UNITED NATIONS
ESCAP
Economic and Social Commission for Asia and the Pacific

FINAL REPORT

SUSTAINABLE URBAN TRANSPORT INDEX (SUTI)

FOR

YANGON CITY, MYANMAR

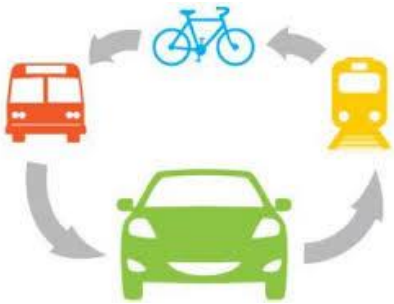

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Table of Contents

List of Figures

List of Tables

Executive Summary

Yangon, the former capital of Myanmar, is a rapidly emerging mega city and the country's centre of commerce. Yangon has a population of 5.2 million with a density of 5346 per km^2 (2014), making it one of the country's most densely populated cities. Due to this population pressure, there is an urgent need for Yangon city to establish a proper Urban Transport Plan. To assess Yangon's existing transportation system, this report has used the "Sustainable Urban Transport Index (SUTI)" index developed by the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). SUTI's 10 indicators provide a quantitative evaluation of Yangon's urban transport system. These results will guide authorities on the necessary sectors and help shape the direction of urban transport in Yangon. All 10 indicators are weighted equally, and each indicator's performance is compared on a scale of 1-100. To analyse the data, a series of high-level meetings took place between the Road and Bridge Authority, City Planning and Land Administration Authority of Yangon City Development Committee, as well as academics and experts in the transportation sector. The results of the index are presented through a geometric mean and a spider diagram. The geometric mean of the index is 49.04, indicating that Yangon's overall transport system is in a moderate situation. Lastly, the spider diagram provides Yangon's city transport authority with a valuable indication as to which areas need to be focused on for the future of urban transport in the city.

CHAPTER 1: INTRODUCTION

1.1 Introduction

Yangon, the former capital of Myanmar, has a population of 5.2 million (as of the 2014 census). It is the country's largest commercial hub. Accelerated economic growth and motorisation have caused Yangon's transport system to undergo rapid development. The increase in traffic volume, mainly attributed to private cars and buses, has also resulted in higher levels of air pollution and an increase in the number of severe traffic accidents. By 2035, the population of Yangon is expected to reach 7.7 million, with the highest concentration in Yangon's urban area. The urban area is also expected to expand into the surrounding areas, transforming Yangon into a megacity with a predicted population of 10 million. Private vehicle ownership will increase as a result of higher household incomes. Increasing motorisation, traffic congestion, emissions, traffic-related accidents, travel time, and congestion costs will impact the quality of life in Yangon city, and could become a significant burden on urban mobility as a growing number of people demand access to jobs, goods and services.

Table 1.1 Area and Population of Yangon

Item		**National wide**	**Yangon Region**	**Yangon City**
Population	Person	51,486,253	7,360,703	5,191,000
	%	100	14	10
Area	km^2	669794	9804	971
	%	100	1.5	0.14
Population Density (per km^2)		77	751	5346

https://www.citypopulation.de/php/myanmar-admin.php

1.2 Study Area

Yangon Region, also known as Yangon Division, is formed of 44 townships and has a total regional population of 7.4 million. The region is dominated by Yangon city, which is home to 70 percent of the population of the whole region. A large share of commerce and services are in the inner part of the city, including the historic central business district and the urban area immediately to the north. There is manufacturing development and activity in the new suburbs of the city (the west, east, northwest and northeast). The Central Business District (CBD) is located at the southern part of the city, adjacent to the confluence of the Yangon River and the Bago River. Administratively, the city is divided into 4 districts (north, east, west, and south) and 33 townships.

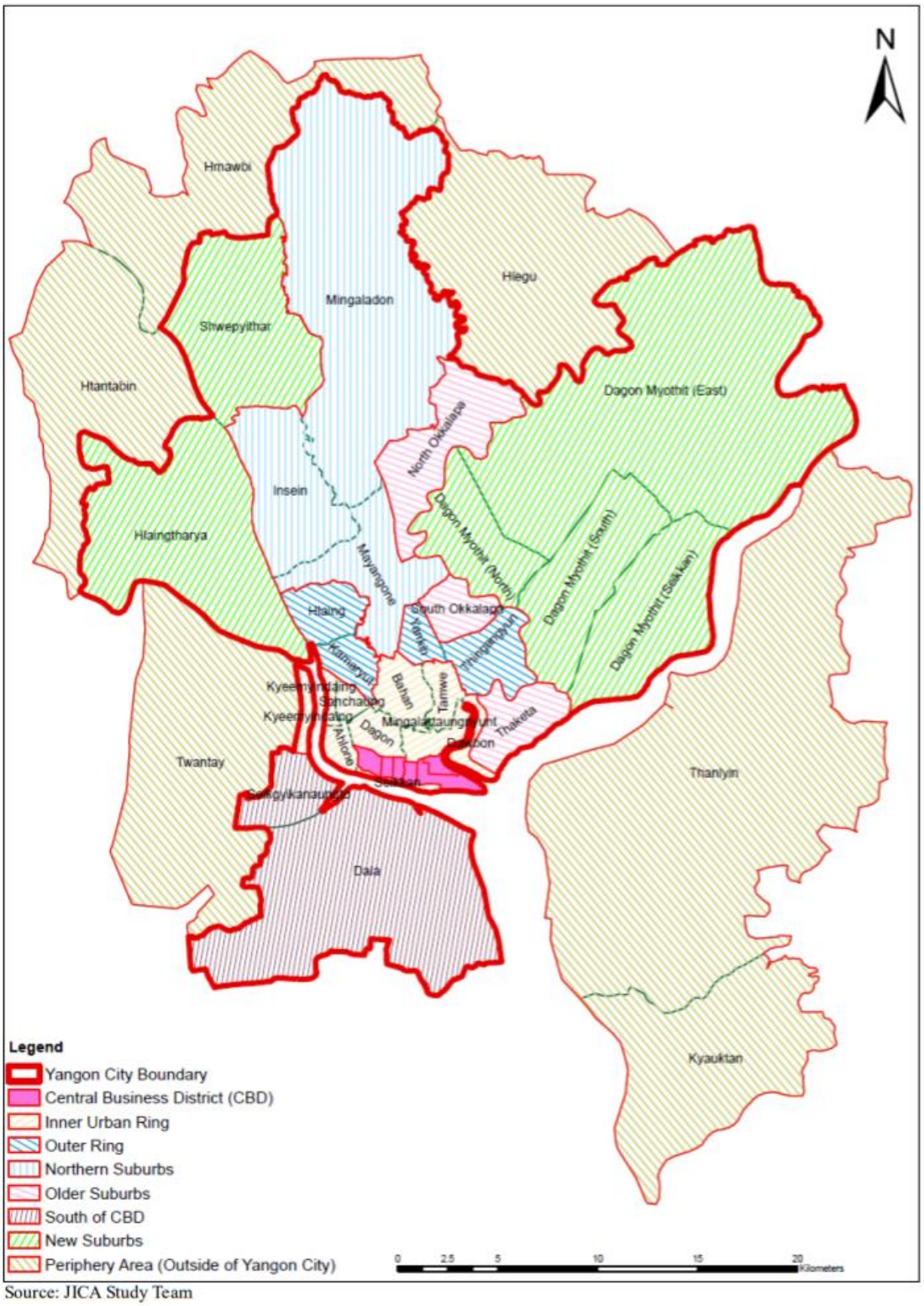
Yangon is expanding outward and various developments have been proposed in the suburban area. The urbanisation of the Thilawa area is remarkable. An Outer Ring Road (ORR) is positioned as both an inter-Turban corridor and urban corridor. The Thilawa area is home to the Thilawa Port and Thilawa SEZ, as well as the North-South Corridor and the East-West Corridor. Together they form two of the most important economic corridors for Myanmar and play a key role in the Asian Economic Regional zone. Building an early link between the Yangon- Mandalay(Y-M) Expressway and the Dala area is crucial for the area's economy.

