveyor**	
Survey Direction	**1. Inbound, 2.Outbound**	**Coded by**	
Date(dd/mm/yy)		**Checked by**	
Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday			
Time 1/2 Hour Beginning (hh:mm)			

06.Taxi	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275
	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325
	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350
	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425
	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450
	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475
	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500
Total number																									
07.Passenger Truck	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
08.Small Bus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
09.Large Bus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
Total number																									

Comments (Any car accidents etc.)

3.1.3. Form of Traffic Count Survey (3)

Comprehensive Urban Transport Plan of the Greater Yangon Screenline Survey (vehicular Traffic Count)

Form 3

Survey Site (Location)		**Surveyor**	
Survey Direction	**1. Inbound, 2.Outbound**	**Coded by**	
Date(dd/mm/yy)		**Checked by**	
Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday			
Time 1/2 Hour Beginning (hh:mm)			

10.Pick Up for Cargo	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
11.Truck (2 axles)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
12.Truck (more than 3 axles)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
13.Trailer (separated type)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
14.Others	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
1.On foot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									

Comments (Any car accidents etc.)

3.2. Forms of Occupancy Count Survey

3.2.1. Form of Occupancy Count Survey (1)

Comprehensive Urban Transport Plan of the Greater Yangon
Screenline Survey (Occupancy Count)

Form 1

Survey Site (Location) ____ Surveyor ____

Survey Direction 1. Inbound, 2.Outbound ____ Coded by ____

Date(dd/mm/yy) ____ Checked by ____

Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday ____

Time 1/2 Hour Beginning (hh:mm) ____

Time Period	2. Bicycle & Tricycle (including tricycle taxi)	3. Motorcycle (including motorcycle taxi)	4. Passenger Car	5. Van (box car)	6.Taxi	14.Others
06:00 - 06:30						
06:30 - 07:00						
07:00 - 07:30						

3.2.2. Form of Occupancy Count Survey (1)

Form 2

Comprehensive Urban Transport Plan of the Greater Yangon
Screenline Survey (Occupancy Count)

Survey Site (Location)
Survey Direction 1. Inbound, 2.Outbound
Date(dd/mm/yy)
Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday
Time 1/2 Hour Beginning (hh:mm)

Surveyor
Coded by
Checked by

Time Period	7.Passenger Truck	8.Small Bus	9.Large Bus	10.Pick Up for Cargo	11.Truck (2 axles)	12.Truck (more than 3 axles)	13.Trailer (separated type)
06:00 - 06:30	%	%	%	%			
06:30 - 07:00	%	%	%	%			
7:00 - 7:30	%	%	%	%			

Comments (Any car accidents etc.)

4. Traffic Count Survey

4.1. Form of Traffic Count Survey (1)

Comprehensive Urban Transport Plan of the Greater Yangon

Traffic count Survey

Form 1

Survey Site (Location)		**Surveyor**	
Survey Direction		**Coded by**	
Date(dd/mm/yy)		**Checked by**	
Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday			
Time 1/2 Hour Beginning (hh:mm)			

04 Passenger Car	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275
	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325
	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350
	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425
	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450
	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475
	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500
	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525
	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550
	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575
	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600
	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625
	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650
	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675
	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700
	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725
	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750
05.Van (box car)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									

02. Bicycle & Tricycle	1	2	3	4	5	6	7	8	9	10	**03.Motorcycle**	1	2	3	4	5	6	7	8	9	10
	11	12	13	14	15	16	17	18	19	20		11	12	13	14	15	16	17	18	19	20
	21	22	23	24	25	26	27	28	29	30		21	22	23	24	25	26	27	28	29	30
	31	32	33	34	35	36	37	38	39	40		31	32	33	34	35	36	37	38	39	40
	41	42	43	44	45	46	47	48	49	50		41	42	43	44	45	46	47	48	49	50
Total number											**Total number**										

Comments (Any car accidents etc.)

4.2. Form of Traffic Count Survey (2)

Comprehensive Urban Transport Plan of the Greater Yangon

Traffic count Survey

Form 2

Survey Site (Location)				**Surveyor**	
Survey Direction				**Coded by**	
Date(dd/mm/yy)				**Checked by**	
Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday					
Time 1/2 Hour Beginning (hh:mm)					

06.Taxi	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275
	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325
	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350
	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425
	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450
	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475
	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500
Total number																									
07.Passenger Truck	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
08.Small Bus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
09.Large Bus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
Total number																									

Comments (Any car accidents etc.)

4.3. Form of Traffic Count Survey (3)

Comprehensive Urban Transport Plan of the Greater Yangon

Traffic count Survey

Form 3

Survey Site (Location)		Surveyor	
Survey Direction		Coded by	
Date(dd/mm/yy)		Checked by	
Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday			
Time 1/2 Hour Beginning (hh:mm)			

10.Pick Up for Cargo	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
11.Truck (2 axles)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
12.Truck (more than 3 axles)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
13.Trailer (separated type)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
14.Others	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									

Comments (Any car accidents etc.)

5. Ferry Passenger OD Survey

5.1. Form of Passenger Interview Survey

Ferry Passenger OD Survey for Interview

Survey Location :_____ ☐☐
Date(DD/MM/YY) :☐☐ / ☐☐ / ☐☐
Day : 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday
Surveyor Name :_____ ☐☐
Code by :_____ ☐☐
Checked by :_____ ☐☐

	Sample 1	Sample 2
1. Interview time	☐☐ : ☐☐	☐☐ : ☐☐
2. Where do you come from? (Origin)	_____ Ward _____ Township (district) _____ Land mark / Famous Building ☐☐☐☐☐☐	_____ Ward _____ Township (district) _____ Land mark / Famous Building ☐☐☐☐☐☐
3. Where are you going to? (Destination)	_____ Ward _____ Township (district) _____ Land mark / Famous Building ☐☐☐☐☐☐	_____ Ward _____ Township (district) _____ Land mark / Famous Building ☐☐☐☐☐☐
4. Access Means of Transport in the city area	1.On Foot 2.Bicycle & Tricycle (including taxi) 3.Motorcycle (including motorcycle taxi) 4.Passenger Car 5.Van (box car) 6.Taxi 7.Passenger Truck Type Bus 8.Small Bus 9.Large Bus 10.Pick Up for Cargo 11.Truck 15. Railway 16. Ferry & Boat 14. Other (Specify_____) ☐☐	1.On Foot 2.Bicycle & Tricycle (including taxi) 3.Motorcycle (including motorcycle taxi) 4.Passenger Car 5.Van (box car) 6.Taxi 7.Passenger Truck Type Bus 8.Small Bus 9.Large Bus 10.Pick Up for Cargo 11.Truck 15. Railway 16. Ferry & Boat 14. Other (Specify_____) ☐☐
5. What is your purpose?	12. From Work to Home 13. From School to Home 14. From Shopping to Home 19. From Others to Home 2.Go to Working 3.Go to School 4.Business 5.Shopping 6.Social activities 7.Sightseeing, Recreation, Leisure 9.Other ☐	12. From Work to Home 13. From School to Home 14. From Shopping to Home 19. From Others to Home 2.Go to Working 3.Go to School 4.Business 5.Shopping 6.Social activities 7.Sightseeing, Recreation, Leisure 9.Other ☐
6. Total Travel Time (min)	☐☐☐ min	☐☐☐ min