Table 1.2: Yangon Regional Townships Classification

Yangon Region Boundary		Urban Group	Township Name	Area Demarcation
THE WHOLE AREA OF YANGON REGION	STUDY AREA OF YANGON REGION	CBD	Lanmadaw	STUDY AREA OF YANGON CITY
			Latha	
			Pebedan	
			Kyauktada	
			Botahtaung	
			Pazundaung	
		INNER URBAN RING	Ahlone	
			Kyee Myin Daing	
			San Chaung	
			Dagon	
			Bahan	
			Tarmwe	
			Mingalar Taung Nyunt	
			Dawbon	
		OUTER RING	Kamaryut	
			Hlaing	
			Yankin	
			Thingangyun	
		NORTHERN SUBURBS	Mayangone	
			Insein	
			Mingalardone	
		OUTER SUBURBS	North Okkalarpa	
			South Okkalarpa	
			Tharketa	
		SOUTH CBD	Dala	
			Seik Gyi Khanungto	
		NEW SUBURBS	Shwe Pyi Thar	
			Hlaing Tharyar (1)	
			Hlaing Tharyar (2)	
			North Dagon	
			South Dagon	
			East Dagon	
			Dagon Seikkan	
	OUTSIDE OF YCDC		Kyauktan	
			Thanlyin	
			Hlegu	
			Hmawbi	
			Htantabin	
			Twantay	
			Taikkyi	
			Kawhmu	
			Kungyangone	
			Kayan	
			Thongwa	

Source: SUDP

Fig 1.1: Study Area of Yangon City *Source: SUDP*

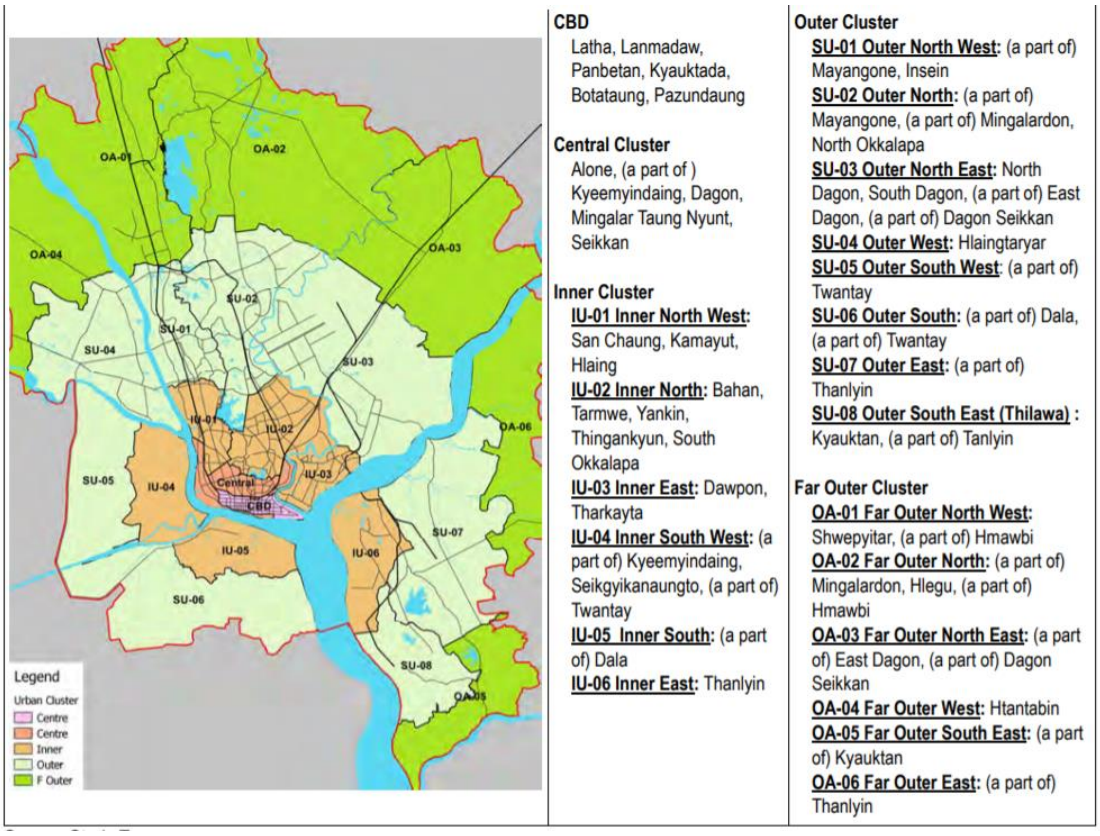


Source: JICA Study Team

Fig 1. 2: Future Planning of Yangon Outer Ring Road

Source: YUTRA Report

Fig 1. 3: Urban Cluster of Greater Yangon *Source: YUTRA Report*



CBD
Latha, Lanmadaw, Panbetan, Kyauktada, Botataung, Pazundaung

Central Cluster
Alone, (a part of) Kyeemyindaing, Dagon, Mingalar Taung Nyunt, Seikkan