5.2. Form of Passenger Count Survey

Comprehensive Urban Transport Plan of the Greater Yangon Ferry Passenger Count Survey

Survey Location : _____ ☐☐
Date(DD/MM/YY) : ☐☐ / ☐☐ / ☐☐
Day : 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday ☐
Surveyor Name : _____ ☐☐
Code by : _____ ☐☐
Checked by : _____ ☐☐

Type		Destination	Number of Boarding Passengers		Departure Time
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:
1. Ferry 2. Boat					:

Destination Code
1. Dala **2. Seikgyikanungto** **3. Twantay** **4. Hlaingtharya**
5. Dagon Myothi **6. Thaketa** **7. Thanlyin** **8. Out of Yangon**
9. Others in Yangon

6. Railway Passenger OD Survey

6.1. Form of Passenger Interview Survey

Railway Passenger OD Survey for Interview

Survey Type : 1. Station Survey 2. Section Survey
Survey Station / Section Name : _____
Direction (For Circular Railway Station) :1. Counterclokwise 2.Clokwise
Direction (For Other Railway Station) :1. Inbound 2.Outbound
Date(DD/MM/YY) : ☐☐ / ☐☐ / ☐☐
Day : 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday
Surveyor Name : _____
Code by :
Checked by : _____

	Sample 1	Sample 2
1.Interview time	☐☐ : ☐☐	☐☐ : ☐☐
2.Where do you come from? (Origin)	Ward _____ Township (district) Land mark / Famous Building ☐☐☐☐☐☐	Ward _____ Township (district) Land mark / Famous Building ☐☐☐☐☐☐
4.Which station did you get on?	_____ ☐☐☐	_____ ☐☐☐
5.Access Means of Transport	1.On Foot 2.Bicycle & Tricycle (including taxi) 3.Motorcycle (including motorcycle taxi) 4.Passenger Car 5.Van (box car) 6.Taxi 7.Passenger Truck Type Bus 8.Small Bus 9.Large Bus 10.Pick Up for Cargo 11.Truck 15. Railway 16. Ferry & Boat 14. Other (Specify) ☐	1.On Foot 2.Bicycle & Tricycle (including taxi) 3.Motorcycle (including motorcycle taxi) 4.Passenger Car 5.Van (box car) 6.Taxi 7.Passenger Truck Type Bus 8.Small Bus 9.Large Bus 10.Pick Up for Cargo 11.Truck 15. Railway 16. Ferry & Boat 14. Other (Specify) ☐
6.Which station do you get off?	_____ ☐☐☐	_____ ☐☐☐
7.Where are you going to? (Destination)	_____ Ward _____ Township (district) Land mark / Famous Building ☐☐☐☐☐☐	_____ Ward _____ Township (district) Land mark / Famous Building ☐☐☐☐☐☐
8.Egress Means of Transport (Means after getting off train)	1.On Foot 2.Bicycle & Tricycle (including taxi) 3.Motorcycle (including motorcycle taxi) 4.Passenger Car 5.Van (box car) 6.Taxi 7.Passenger Truck Type Bus 8.Small Bus 9.Large Bus 10.Pick Up for Cargo 11.Truck 15. Railway 16. Ferry & Boat 14. Other (Specify_____) ☐☐	1.On Foot 2.Bicycle & Tricycle (including taxi) 3.Motorcycle (including motorcycle taxi) 4.Passenger Car 5.Van (box car) 6.Taxi 7.Passenger Truck Type Bus 8.Small Bus 9.Large Bus 10.Pick Up for Cargo 11.Truck 15. Railway 16. Ferry & Boat 14. Other (Specify_____) ☐☐
9.What is your purpose?	1.Go Home 2.Go to Working 3.Go to School 4.Business 5.Shopping 5.Social activities 7.Sightseeing, Recreation, Leisure 9.Other ☐	1.Go Home 2.Go to Working 3.Go to School 4.Business 5.Shopping 5.Social activities 7.Sightseeing, Recreation, Leisure 9.Other ☐
10.Total Travel Time (min)	☐☐☐ min	☐☐☐ min

6.2. Form of Passenger Count Survey

Railway Passenger OD Survey for Counting

Survey Type : 1. Station Survey 2. Section Survey
Survey Station / Section Name : _____
Direction (For Circular Railway Station) : 1. Counterclokwise 2.Clokwise
Direction (For Other Railway Station) : 1. Inbound 2.Outbound
Boarding / Alighting (Only for station survey): 1. Boarding 2. Alighting
Date(DD/MM/YY) : ☐☐ / ☐☐ / ☐☐
Day : 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday
Surveyor Name : _____
Code by : _____
Checked by : _____

Time	Number of Passengers		Time	Number of Passengers	
4:00 - 4:30			13:00 - 13:30		
4:30 - 5:00			13:30 - 14:00		
5:00 - 5:30			14:00 - 14:30		
5:30 - 6:00			14:30 - 15:00		
6:00 - 6:30			15:00 - 15:30		
6:30 - 7:00			15:30 - 16:00		
7:00 - 7:30			16:00 - 16:30		
7:30 - 8:00			16:30 - 17:00		
8:00 - 8:30			17:00 - 17:30		
8:30 - 9:00			17:30 - 18:00		
9:00 - 9:30			18:00 - 18:30		
9:30 - 10:00			18:30 - 19:00		
10:00 - 10:30			19:00 - 19:30		
10:30 - 11:00			19:30 - 20:00		
11:00 - 11:30			20:00 - 20:30		
11:30 - 12:00			20:30 - 21:00		
12:00 - 12:30			21:00 - 21:30		
12:30 - 13:00			21:30 - 22:00		

7. Intersection Survey

7.1. Forms for vehicular turning movement

7.1.1. Form for vehicular turning movement (1)

Comprehensive Urban Transport Plan of the Greater Yangon
Intersection Survey (Vehicular turning movement)

Form 1

Survey Site (Location)		**Surveyor**	
Survey Direction		**Coded by**	
Date(dd/mm/yy)		**Checked by**	
Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday			
Time 1/2 Hour Beginning (hh:mm)			

04 Passenger Car	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275
	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325
	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350
	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425
	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450
	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475
	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500
	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525
	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550
	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575
	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600
	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625
	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650
	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675
	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700
	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725
	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750
05.Van (box car)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									

02. Bicycle & Tricycle	1	2	3	4	5	6	7	8	9	10	**03.Motorcycle**	1	2	3	4	5	6	7	8	9	10
	11	12	13	14	15	16	17	18	19	20		11	12	13	14	15	16	17	18	19	20
	21	22	23	24	25	26	27	28	29	30		21	22	23	24	25	26	27	28	29	30
	31	32	33	34	35	36	37	38	39	40		31	32	33	34	35	36	37	38	39	40
	41	42	43	44	45	46	47	48	49	50		41	42	43	44	45	46	47	48	49	50
Total number											**Total number**										

Comments (Any car accidents etc.)

7.1.2. Form for vehicular turning movement (2)

Comprehensive Urban Transport Plan of the Greater Yangon Intersection Survey (Vehicular turning movement)

Form 2

Survey Site (Location)		**Surveyor**	
Survey Direction		**Coded by**	
Date(dd/mm/yy)		**Checked by**	
Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday			
Time 1/2 Hour Beginning (hh:mm)			

06.Taxi	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275
	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325
	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350
	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425
	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450
	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475
	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500
Total number																									
07.Passenger Truck	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
08.Small Bus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
09.Large Bus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
Total number																									

Comments (Any car accidents etc.)