Inner Cluster
IU-01 Inner North West: San Chaung, Kamayut, Hlaing
IU-02 Inner North: Bahan, Tarmwe, Yankin, Thingankyun, South Okkalapa
IU-03 Inner East: Dawpon, Tharkayta
IU-04 Inner South West: (a part of) Kyeemyindaing, Seikgyikanaungto, (a part of) Twantay
IU-05 Inner South: (a part of) Dala
IU-06 Inner East: Thanlyin

Outer Cluster
SU-01 Outer North West: (a part of) Mayangone, Insein
SU-02 Outer North: (a part of) Mayangone, (a part of) Mingalardon, North Okkalapa
SU-03 Outer North East: North Dagon, South Dagon, (a part of) East Dagon, (a part of) Dagon Seikkan
SU-04 Outer West: Hlaingtaryar
SU-05 Outer South West: (a part of) Twantay
SU-06 Outer South: (a part of) Dala, (a part of) Twantay
SU-07 Outer East: (a part of) Thanlyin
SU-08 Outer South East (Thilawa) : Kyauktan, (a part of) Tanlyin

Far Outer Cluster
OA-01 Far Outer North West: Shwepyitar, (a part of) Hmawbi
OA-02 Far Outer North: (a part of) Mingalardon, Hlegu, (a part of) Hmawbi
OA-03 Far Outer North East: (a part of) East Dagon, (a part of) Dagon Seikkan
OA-04 Far Outer West: Htantabin
OA-05 Far Outer South East: (a part of) Kyauktan
OA-06 Far Outer East: (a part of) Thanlyin

The impact of the Urban Development Plan in the South-Western Area of CBD and the planned development of the southern area across the river bridges is expected to change the transportation and spatial structure of Yangon. The area is composed of Dala and Kyee Myin Daing, shown in as IU-04, IU-05, SU-05 and SU-06 in Figure 1.3.

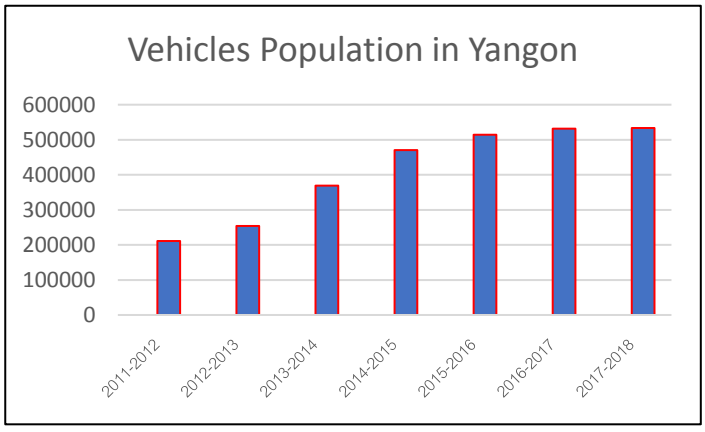
1.3 Objective of Study

The objective of this study is to develop the Sustainable Urban Transport Index (SUTI) for the Yangon city area. This index was developed by United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) to measure, compare and evaluate the performance of sustainable urban transport and related sustainable development goals of Asian cities. In this project, using 10 predefined indicators, the overall existing Yangon city transportation system will be evaluated. The results will be depicted in a spider diagram and will help identify the required fields of improvement and assist policy makers and planners to take appropriate measures.

CHAPTER 2: CURRENT TRANSPORT SYSTEM IN YANGON

The current urban transport system in Yangon city is comprised of roads, railway, waterways, ports and airports. Considering the significance of the entire Yangon region, the city's urban transport issues should be well linked to wider international and regional transport systems. Yangon is the gateway for passengers and cargo. As Myanmar's economy grows, and the country becomes more globally integrated and globalised, international traffic will increase and concentrate in gateway points, such as the airport and sea ports. The impact of international and regional traffic will be increasingly significant.

Fig 2.1: Yearly Vehicle Population in Yangon



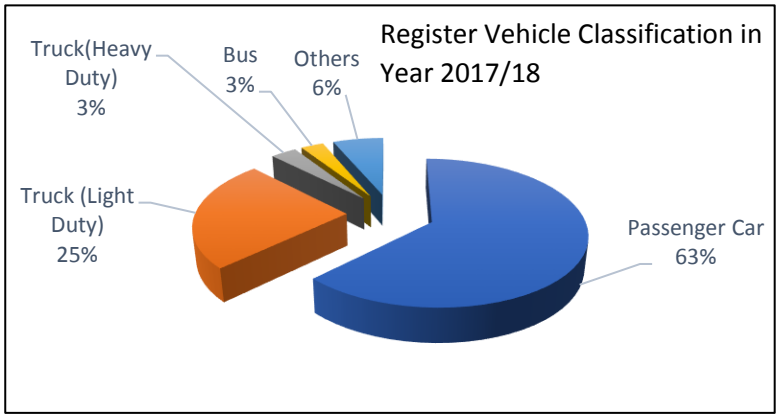


Fig 2.2: Vehicle Classification at Yangon (2017/18)

Sources: MOTC

2.1 Urban Roads

Roads are a fundamental form of infrastructure in urban areas. The existing 'right of way' system provides space not only for the movement of vehicles and pedestrians, but also space for various socio-economic activities. They provide venues for various events and recreational activities. Roads provide a connection between households and the main socio-economic centre. Roads also serve a key role as a fire belt and evacuation route. Moreover, the design of road spaces enhances the landscape. A well-designed road greatly improves the quality of life of those that use it. Above all, roads enable the everyday function of vital urban utilities such as water supply, drainage, electricity, and telecommunications.

The CBD area is located in the southern part of Yangon city. The majority of government offices, as well as most social, commercial and business activities, are within the CBD. Yangon's CBD was formed under British colonial rule and consists of 6 townships and a smart road network system. Three different road systems were incorporated into the design. Roads running west to east are broad roads (160 feet wide) and include Bogyoke Aung San Road, Anawyahta Road, Maharbandoola Road, Merchant Road and Kannar Road. Roads running to the south consist of two small 30-feet wide roads, one medium-sized road 50-feet wide, two additional 35-feet wide roads and one broad 100-foot wide road. They are: Lanthit Road, Phone Gyi Road, Lanmadaw Road, Latha Road, Shwe Dagon Pagoda Road, Shwebonthar Road, Sule Pagoda Road, Pansodan Road, Thein Phyu Road, Bo Aung Kyaw Road, Bo Myat Tun Road and Botahtaung Pagoda Road. This order was repeated from west to east. The smaller roads are numbered, while the medium and broad roads are named, many after eminent leaders during British colonial rule. They include the 100-foot wide Lanmadaw Road, followed by 17th and 18th street, which are small roads, the medium 50-foot Sin-O-Dan Road, and the small 21st and 22nd streets. The roads running parallel west to east are: The Strand Road, Merchant Road, Maha Bandoola Road, Anawyahta Road and Bogyoke Aung San Road, and a medium 50-foot wide road known as Bank Road. By this design, Yangon became a model city in South-East Asia.

After Independence in 1947, Yangon city area expanded to the north to incoporate the following in its 'Inner Urban Ring': Ahlone Township, Dagon Township, Mingalartaung Nyunt Township, San Chaung Township, Banhan Township, Tarmwe Township and Kyee Myindaing Township. From 1962 onwards, the city area expanded once again to include: Mayangone Township, Insein Township, Hlaing Township, Kamaryut Township, Mingalardone Township, Thingungyun Township, Yankin Township, South Okkalarpa Township, North Okkalarpa Township, Dawbon Township and Tharketa Township. By the year 1988, North Dagon Township, South Dagon Township, Hlaing Tharyar Township and Shwe Pyi Thar Township were established as the new satellite townships.

Every township is connected to the CBD area with arterial roads for daily commuting trips. Pyay Road, Insein Road, Bayint Naung Road, Lower Mingalardone Road, Baho Road, Thudamar Road, Kabaraye Pagoda Road, Thanthumar Road, Waizayandar Road, Upper Pazundaung Road, East Race Course Road, Banyadala Road, Kyaik Ka San Road, Thein Phyu Road, Kyee Myin Daing Road, Kannar Road are connected from the North, East and West to CBD. Khayaepin Road, Okkalar Road, Parami Road, Thitsar Road, Yadanar Road, Laydaunkkan Road, Thamainbayan Road, Shwe Gon Daing Road, U Chit Maung Road, Sayarsan Road, University Avenue Road, Bargayar Road are six lanes primary roads as East & West connection. Kan Yeik Thar Road, U Htaung Bo Road, Ahlone Road, Hantharwaddy Road, Dama Seti Road,U Wi Sara Road, Inya Road, Thumingalar Road, Khaymarthi Road, Waibargi Road, South Racecourse Road, North Racecourse Road, Sa Yar San Road, University Avenue Road and Hledan

Road are primary roads that link to six lanes. Four roundabouts help manage the heavy traffic volume at peak hours.

Road traffic has increased rapidly. As shown in Table 2.3, between 2011 to 2018, the total number of vehicles in Yangon region increased rapidly from 210,923 to 533,776, with a 2.5 times growth. Between 2014-2015 alone, the number of vehicles increased by 2.2 times. It is widely understood that vehicle ownership increases as an economy develops and household incomes rise. As with other cities, it is expected that vehicle ownership in Yangon will further increase and the impact on roads will become increasingly significant.

Restrictions on motorcycles have severely limited the use of two-wheeler motor vehicle modes in Yangon city, although they are now increasingly used in non-urban areas of the region. These restrictions have helped maintain a safe demand for public transport in the city, predominantly by bus. The urban road network of Yangon city is shown in Table 2.1. The share of the overall road area to the total urban area is only 4.5 per cent. This is much lower than other large cities in the world (Table 2.2). This points to a need for an improved network in order to link the inner and outer ring to the roads inside the CBD.

Table2.1: Classification of Roads in Yangon

Number of Lanes	Length (Km)	Average Right of Way(m)	Road Area (Km2)
≥ 6 Lanes	126	32	4.0
≥ 4 Lanes	429	24	10.3
≥ 2 Lanes	2,906	8	23.2
< 2 Lanes	6,349	4	25.4
Total	9,810		63.0

Source: YUTRA

City / Urban Area	Share (%)
Tokyo (Japan)	18.4
Seoul (Korea)	13.2
Singapore	10
Hong Kong	6.3
Taipei City (Taiwan)	7.7
Bangkok (Thailand)	7.1
Jakarta (Indonesia)	7.3

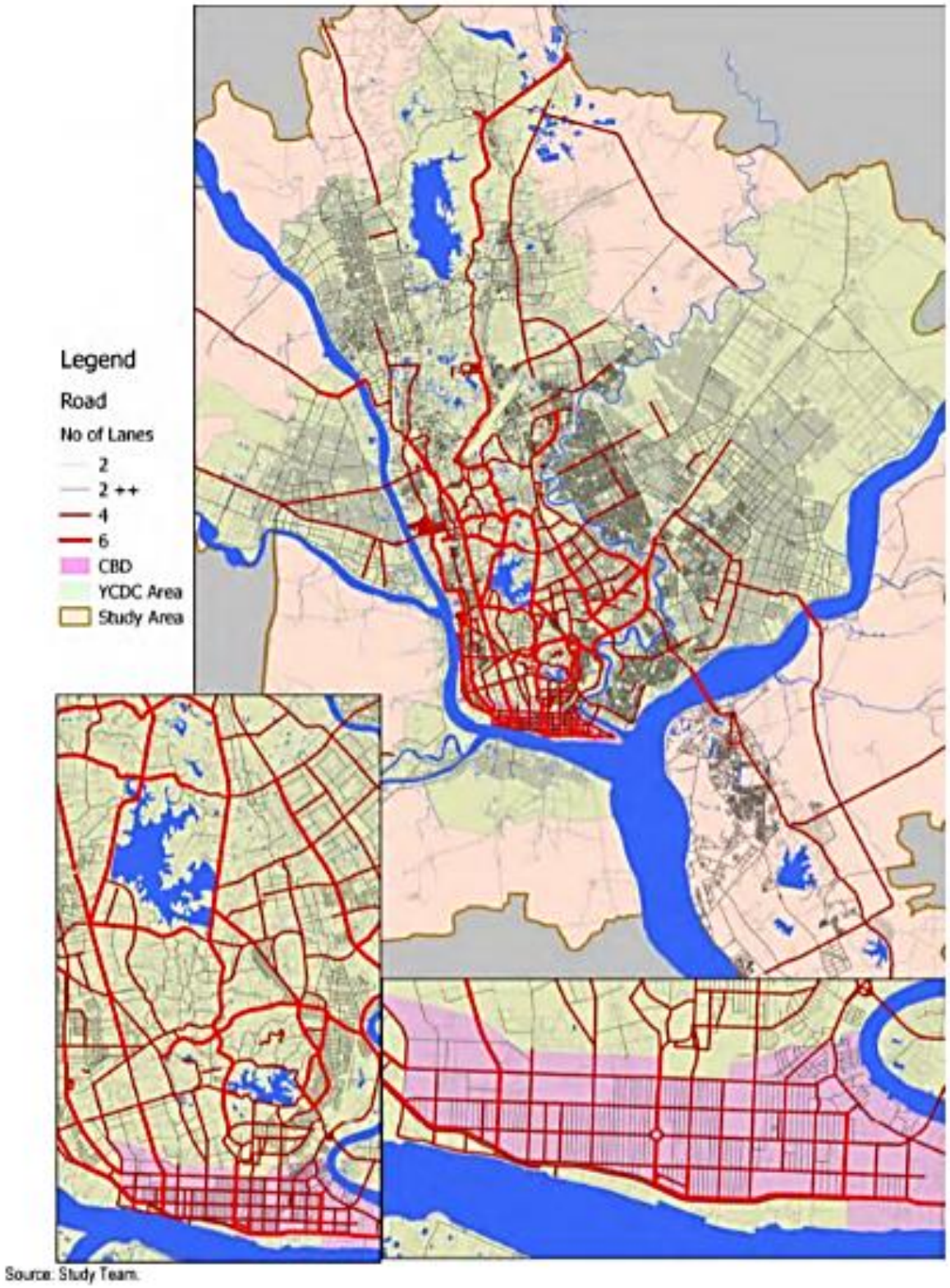
Table 2.2: International Comparison for Share of Road Area to Urban Area