7.1.3. Form for vehicular turning movement (3)

Comprehensive Urban Transport Plan of the Greater Yangon Intersection Survey (Vehicular turning movement)

Form 3

Survey Site (Location)		**Surveyor**	
Survey Direction		**Coded by**	
Date(dd/mm/yy)		**Checked by**	
Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday			
Time 1/2 Hour Beginning (hh:mm)			

10.Pick Up for Cargo	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
11.Truck (2 axles)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
12.Truck (more than 3 axles)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
13.Trailer (separated type)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
14.Others	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									

Comments (Any car accidents etc.)

7.2. Form for vehicular turning movement

Comprehensive Urban Transport Plan of the Greater Yangon Intersection Survey (Congestion Queue Length and Signal Cycle)

Date(DD/MM/YY) ☐☐/☐☐/☐☐
Day : 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday
Survey Site : _____
Surveyor : _____
Check by : _____

Duraiton		Road No	Duration of signal (second)			Congestion queue lengt
			Green	Yellow	Red	Mesured by pedometer
6:00	6:30	1				
		2				
		3				
		4				
		5				
		6				
6:30	7:00	1				
		2				
		3				
		4				
		5				
		6				
7:00	7:30	1				
		2				
		3				
		4				
		5				
		6				
7:30	8:00	1				
		2				
		3				
		4				
		5				
		6				
8:00	8:30	1				
		2				
		3				
		4				
		5				
		6				
8:30	9:00	1				
		2				
		3				
		4				
		5				
		6				

This form will be continued until 22:00

8. Truck OD Interview Survey

8.1. Form of Traffic Count Survey

Comprehensive Urban Transport Plan of the Greater Yangon
Truck OD Interview Survey (vehicular Traffic Count)

Form 3

Survey Site (Location)		**Surveyor**	
Survey Direction 1. Inbound, 2.Outbound		**Coded by**	
Date(dd/mm/yy)		**Checked by**	
Day: 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday			
Time 1/2 Hour Beginning (hh:mm)			

10.Pick Up for Cargo	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
11.Truck (2 axles)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
12.Truck (more than 3 axles)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									
13.Trailer (separated type)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Total number																									

Comments (Any car accidents etc.)

8.2. Form of Truck OD Interview Survey

Comprehensive Urban Transport Plan of the Greater Yangon Truck OD Interview Survey

Survey Location :_____ ☐☐

Direction(Only for roadside interview) : **1. Inbound** **2. Outbound** ☐

Date(DD/MM/YY) : ☐☐ / ☐☐ / ☐☐

Day : **2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday** ☐

Surveyor Name :_____ ☐☐

Code by :_____ ☐☐

Checked by :_____ ☐☐

	Sample 1	Sample 2
1. Interview time	☐☐ : ☐☐	☐☐ : ☐☐
2. Vehicle type	10. Pick Up for Cargo 11. Truck (2 axles) 12. Truck (more than 3 axles) 13. Trailer (separated type) ☐	10. Pick Up for Cargo 11. Truck (2 axles) 12. Truck (more than 3 axles) 13. Trailer (separated type) ☐
3. Where do you come from? (Origin)	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐
4. Where are you going to? (Destination)	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐
5. Total travel time (min)	☐☐☐ min	☐☐☐ min
6. Number of passengers	☐☐	☐☐
7. Main items carried	1. Agricultural/Fishery Product, 2. Forestry Product (Including wood) 3. Mining Mineral Product 4. Oil/Gas/Gasoline/Water 5. Stone/Earth/Sand/Cement 6. Metal/Machinery/Automobile/Electric 7. Chemical Product (including Fertilizer) 8. Paper, Textile, Food Product 9. Daliy small commodity 10 .Waste/Garbage 11. Others ☐ 12. No item	1. Agricultural/Fishery Product, 2. Forestry Product (Including wood) 3. Mining Mineral Product 4. Oil/Gas/Gasoline/Water 5. Stone/Earth/Sand/Cement 6. Metal/Machinery/Automobile/Electric 7. Chemical Product (including Fertilizer) 8. Paper, Textile, Food Product 9. Daliy small commodity 10 .Waste/Garbage 11. Others ☐ 12. No item
8. Capacity of truck (Unit Ton)	☐☐☐	☐☐☐
9. Loaded ratio	0. Empty 1. 1/4 2. 1/2 3.3/4 4.Full 5.More than Full 6.Unknown ☐	0. Empty 1. 1/4 2. 1/2 3.3/4 4.Full 5.More than Full 6.Unknown ☐

9. Bus Passenger OD Interview Survey

9.1. Forms of Bus Passenger Interview Survey

9.1.1. Form of Intercity Bus Passenger Interview Survey

Bus Passenger OD Interview Survey for
Intercity Bus Passenger Interview

Survey Bus Terminal : 1. Dagon Ayar Highway Bus Center
2. Aung Mingalar Bus Terminal ☐

Date(DD/MM/YY) : ☐☐ / ☐☐ / ☐☐

Day : 2. Monday, 3. Tuesday, 4. Wednesday,
5. Thursday, 6.Friday ☐

Surveyor Name :_____ ☐☐

Code by :_____ ☐☐

Checked by :_____ ☐☐

	Sample 1	Sample 1
1.Interview time	☐☐ : ☐☐	☐☐ : ☐☐
2.Bus route number	☐☐☐☐	☐☐☐☐
3.Where do you come from? (Origin)	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐
4.Access Means of Transport	1.On Foot 2.Bicycle & Tricycle (including taxi) 3.Motorcycle (including motorcycle taxi) 4.Passenger Car 5.Van (box car) 6.Taxi 7.Passenger Truck Type Bus 8.Small Bus 9.Large Bus 10.Pick Up for Cargo 11.Truck 15. Railway 16. Ferry & Boat 14. Other (Specify_____) ☐	1.On Foot 2.Bicycle & Tricycle (including taxi) 3.Motorcycle (including motorcycle taxi) 4.Passenger Car 5.Van (box car) 6.Taxi 7.Passenger Truck Type Bus 8.Small Bus 9.Large Bus 10.Pick Up for Cargo 11.Truck 15. Railway 16. Ferry & Boat 14. Other (Specify_____) ☐
5.Which bus stop do you get off?	☐☐☐☐☐☐	☐☐☐☐☐☐
6.Where are you going to? (Destination)	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐
7.What is your purpose?	12. From Work to Home 13. From School to Home 14. From Shopping to Home 19. From Others to Home 2.Go to Working 3.Go to School 4.Business 5.Shopping 6.Social activities 7.Sightseeing, Recreation, Leisure 9.Other ☐	12. From Work to Home 13. From School to Home 14. From Shopping to Home 19. From Others to Home 2.Go to Working 3.Go to School 4.Business 5.Shopping 6.Social activities 7.Sightseeing, Recreation, Leisure 9.Other ☐
8.Total Travel Time (min)	☐☐☐ min	☐☐☐ min

9.1.2. Intra city Bus Passenger Interview Survey

Bus Passenger OD Interview Survey for Intra city Bus Passenger Interview (Bus Stop Survey)

Survey Bus Stop :_____ ☐☐
Date(DD/MM/YY) :☐☐ / ☐☐ / ☐☐
Day : 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday
Surveyor Name :_____ ☐☐
Code by :_____ ☐☐
Checked by :_____ ☐☐