Table 2.3: Vehicle Registration in Yangon

Classification	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Passenger Car	160,290	196,872	269,829	308,976	325,963	331,588	334,820
Light Truck	16,426	17,223	48,948	99,692	124,245	134,991	132,449
Heavy Truck	10,916	13,236	16,917	17,120	17,675	17,674	17,295
Bus	11,393	11,443	13,036	16,816	15,543	13,902	15,262
Others	11,898	14,792	19,941	27,977	30,411	33,232	33,950
Total	210,923	253,566	368,671	470,581	513,837	531,387	533,776

Source: MOTC

Fig 2.3: Urban Road in Yangon *Source: YUTRA Report*



Source: Study Team

Due to the recent rapid growth in the number of cars, and the traffic on the main roads directly connected to the CBD, chronic traffic jams have been observed in the peak hours. Occasional traffic jams have also been observed at the level crossing points with the railway. The main bottleneck points are observed at the entrance of the CBD (Shwe Dagon Pagoda Road with V/C=1.3, and Lower

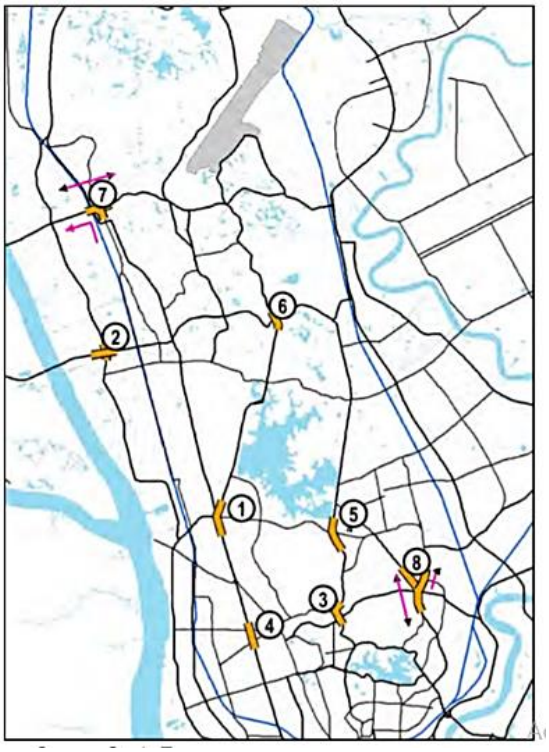
Pazundaung Road with V/C=1.1), and road sections near the inner urban ring zone (Pyay Road, Kabar Aye Pagoda Road, and Ba Yint Naung Road). As these road sections are located in the areas where road widening is difficult, the construction of flyovers and reconfiguration of intersections were required. Eight flyovers have been implemented to increase traffic capacity at Junctions (Table2.4). Disorganised street parking in the CBD also hinders traffic flows. At present, on street car parking in the CBD is illegal and restricted. However, due to the shortage in parking spaces, a strict control policy has not yet been implemented.

Table 2.4: Flyovers in Yangon

	Flyover	Opening Year
1	Hledan Flyover	April 2013
2	Bayintnaung Flyover	December 2013
3	Shwe Gon Daing Flyover	March 2014
4	Mya Ni Gone Flyover	March 2015
5	Kokkaing Flyover	February 2016
6	8 Mile Flyover	March 2016
7	Insein Flyover	March 2016
8	Tarmwe Flyover	July 2017

Source: YUTRA Report

Fig 2.4: Location of Flyovers



Source: YUTRA Report

2.2 Bus Transport

In response to the needs of the people, the Yangon Regional Government (YRG) established the Yangon Regional Transport Authority (YRTA) in 2016. YRTA oversees road and water public transport modes (but excludes rail, which is still under the control of Myanmar Railways).

As part of reforms to the bus system, an updated bus network and service scheme branded under the Yangon Bus Services (YBS) began operations under YRTA's supervision in 2017, effectively improving the quality of public transport services and advancing it in the right direction to allow regulated private sector participation in the provision of transport services.

Public transport in Yangon relies heavily on buses. Buses share about 40% of the total motorised trips and carry about 2 million passengers daily. The Government of Myanmar has committed to reform the system drastically. The reform program was initiated in January 2017, beginning with the restructuring of bus routes from 3333 to 70. This later increased to 91 in August 2017. More than 100 companies and operators were amalgamated into 8 groups. New buses were introduced to replace old ones. A planned improvement of bus stops and terminals is also due to commence. *(Source: YUTRA)*

Table 2.5: Yangon City Bus Service Information (October 2018)