	Sample 1	Sample 2
1.Interview time	☐☐ : ☐☐	☐☐ : ☐☐
2.Bus route number	☐☐☐☐	☐☐☐☐
3.Bus type	7.Passenger Truck, 8. Small bus 9. Large bus	7.Passenger Truck, 8. Small bus 9. Large bus
4.Where do you come from? (Origin)	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐
5.Access Means of Transport	1.On Foot 2.Bicycle & Tricycle (including taxi) 3.Motorcycle (including motorcycle taxi) 4.Passenger Car 5.Van (box car) 6.Taxi 7.Passenger Truck Type Bus 8.Small Bus 9.Large Bus 10.Pick Up for Cargo 11.Truck 15. Railway 16. Ferry & Boat 14. Other (Specify_____) ☐	1.On Foot 2.Bicycle & Tricycle (including taxi) 3.Motorcycle (including motorcycle taxi) 4.Passenger Car 5.Van (box car) 6.Taxi 7.Passenger Truck Type Bus 8.Small Bus 9.Large Bus 10.Pick Up for Cargo 11.Truck 15. Railway 16. Ferry & Boat 14. Other (Specify_____) ☐
6.Which bus stop do you get off?	☐☐☐☐☐☐	☐☐☐☐☐☐
7.Where are you going to? (Destination)	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐	_____ Ward _____ Township district _____ Land mark / Famous Building ☐☐☐☐☐☐
8.Egress Means of Transport (Means after getting off train)	1.On Foot 2.Bicycle & Tricycle (including taxi) 3.Motorcycle (including motorcycle taxi) 4.Passenger Car 5.Van (box car) 6.Taxi 7.Passenger Truck Type Bus 8.Small Bus 9.Large Bus 10.Pick Up for Cargo 11.Truck 15. Railway 16. Ferry & Boat 14. Other (Specify_____) ☐	1.On Foot 2.Bicycle & Tricycle (including taxi) 3.Motorcycle (including motorcycle taxi) 4.Passenger Car 5.Van (box car) 6.Taxi 7.Passenger Truck Type Bus 8.Small Bus 9.Large Bus 10.Pick Up for Cargo 11.Truck 15. Railway 16. Ferry & Boat 14. Other (Specify_____) ☐
9.What is your purpose?	1.Go Home 2.Go to Working 3.Go to School 4.Business 5.Shopping 6.Social activities 7.Sightseeing, Recreation, Leisure 9.Other ☐	1.Go Home 2.Go to Working 3.Go to School 4.Business 5.Shopping 6.Social activities 7.Sightseeing, Recreation, Leisure 9.Other ☐
10.Total Travel Time (min)	☐☐☐ min	☐☐☐ min

9.2. Bus Occupancy Survey

Bus Passenger OD Interview Survey for Intercity Bus Occupancy

Survey Bus Terminal : 1. Dagon Ayar Highway Bus Center
2. Aung Mingalar Bus Terminal ☐

Date(DD/MM/YY) : ☐☐ / ☐☐ / ☐☐

Day : 2. Monday, 3. Tuesday, 4. Wednesday,
5. Thursday, 6.Friday ☐

Surveyor Name :____________ ☐☐

Code by :____________ ☐☐

Checked by :____________ ☐☐

Time	Destination	Occupancy
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%
:		%

if you can not see the occupancy, write down 999 in the box

10. Parking Survey

10.1. Form for Parked Vehicle Count

Parking Survey Form

Comprehensive Urban Transport Plan of the Greater Yangon
Parking Survey for Parked Vehicle Count

Survey Location : _____ □□□

Date(DD/MM/YY) : □□/□□/□□

Day : **2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6. Friday** □

Surveyor Name _____ □□□□□

Code by : _____ □□□□□

Checked by : _____ □□□□□

No.1-1

Record Time	04 Car	05 Van (box car)	06 Taxi	07 Passenger Truck	08 Small Bus	09 Large Bus	10 Pick Up for Cargo	11 Truck (2 axles)	12 Truck (more than 3 axles)	13 Trailer (separated type)	14 Others
6:00											
6:30											
7:00											
7:30											
8:00											
8:30											
9:00											
9:30											
10:00											

This form will be continued until 10:00 PM.

10.2. Form for Counting Entering / Exiting Vehicles

Parking Survey Form

Comprehensive Urban Transport Plan of the Greater Yangon
Parking Survey for
Counting entering and exiting Vehicle

Survey Location : _____ □□□
Date(DD/MM/YY) : □□/□□/□□
Day : 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6. Friday □
Surveyor Name : _____ □□□□□
Code by : _____ □□□□□
Checked by : _____ □□□□□

No.2

NO	Time	Vehicle Type	IN : 1 OUT: 2	NO	Time	Vehicle Type	IN : 1 OUT: 2	NO	Time	Vehicle Type	IN : 1 OUT: 2
1	:			31	:			61	:		
2	:			32	:			62	:		
3	:			33	:			63	:		
4	:			34	:			64	:		
5	:			35	:			65	:		
6	:			36	:			66	:		
7	:			37	:			67	:		
8	:			38	:			68	:		
9	:			39	:			69	:		
10	:			40	:			70	:		
11	:			41	:			71	:		
12	:			42	:			72	:		
13	:			43	:			73	:		
14	:			44	:			74	:		
15	:			45	:			75	:		
16	:			46	:			76	:		
17	:			47	:			77	:		
18	:			48	:			78	:		
19	:			49	:			79	:		
20	:			50	:			80	:		
21	:			51	:			81	:		
22	:			52	:			82	:		
23	:			53	:			83	:		
24	:			54	:			84	:		
25	:			55	:			85	:		
26	:			56	:			86	:		
27	:			57	:			87	:		
28	:			58	:			88	:		
29	:			59	:			89	:		
30	:			60	:			90	:		

03	04	05	06	07	08	09	10	11	12	13	14
Motrocycle	Car	Van (box car)	Taxi	Passen-gerTruck	Small Bus	Large Bus	Pick Up for Cargo	Truck (2axles)	Truck(more than 3 axles)	Trailer(separated type)	Others
											

11. Form for Travel Speed Survey

Comprehensive Urban Transport Plan of the Greater Yangon
TRAVEL SPEED SURVEY

Date(DD/MM/YY) : □ / □□ / □□
Day : 2. Monday, 3. Tuesday, 4. Wednesday, 5. Thursday, 6.Friday □
Surveyor Name :_____ □
Route No : 1. Route 01, 2. Route 02, 3. Route 03, 4. Route 04, 5. Route 05, □□
6. Route 06, 7. Route 07, 8. Route 08, 9. Route 09, 10. Route 10,

Sample No	Start intersection between			End intersection between			Direction code	Start time (hh:mm:ss)	End time (hh:mm:ss)	Remark for any accident
1		and			and			: :	: :	
2		and			and			: :	: :	
3		and			and			: :	: :	
4		and			and			: :	: :	
5		and			and			: :	: :	
6		and			and			: :	: :	
7		and			and			: :	: :	
8		and			and			: :	: :	
9		and			and			: :	: :	
10		and			and			: :	: :	
11		and			and			: :	: :	
12		and			and			: :	: :	

Appendix 2 YUTRA ZONING SYSTEM

YUTRA Study Area Zone System

Traffic Zone	Zone Name	Township
1	Latha 1	Latha
2	Latha 2	Latha
3	Latha 3	Latha
4	Lanmadaw 1	Lanmadaw
5	Lanmadaw 2	Lanmadaw
6	Lanmadaw 3	Lanmadaw
7	Pabedan 1	Panbetan
8	Pabedan 2	Panbetan
9	Pabedan 3	Panbetan
10	Kyauktada 1	Kyauktada
11	Kyauktada 2	Kyauktada
12	Botahtaung 1	Botataung
13	Botahtaung 2	Botataung
14	Botahtaung 3	Botataung
15	Pazundaung 1	Pazundaung
16	Pazundaung 2	Pazundaung
17	Pazundaung 3	Pazundaung
18	Ahlone 1	Alone
19	Ahlone 2	Alone
20	Ahlone 3	Alone
21	Kyee Myin Daing 1	Kyee Myin Daing
22	Kyee Myin Daing 2	Kyee Myin Daing
23	Kyee Myin Daing 3	Kyee Myin Daing
24	Sanchaung 1	San Chaung
25	Sanchaung 2	San Chaung
26	Sanchaung 3	San Chaung
27	Sanchaung 4	San Chaung
28	Dagon 1	Dagon
29	Dagon 2	Dagon
30	Dagon 3	Latha
31	Bahan 1	Latha
32	Bahan 2	Latha
33	Bahan 3	Lanmadaw
34	Tarmwe 1	Lanmadaw
35	Tarmwe 2	Lanmadaw
36	Tarmwe 3	Pabedan
37	Tarmwe 4	Pabedan
38	Tarmwe 5	Pabedan
39	Mingalar Taung Nyunt 1	Kyauktada
40	Mingalar Taung Nyunt 2	Kyauktada
41	Mingalar Taung Nyunt 3	Botahtaung
42	Seikkan 1	Botahtaung
43	Seikkan 2	Botahtaung

Traffic Zone	Zone Name	Township
44	Dawbon 1	Pazundaung
45	Dawbon 2	Pazundaung
46	Dawbon 3	Pazundaung
47	Kamaryut 1	Ahlone
48	Kamaryut 2	Ahlone
49	Kamaryut 3	Ahlone
50	Kamaryut 4	Kyee Myin Daing
51	Hlaing 1	Hlaing
52	Hlaing 2	Hlaing
53	Hlaing 3	Hlaing
54	Yankin 1	Yankin
55	Yankin 2	Yankin
56	Yankin 3	Yankin
57	Thingankyun 1	Thingangyun
58	Thingankyun 2	Thingangyun
59	Thingankyun 3	Thingangyun
60	Thingankyun 4	Thingangyun
61	Thingankyun 5	Thingangyun
62	Mayangone 1	Mayangone
63	Truck Terminal (Bayint Naung Warehouse)	Mayangone
64	Mayangone 2	Mayangone
65	Mayangone 3	Mayangone
66	Insein 1	Insein
67	Insein 2	Insein
68	Insein 3	Insein
69	Insein 4	Insein
70	Mingalardon 1	Mingalardon
71	Bus Terminal (T02)	Mingalardon
72	Mingalardon 2	Mingalardon
73	Mingalardon 3	Mingalardon
74	Mingalardon 4	Mingalardon
75	Mingalardon 5	Mingalardon
76	Mingalardon 6	Mingalardon
77	Airport	Mingalardon
78	North Okkalapa 1	North Okkalapa
79	North Okkalapa 2	North Okkalapa
80	North Okkalapa 3	North Okkalapa
81	South Okkalapa 1	South Okkalapa
82	South Okkalapa 2	South Okkalapa
83	South Okkalapa 3	South Okkalapa
84	Tharkayta 1	Thaketa
85	Tharkayta 2	Thaketa
86	Tharkayta 3	Thaketa
87	Tharkayta 4	Thaketa

Traffic Zone	Zone Name	Township
88	Dala 1	Dala
89	Dala 2	Dala
90	Dala 3	Dala
91	Dala 4	Dala
92	Dala 5	Dala
93	Dala 6	Dala
94	Seikgyikanaungto 1	Seikgyikhanaungto
95	Seikgyikanaungto 2	Seikgyikhanaungto
96	Seikgyikanaungto 3	Seikgyikhanaungto
97	Shwepyithar 1	Shwepyithar
98	Shwepyithar 2	Shwepyithar
99	Shwepyithar 3	Shwepyithar
100	Shwepyithar 4	Shwepyithar
101	Shwepyithar 5	Shwepyithar
102	Shwepyithar 6	Shwepyithar
103	Shwepyithar 7	Shwepyithar
104	Hlaingtharyar 1	Hlaingtharyar
105	Hlaingtharyar 2	Hlaingtharyar
106	Hlaingtharyar 3	Hlaingtharyar
107	Hlaingtharyar 4	Hlaingtharyar
108	Bus Terminal (T01)	Hlaingtharyar
109	Hlaingtharyar 5	Hlaingtharyar
110	Hlaingtharyar 6	Hlaingtharyar
111	Hlaingtharyar 7	Hlaingtharyar
112	Dagon Myothit (North) 1	Dagon Myothit (North)
113	Dagon Myothit (North) 2	Dagon Myothit (North)
114	Dagon Myothit (North) 3	Dagon Myothit (North)
115	Dagon Myothit (South) 1	Dagon Myothit (South)
116	Dagon Myothit (South) 2	Dagon Myothit (South)
117	Dagon Myothit (South) 3	Dagon Myothit (South)
118	Dagon Myothit (South) 4	Dagon Myothit (South)
119	Dagon Myothit (South) 5	Dagon Myothit (South)
120	Dagon Myothit (South) 6	Dagon Myothit (South)
121	Dagon Myothit (South) 7	Dagon Myothit (South)
122	Dagon Myothit (East) 1	Dagon Myothit (East)
123	Dagon Myothit (East) 2	Dagon Myothit (East)
124	Dagon Myothit (East) 3	Dagon Myothit (East)
125	Dagon Myothit (East) 4	Dagon Myothit (East)
126	Dagon Myothit (East) 5	Dagon Myothit (East)
127	Dagon Myothit (East) 6	Dagon Myothit (East)
128	Dagon Myothit (East) 7	Dagon Myothit (East)
129	Dagon Myothit (Seikkan) 1	Dagon Myothit (Seikkan)
130	Dagon Myothit (Seikkan) 2	Dagon Myothit (Seikkan)
131	Dagon Myothit (Seikkan) 3	Dagon Myothit (Seikkan)
132	Dagon Myothit (Seikkan) 4	Dagon Myothit (Seikkan)