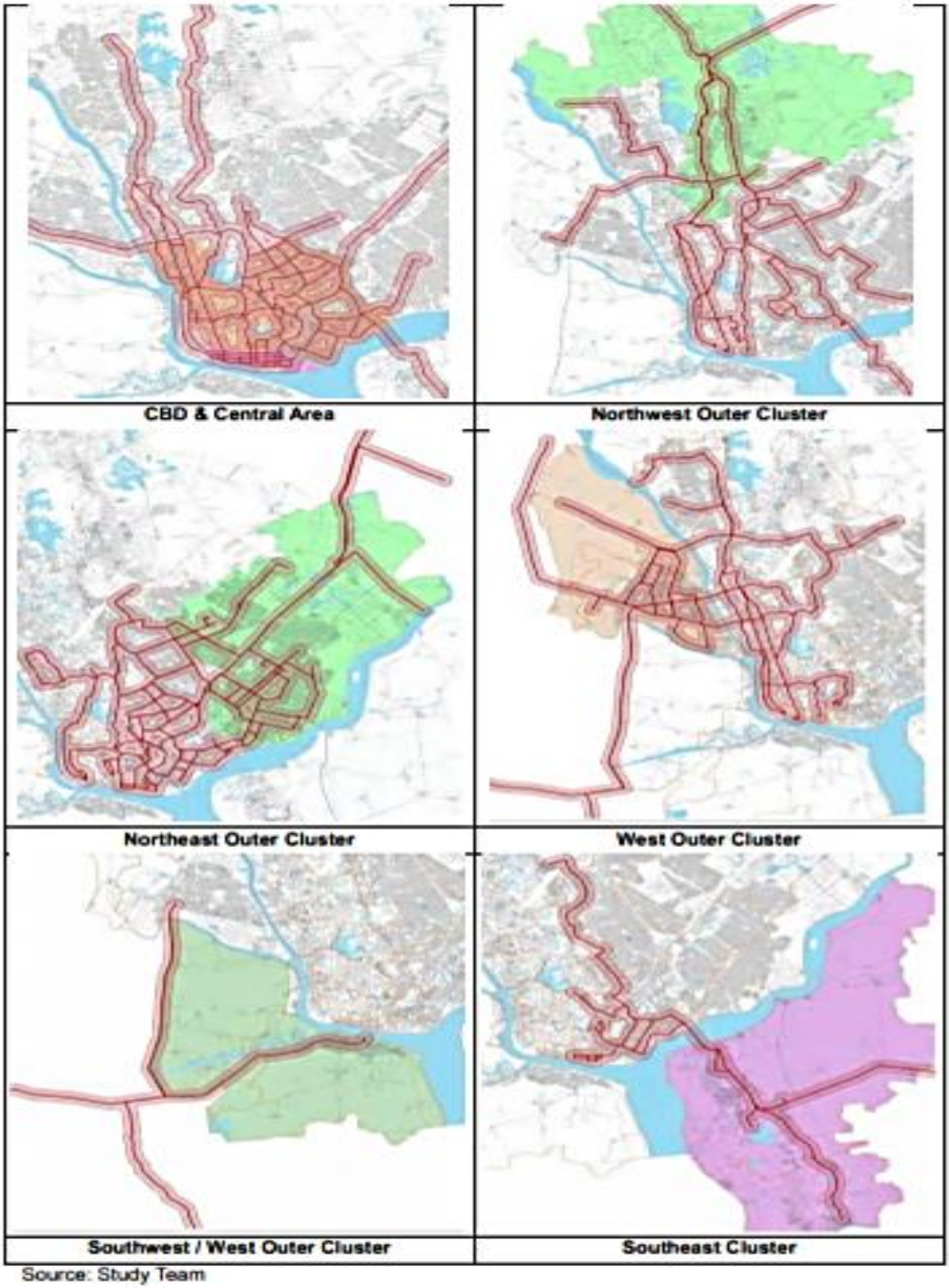
S/No	Bus Line Company	Number of Bus Line	Trip Length (mile)	Normal Bus	Mini Bus	Others	Total Bus
1	YUPT	28	781.7	1045	185	0	1230
2	Bandoola	5	142.9	243			243
3	Khit Thit Bayint Naung	11	322.7	350	256		606
4	Golden Southern	15	532	165	45	539	749
5	Omini Focus General Service Co., Ltd.	8	244.7	464			464
6	Holiest Vim	5	196	110	64		174
7	Kong Baung	2	60	170			170
8	Power Eleven Public Co., Ltd	4	133	146	79		225
9	Yangon Bus Public Co., Ltd	11	468	546			546
10	Yangon Northern Tikkyithar	2	222	66	18		84
11	Shwe Lan Khin	1	40	70			70
12	GYCT Co., Ltd.	12	377.6	584	112		696
13	Trans Link Co., Ltd.	2	59	60			60
14	City Liner Co., Ltd.	1	24		16		16
15	Sanwaila	2	48	50			50
16	Ever Green Lucky Family (65)	3	100	126	72		198
17	Rapid City	8	299.6	96	227		323
18	People Partner	5	200	265	0		265
19	Individual Owners	10	315	232	179		411
	Total	135	4566.2	4788	1253	539	6580

Ref: UTRA Report

Fig 2.5: Comparison of Bus Routes Coverage between Current and Previous *Ref: UTRA Report*

Source: Study Team

Fig 2.6: YBS Bus Route Coverage



Source: Study Team

Ref: UTRA Report

Fig 2.7 Yangon Bus Service

Fig 2.8 Airport Shuttle Bus

2.3 Railway Service

At present, urban railway services are operated by Myanmar Railway, with a total network length of 82 km and 46 stations. The characteristics of the main lines include the following:

(a) Circular Line:

This line is operated in two sections, the western section from Yangon central to Da Nyin Gone via Insein, clockwise direction (20.3 km and 21 stations) and the eastern section which runs from Yangon central to Da Nyin Gone (counter clockwise direction) via the western side of the Circular Railway Line, which has 25.8 km and 17 stations.

(b) Pyay Line:

This stretches from north of Da Nyin Gone to Hmawbi, a 26.5-km section with six stations and a 3.0-km spur which serves the Computer University of Yangon.

(c) Yangon–Mandalay Line Section in Yangon Area:

This is part of the north–south main line section from Yangon to Mandalay. The section from Yangon central to Dabein is a 36.0-km section with seven stations and a 6.4-km spur which serves the Dagon University in northeast Yangon.

(d) Thilawa Line:

This is a 26.7-km branch line to the industrial area in southeast Yangon and has five stations and a 5.0-km spur which serves the East University of Yangon. At present, existing railway lines exclude intercity services and carry approximately 80,000 passengers daily.

Table 2.6: Existing Urban Railway Lines in Yangon

Type	Line Name	Section	Length (Km)	Number of Stations
Main Line	Circular Railway	Entire Loos	46	38
Branch Line	Thilawa	Toe Gaung Galay-Okhposu- Thilawa	26.7	5
	East Dagon University	Okhposu- Eastern University	5.0	1
	Dagon University	Toe Kyaung Ka Lay- Dagon University	6.4	1
	Computer University	Hlawga - Computer University	3	1

Ref: UTRA Report

Daily peak hours are 07:00–09:00 in the morning and 17:00– 18:00 in the evening. There is a 15 minute interval during peak hours for daily commuting trips on the Circular Railway. About 42% (AM) and 36% (PM) of railway passengers use the service for home-work trips. Access to stations is via a narrow street. The station itself is powerless; the site is in a poor neighbourhood. The railway tracks are between two platforms without an over- or under-pass. Users are forced to cross the railway tracks and walk up to the platform. This is particularly difficult for women, the elderly, and the disabled.