Traffic Zone	Zone Name	Township
133	Dagon Myothit (Seikkan) 5	Dagon Myothit (Seikkan)
134	Dagon Myothit (Seikkan) 6	Dagon Myothit (Seikkan)
135	Kyauktan 1	Kyauktan
136	Kyauktan 2	Kyauktan
137	Kyauktan 3	Kyauktan
138	Thanlyin 1	Thanlyin
139	Thanlyin 2	Thanlyin
140	Thanlyin 3	Thanlyin
141	Thanlyin 4	Thanlyin
142	Thanlyin 5	Thanlyin
143	Thanlyin 6	Thanlyin
144	Thanlyin 7	Thanlyin
145	Thanlyin 8	Thanlyin
146	Hlegu 1	Hlegu
147	Hlegu 2	Hlegu
148	Hlegu 3	Hlegu
149	Hlegu 4	Hlegu
150	Hmawbi 1	Hmawbi
151	Hmawbi 2	Hmawbi
152	Hmawbi 3	Hmawbi
153	Hmawbi 4	Hmawbi
154	Htantabin 1	Htantabin
155	Htantabin 2	Htantabin
156	Htantabin 3	Htantabin
157	Twan Tay 1	Twan Tay
158	Twan Tay 2	Twan Tay
159	Twan Tay 3	Twan Tay
160	Twan Tay 4	Twan Tay
161	Rest of Dala	Dala
162	Rest of Kyauktan	Kyauktan
163	Rest of Thanlyin	Thanlyin
164	Rest of Hlegu	Hlegu
165	Rest of Hmawbi	Hmawbi
166	Rest of Htantabin	Htantabin
167	Rest of Twan Tay	Twan Tay
168	Thongwa	Thongwa
169	Kayan	Kayan
170	Kawhmu	Kawhmu
171	Kungyangon	Kungyangon
172	Taikkyi	Taikkyi
173	Coco Kyun	Coco Kyun
174	Ayeyarwaddy	MM Region
175	Sagaing	MM Region
176	Magway	MM Region
177	Mandalay	MM Region

Traffic Zone	Zone Name	Township
178	Bago	MM Region
179	Tanintharyi	MM Region
180	Kachin	MM State
181	Kayah	MM State
182	Kayin	MM State
183	Chin	MM State
184	Mon	MM State
185	Rakhine	MM State
186	Shan	MM State
187	Foreign Countries	Overseas

Appendix 3 YUTRA DATABASE

Group	Category	Folder	Sub_Folder	3rd_Folder	File_Name	Type	Application	Source	Coordination	Year
GIS	GIS	1)_Administrative_Boundary	0101_Township		A_Township_Boundaries_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Township_BND_YUTRA_py_2013Jun28.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0102_Word		Ward_BND_YUTRA_py_2013Jun28.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0103_YUTRATrafficZones		TrafficZone_YUTRA_byPTZone_wtData.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					TrafficZone_YUTRA_OutOfStudyArea_TZ01.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					TrafficZone_YUTRA_SpecialGenerator.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					TrafficZone_YUTRA_TZ01_rev.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					TrafficZone_YUTRA_TZ01_rev_point_SGZ.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					TrafficZone_YUTRA_TZ01_rev_single.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Traffic_Zone_20131126.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
		2)_Landuse	0201_Industrial Zones		Industrial Zones.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0202_Government		Government_Area_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Government_Area_YUTRA2.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Government_Area_YUTRA3.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0203_Commercial Area		Commercial_polygon_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Commercial_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0204_Residencial Area		Residential_point_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Residential_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0205_Landmark		Landmark_Area.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0206_Other Landuse	Cargo-Port	InternationalPorts.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					RailWayCargoStations.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
				Future Landuse planed by SUDP	FutureLandUsePlan_bySUDP.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
				HospitalArea	Hospital-Old.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					HospitalArea.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
				LandOwnbyMyanRailway	LandOwnbyMyanRailway.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					RS_LandYardArea.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
				Public_Parks	Public Parks.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
				University	Uni-old.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					UniversityArea.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
				UrbanizedArea	UrbanizedArea.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
				YCDC-OwnedLand	001.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					002.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					003.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					004.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					005.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					006.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					007.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
		3)_Natural_Condition	0301_River		River_line_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					River_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0302_Vegetation		Vegetation_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
		4)_Public_and_Transport_Facility	0401_Airport		AirportTerminal.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0402_Freight		Freight_Transport_point_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Freight_Transport_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0402_Railway		Current_Railway_Pts.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Railway_Class.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Railway_Line.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0403_Railway Station		RailwayStation_10k.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0404_Public Transport		BusTerminal.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0404_Public Utility	Public Facilities	Commercial_polygon_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Commercial_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Governmental_units_polygon_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Governmental_units_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Industries_polygon_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Industries_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Public_facilities_polygon_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Public_facilities_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Utilities_line_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Utilities_polygon_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Utilities_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013

Group	Category	Folder	Sub_Folder	3rd_Folder	File_Name	Type	Application	Source	Coordination	Year
			0405_Road(Highway,Primary Road and Secondary Road)		Roads_point_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Roads_TruckBan.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Roads_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0406_Main Signalized Intersection		MainSignalized Intersections.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0407_Inter-city Bus Terminal		Inner-city_Bus_Terminal.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0408_Intra-city Bus Stops		Inner-city_Bus_Stops.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0409_Jetty Location		Jetty_Location_P_130203_point.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0410_Ferry Terminal		FerryTerminal_10k.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0411_Other Public Facility		Public_Transport_line_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Public_Transport_point_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Public_Transport_YUTRA.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
		5)_Traffic_Survey_Location	0501_Bus		Bus_Terminal_and_Stop130305_point.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Intercity_Bus_Terminal_point.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0502_Railway		Railway_station_130206_point.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0503_Ferry		Jetty_Location_P_130203_point.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0504_TravelSpeed		Ahlone_RD_polyline.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Dhama_Zedi_RD_polyline.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					No1main_RD_polyline.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					No2main_RD_polyline.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					No3main_RD_polyline.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					No4main_RD_polyline.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					No5main_RD_polyline.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					No6main_RD_polyline.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Parami_RD_polyline.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Travelspeedsurvey.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					University_Avenue_polyline.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0505_Intersection		Intersection Traffic Point.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0506_Truck_Interview		Intersection Traffic Point.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0511_Lane-Marking		Export_Output.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Export_Output_2.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Export_Output_3.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Export_Output_4.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					LaneMarking.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					LaneMarking2.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Node.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Segment.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
			0512_On-street parking		Parking Point.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Parking_Shape.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Parking_Shape2.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Parking_Shape3.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
					Parking_Shape3_region.shp	shp	ArcGIS	SUDP	WGS84_UTM_NZ47	2013
	Traffic Survey	00_Survey_Form			Survey_Form.pdf	pdf	Adobe			
	Survey	01_PT			HIS_Result.xlsx	worksheet	Excel	YUTRA		2013
					Screen_Adjustment_Factor_for_PT.xlsx	worksheet	Excel	YUTRA		2013
		02_Cordon	Count		Cordon_Traffic_Count_CA01_24hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CA02_24hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR01_24hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR01_24hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR02_16hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR03_16hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR04_16hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR05_16hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR06_24hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR07_16hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR08_16hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR09_16hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR10_16hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR11_16hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR12_24hr.xlsx	worksheet	Excel	YUTRA		2013