There are 25 level crossings along the circular railway line. Many of the level crossings connected to roads cause traffic congestion (e.g., Parami Road, Main Road No. 4, Bayint Naung Road, etc). Under the Yangon Urban Development Plan, and with the assistance of the JICA loan project, 12 level crossings will be upgraded by removing bottlenecks. This project intends to improve the signal system, introduce a new diesel/electric multiple unit (DEMU), improve the platforms, and rehabilitate the track and civil structure. The project is expected to increase transport capacities to 300,000 passengers or more a day and be completed by 2021.

Fig 2.9 Yangon Circular Railway and Station

Fig 2.10: Circular Railway Line and Branch Line

Ref: UTRA Report

2.4 Taxi Service

The total number of registered taxis increased by more than 3 times from 2011 to 2017. Following the Government of Myanmar's chang to the vehicle import policy in 2013, the number of taxis increased rapidly. Currently, the total number of taxis in Yangon stands at over 70,000.

Table 2.7: Number of Taxi in Yangon

2011	2012	2013	2014	2015	2016	2017
24288	31931	46460	55000	60522	68731	Over 70,000

Ref: UTRA Report

Taxi fares are a lump sum based on the negotiation. According to the drivers, taxi fares will vary depending on the congestion. The fare rate is assumed to be a commodity charge, with shorter trips garnering a higher fare rate.

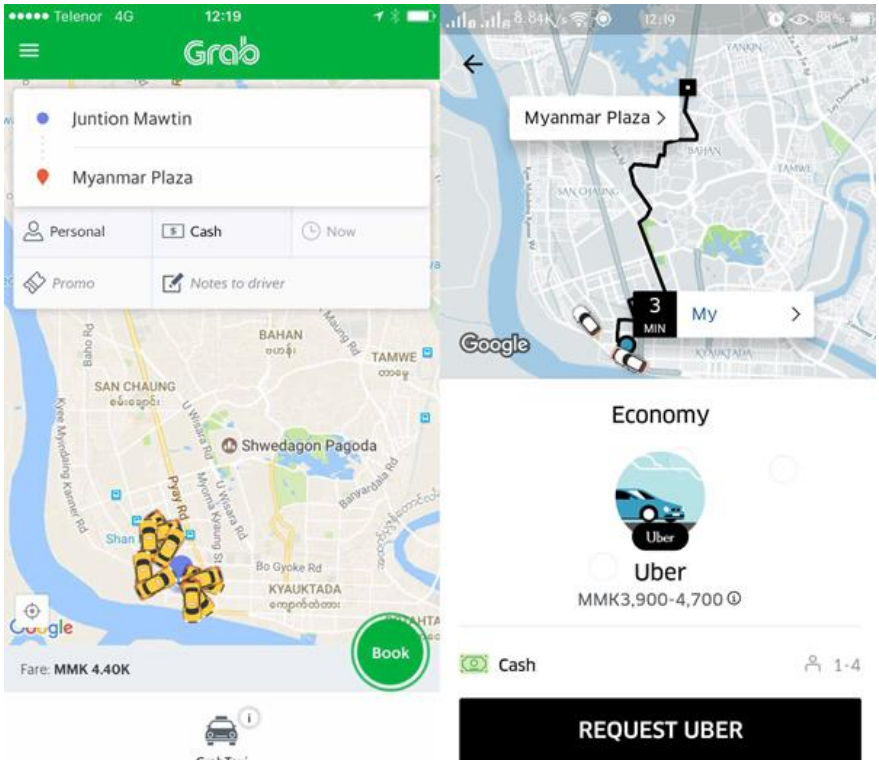
Table 2.8: Taxi Fare in Yangon

2km	3km	4km	5km	6-8km	9-12km	13-15km
1500	2000	2500	3000	3500	4500	5500

Ref: UTRA Report

Mobile application-based taxi services have grown in use in Yangon. Hello Cab and Oway Ride, introduced in 2016, are the local service providers. Foreign services, including Grab (Singapore based) and Uber (US based), expanded into Myanmar in 2017.

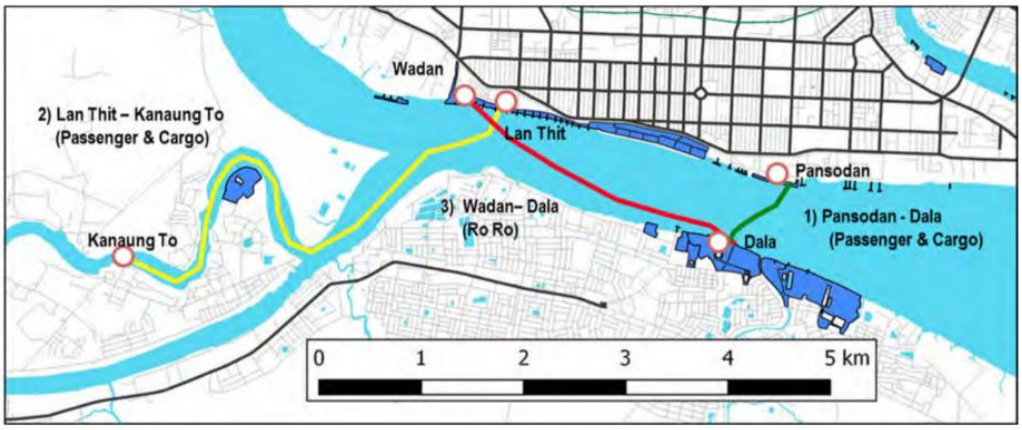
Fig 2.11: Online booking Taxi Services



2.5 Ferry Service

There are three major water transport routes in Yangon. These routes connect Yangon and the opposite side of the river, as shown in Figure 2.12. Table 2.9 shows the three existing routes and Figure 2.13 shows the present condition of the jetties and ships that operate in these routes. In addition to these routes, small boats at Yangon Port provide a daily service for commuting passengers.