Group	Category	Folder	Sub_Folder	3rd_Folder	File_Name	Type	Application	Source	Coordination	Year
					Cordon_Traffic_Count_CR13_16hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR14_24hr.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Traffic_Count_CR15_16hr.xlsx	worksheet	Excel	YUTRA		2013
			Interview		Cordon_Line_Survey_CA01.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CA02.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR01.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR02.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR03.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR04.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR05.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR06.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR07.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR08.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR09.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR10.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR11.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR12.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR13.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR14.xlsx	worksheet	Excel	YUTRA		2013
					Cordon_Line_Survey_CR15.xlsx	worksheet	Excel	YUTRA		2013
					TrafficCordon_ODExpansion.xlsx	worksheet	Excel	YUTRA		2013
		03_Screen	Count		Screen_line_Survey_Traffic_Count_SE01_24hr.xls	worksheet	Excel	YUTRA		2013
					Screen_line_Survey_Traffic_Count_SE02_16hr.xls	worksheet	Excel	YUTRA		2013
					Screen_line_Survey_Traffic_Count_SE03_16hr.xls	worksheet	Excel	YUTRA		2013
					Screen_line_Survey_Traffic_Count_SE04_16hr.xls	worksheet	Excel	YUTRA		2013
					Screen_line_Survey_Traffic_Count_SE05_16hr.xls	worksheet	Excel	YUTRA		2013
					Screen_line_Survey_Traffic_Count_SE06_24hr.xls	worksheet	Excel	YUTRA		2013
					Screen_line_Survey_Traffic_Count_SE07_24hr.xls	worksheet	Excel	YUTRA		2013
					Screen_line_Survey_Traffic_Count_SE08_16hr.xls	worksheet	Excel	YUTRA		2013
					Screen_line_Survey_Traffic_Count_SE09_16hr.xls	worksheet	Excel	YUTRA		2013
					Screen_line_Survey_Traffic_Count_SE10_16hr.xls	worksheet	Excel	YUTRA		2013
					Screen_line_Survey_Traffic_Count_SW01_24hr.xls	worksheet	Excel	YUTRA		2013
					Screen_line_Survey_Traffic_Count_SW02_24hr.xls	worksheet	Excel	YUTRA		2013
					Screen_line_Survey_Traffic_Count_SW03_16hr.xls	worksheet	Excel	YUTRA		2013
			Occupancy		Screenline_Occupancy_Count_SE01_24hr.xls	worksheet	Excel	YUTRA		2013
					Screenline_Occupancy_Count_SE02_16hr.xls	worksheet	Excel	YUTRA		2013
					Screenline_Occupancy_Count_SE03_16hr.xls	worksheet	Excel	YUTRA		2013
					Screenline_Occupancy_Count_SE04_16hr.xls	worksheet	Excel	YUTRA		2013
					Screenline_Occupancy_Count_SE05_16hr.xls	worksheet	Excel	YUTRA		2013
					Screenline_Occupancy_Count_SE06_24hr.xls	worksheet	Excel	YUTRA		2013
					Screenline_Occupancy_Count_SE07_24hr.xls	worksheet	Excel	YUTRA		2013
					Screenline_Occupancy_Count_SE08_16hr.xls	worksheet	Excel	YUTRA		2013
					Screenline_Occupancy_Count_SE09_16hr.xls	worksheet	Excel	YUTRA		2013
					Screenline_Occupancy_Count_SE10_16hr.xls	worksheet	Excel	YUTRA		2013
					Screenline_Occupancy_Count_SW01_24hr.xls	worksheet	Excel	YUTRA		2013
					Screenline_Occupancy_Count_SW02_24hr.xls	worksheet	Excel	YUTRA		2013
					Screenline_Occupancy_Count_SW03_16hr.xls	worksheet	Excel	YUTRA		2013
		04_Traffic_Count			Traffic_Count_Survey_T01.xls	worksheet	Excel	YUTRA		2013
					Traffic_Count_Survey_T02.xls	worksheet	Excel	YUTRA		2013
					Traffic_Count_Survey_T03.xls	worksheet	Excel	YUTRA		2013
					Traffic_Count_Survey_T04.xls	worksheet	Excel	YUTRA		2013
					Traffic_Count_Survey_T05.xls	worksheet	Excel	YUTRA		2013
					Traffic_Count_Survey_T06.xls	worksheet	Excel	YUTRA		2013
		05_Ferry_Passenger	Count		Ferry_OD_Survey_for_Counting_F01.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F02.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F03.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F04.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F05.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F06.xls	worksheet	Excel	YUTRA		2013

Group	Category	Folder	Sub_Folder	3rd_Folder	File_Name	Type	Application	Source	Coordination	Year
					Ferry_OD_Survey_for_Counting_F07.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F08.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F09.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F10.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F11.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F12.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F13.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F14.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F15.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F16.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F17.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F18.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F19.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F20.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F21.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F22.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F23.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F24.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F25.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F26.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F27A.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F27B.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F28.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F29.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F30.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Counting_F31.xls	worksheet	Excel	YUTRA		2013
			Interview		FerryODInterviewExpansion.xlsx	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Interview_F10.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Interview_F12.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Interview_F16.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Interview_F17.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Interview_F18.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Interview_F19.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Interview_F30.xls	worksheet	Excel	YUTRA		2013
					Ferry_OD_Survey_for_Interview_F31.xls	worksheet	Excel	YUTRA		2013
		06_Railway_Passenger	Count		Railway_Passenger_Counting_R01.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R02.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R03.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R04.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R05.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R06_A.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R06_B.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R07.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R08.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R09.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R10.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R11.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R12.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R13.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R14.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R15.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R16.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R17.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R18.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R19.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R20.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R21.xls	worksheet	Excel	YUTRA		2013
					Railway_Passenger_Counting_R22.xls	worksheet	Excel	YUTRA		2013
			Interview		RailOD Expansion.xlsx	worksheet	Excel	YUTRA		2013

Group	Category	Folder	Sub_Folder	3rd_Folder	File_Name	Type	Application	Source	Coordination	Year
					Railway_OD_Survey_Interview_R01.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R02.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R03.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R04.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R05.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R06.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R07.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R08.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R09.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R10.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R11.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R12.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R13.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R14.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R15.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R16.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R17.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R18.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R19.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R20.xls	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R21.xlsx	worksheet	Excel	YUTRA		2013
					Railway_OD_Survey_Interview_R22.xlsx	worksheet	Excel	YUTRA		2013
		07_Intersection			Intersection_Survey_I01.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I02.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I03.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I04.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I05.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I06.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I07.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I08.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I09.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I10.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I11.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I12.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I13.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I14.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I15.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I16.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I17.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I18.xls	worksheet	Excel	YUTRA		2013
					Intersection_Survey_I19.xls	worksheet	Excel	YUTRA		2013
		08_Truck_OD			Truck Interview Expansion.xlsx	worksheet	Excel	YUTRA		2013
					Truck_OD_Survey_Interview_TI01.xlsx	worksheet	Excel	YUTRA		2013
					Truck_OD_Survey_Interview_TI02.xlsx	worksheet	Excel	YUTRA		2013
					Truck_OD_Survey_Interview_TI03.xlsx	worksheet	Excel	YUTRA		2013
					Truck_OD_Survey_Interview_TI04.xlsx	worksheet	Excel	YUTRA		2013
					Truck_OD_Survey_Interview_TI05.xlsx	worksheet	Excel	YUTRA		2013
					Truck_OD_Survey_Interview_TI06.xls	worksheet	Excel	YUTRA		2013
					Truck_OD_Survey_Interview_TI07.xlsx	worksheet	Excel	YUTRA		2013
					Truck_OD_Survey_Interview_TI08.xlsx	worksheet	Excel	YUTRA		2013
					Truck_OD_Survey_Interview_TI09.xlsx	worksheet	Excel	YUTRA		2013
					Truck_OD_Survey_Interview_TI10.xlsx	worksheet	Excel	YUTRA		2013
					Truck_OD_Survey_Interview_TI11.xlsx	worksheet	Excel	YUTRA		2013
					Truck_OD_Survey_Interview_TI12.xlsx	worksheet	Excel	YUTRA		2013
		09_Bus_Passenger_OD	Count		Bus_OD_Survey_for_Intercity_Bus_Counting_T01.xls	worksheet	Excel	YUTRA		2013
					Bus_OD_Survey_for_Intercity_Bus_Counting_T02.xls	worksheet	Excel	YUTRA		2013
			Interview		BusSurveyExpansion.xlsx	worksheet	Excel	YUTRA		2013
					Bus_OD_Interview_Survey_for_Intercity_T01.xls	worksheet	Excel	YUTRA		2013
					Bus_OD_Interview_Survey_for_Intercity_T02.xls	worksheet	Excel	YUTRA		2013

Group	Category	Folder	Sub_Folder	3rd_Folder	File_Name	Type	Application	Source	Coordination	Year
					Bus_OD_Interview_Survey_for_Intracity_B01.xls	worksheet	Excel	YUTRA		2013
					Bus_OD_Interview_Survey_for_Intracity_B02.xls	worksheet	Excel	YUTRA		2013
					Bus_OD_Interview_Survey_for_Intracity_B03.xls	worksheet	Excel	YUTRA		2013
					Bus_OD_Interview_Survey_for_Intracity_B04.xls	worksheet	Excel	YUTRA		2013
					Bus_OD_Interview_Survey_for_Intracity_B05.xls	worksheet	Excel	YUTRA		2013
					Bus_OD_Interview_Survey_for_Intracity_B06.xls	worksheet	Excel	YUTRA		2013
					Bus_OD_Interview_Survey_for_Intracity_B07.xls	worksheet	Excel	YUTRA		2013
					Bus_OD_Interview_Survey_for_Intracity_B08.xls	worksheet	Excel	YUTRA		2013
					Bus_OD_Interview_Survey_for_Intracity_B09.xls	worksheet	Excel	YUTRA		2013
					Bus_OD_Interview_Survey_for_Intracity_B10.xls	worksheet	Excel	YUTRA		2013
					Bus_OD_Interview_Survey_for_Intracity_B11.xls	worksheet	Excel	YUTRA		2013
					Bus_OD_Interview_Survey_for_Intracity_B12.xls	worksheet	Excel	YUTRA		2013
					Bus_OD_Interview_Survey_for_Intracity_B13.xls	worksheet	Excel	YUTRA		2013
		10_Parking	Parking_Sketch		Parking_Survey.xlsx	worksheet	Excel	YUTRA		2013
					P01.pdf	pdf	Adobe	YUTRA		2013
					P02.pdf	pdf	Adobe	YUTRA		2013
					P03.pdf	pdf	Adobe	YUTRA		2013
					P04.pdf	pdf	Adobe	YUTRA		2013
					P05.pdf	pdf	Adobe	YUTRA		2013
					P06.pdf	pdf	Adobe	YUTRA		2013
					P07.pdf	pdf	Adobe	YUTRA		2013
					P08.pdf	pdf	Adobe	YUTRA		2013
		11_Travel_Speed			Travel_Speed_Survey_01_1.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_01_1.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_01_2.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_01_2.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_01_Resurvey.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_01_Resurvey.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_02_1.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_02_1.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_02_2.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_02_2.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_03_1.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_03_1.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_03_2.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_03_2.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_04_1.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_04_1.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_04_2.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_04_2.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_05_1.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_05_1.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_05_2.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_05_2.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_06.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_06.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_06_Resurvey.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_06_Resurvey.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_07.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_07.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_08.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_08.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_09.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_09.itm	GPS		YUTRA		2013
					Travel_Speed_Survey_10.csv	worksheet	Excel-csv	YUTRA		2013
					Travel_Speed_Survey_10.itm	GPS		YUTRA		2013
					Travel_Speed_Suvery_Day_2.xls	worksheet	Excel	YUTRA		2013
					Travel_Speed_Suvery_Day_3.xls	worksheet	Excel	YUTRA		2013
					Travel_Speed_Suvery_Day_6.xls	worksheet	Excel	YUTRA		2013

Group	Category	Folder	Sub_Folder	3rd_Folder	File_Name	Type	Application	Source	Coordination	Year
		99_Survey_Location			01_PTStudy_Area.jpg	jpg		YUTRA		2013
					02_Cordon.jpg	jpg		YUTRA		2013
					03_Screen.jpg	jpg		YUTRA		2013
					04_Traffic Count.jpg	jpg		YUTRA		2013
					04_Traffic Count.png	jpg		YUTRA		2013
					05_Ferry.jpg	jpg		YUTRA		2013
					05_Ferry.png	jpg		YUTRA		2013
					06_Railway Interview.jpg	jpg		YUTRA		2013
					07_Intersection.jpg	jpg		YUTRA		2013
					08_Interview point.jpg	jpg		YUTRA		2013
					09_Bus Survey.jpg	jpg		YUTRA		2013
					10_Parking Survey.jpg	jpg		YUTRA		2013
					10_Parking.png	jpg		YUTRA		2013
					11_Travel Speed.jpg	jpg		YUTRA		2013
					11_TravelSpeed.png	jpg		YUTRA		2013
	Demand_Forecast	00_Network	STRADA		2013.int	Text	STRADA	YUTRA		2013
					2018MP.int	Text	STRADA	YUTRA		2018
					2025MP.int	Text	STRADA	YUTRA		2025
					2035MP.int	Text	STRADA	YUTRA		2035
			CUBE		DM_2013_NET(NO-ONSTPARK).NET	Text	CUBE	YUTRA		2013
					DN_2013_NET.NET	Text	CUBE	YUTRA		2013
					MP_2018_ASS_NET.NET	Text	CUBE	YUTRA		2018
					MP_2018_NET.NET	Text	CUBE	YUTRA		2018
					MP_2025_NET.NET	Text	CUBE	YUTRA		2025
					DO_MAX_MP_2035.NET	Text	CUBE	YUTRA		2035
		01_OD			2013_PCU.aod	Text	STRADA	YUTRA		2013
					2018MP_PCU.aod	Text	STRADA	YUTRA		2018
					2025MP_PCU.aod	Text	STRADA	YUTRA		2025
					2035MP_PCU.aod	Text	STRADA	YUTRA		2035
		02_PAR			2013.par	Text	STRADA	YUTRA		2013
					2018MP.par	Text	STRADA	YUTRA		2018
					2025MP.par	Text	STRADA	YUTRA		2025
					2035MP.par	Text	STRADA	YUTRA		2035
		03_Result	STRADA		2013_PCU.ire	Text	STRADA	YUTRA		2013
					2018MP_PCU.ire	Text	STRADA	YUTRA		2018
					2025MP_PCU.ire	Text	STRADA	YUTRA		2025
					2035MP_PCU.ire	Text	STRADA	YUTRA		2035
			CUBE		DM_2013_NET(NO-ONSTPARK).DAT	Text	CUBE	YUTRA		2013
					DN_2013_NET.DAT	Text	CUBE	YUTRA		2013
					MP_2018_ASS_NET.DAT	Text	CUBE	YUTRA		2018
					MP_2025_NET.DAT	Text	CUBE	YUTRA		2018
					MP_2025_NET.NET	Text	CUBE	YUTRA		2025
					DO_MAX_MP_2035.DAT	Text	CUBE	YUTRA		2035
		04_Other			PCU_and_Occupancy_for Assignment.xlsx	worksheet	Excel	YUTRA		2013