Fig 2.12: Ferry Service in Yangon City *Ref: YUTRA Report*



Source: Study Team

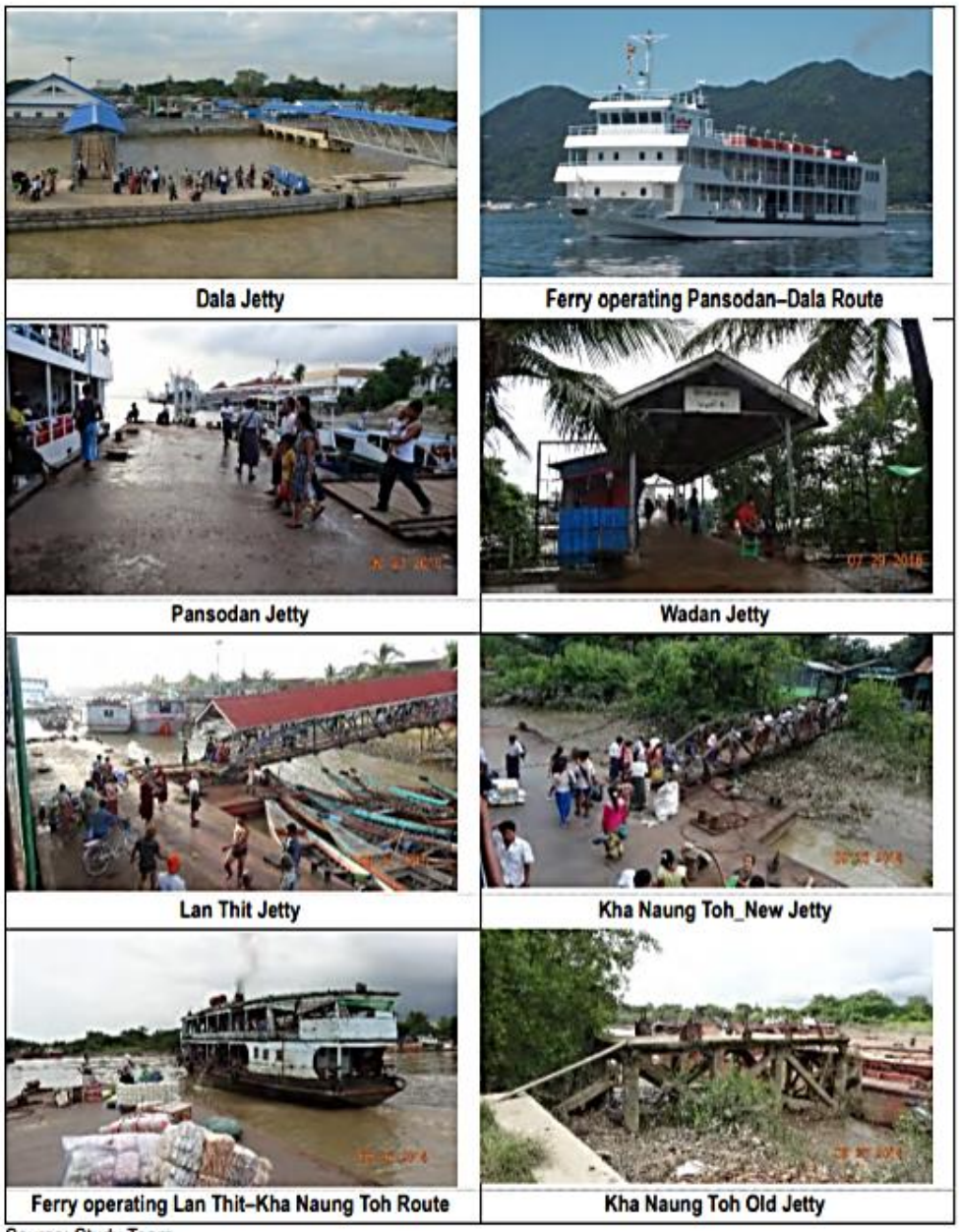
Table 2.9 indicates the number of passengers and ferry fare per head in recent years, operated by Irrawaddy Water Transport (IWT) and under the Ministry of Transport and Communication (MOTC). Of the number of passengers, around 90 per cent are comprised of passengers from Pansodan to Dala. The total is in the range of 0.8 million to 1.0 million, illustrating a stable demand.

Table 2.9: Ferry service in Yangon City to Dala and Khanaung Toh Regions

Route Name	Ship Type	Ferry	
Pansodan to Dala	Route Distance(km)	1	First service starts at 5:30 AM and last service 21:30
	Schedule	46 services/day (one-way trip)	
		From Pansodan	
		From Dala	First service starts at 5:00 AM and last service 21:00
	Number of Passenger	Average per month	816,014
		Average per service	295
		Total passenger per year	9,792,173
	Fare (Kyat)	Per passenger	100 Kyat
Wadan to Dala	Ship Type	Ferry	
	Route Distance(km)	2	
	Schedule	10 services/day(one way trip)	
		From Wadan	First service start at 7:00 AM and last service 18:30
		From Dala	First service start at 6:30 AM and last service 18:00
	Number of Passenger	Average per month	8,519
		Average per service	15
		Total passenger per year	102,226
	Fare (Myanmar Kyat)	Per passenger	100 Kyat

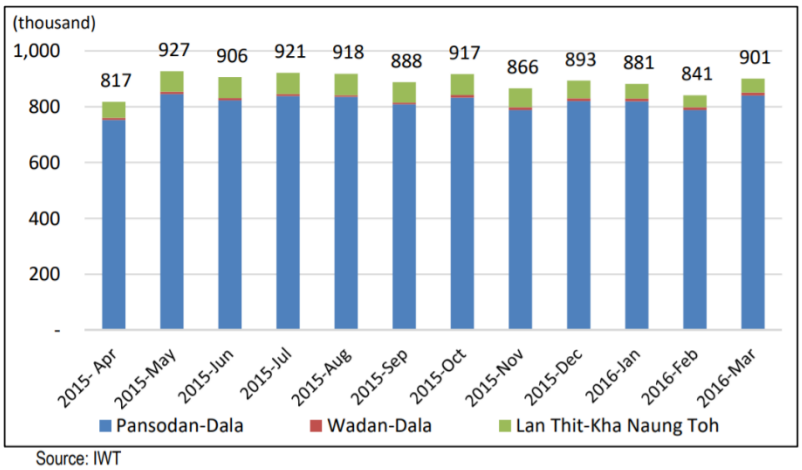
Lanthit to Kha Naung Toh	Ship Type	Ferry	
	Route Distance(km)	6	
	Schedule	8 services/day(one way trip)	
		From Lanthit	First service start at 5:30 AM and last service 17:30
		From Kha Naung Toh	First service start at 6:00 AM and last service 18:20
	Number of Passenger	Average per month	65,232
		Average per service	135
		Total passenger per year	782,778
	Fare (Myanmar Kyat)	Per passenger	200 Kyat

Fig 2.13: Current Ferry Services and Jetties iin Yangon City



Source: Study Team

Fig 2.14: Ferry Passenger by Jetties in Year 2015 -2016



Source: IWT

2.6 Water Bus Transport Service

In October 2017, the first phase of Yangon Water Bus commenced operations between Insein and Bothtaung (Figure 2.15). In June 2018, a plan to begin operating the second phase (Botahtaung to North Dagon) and third phases (Botahtaung to Thanlyin) by 2018 was established. The operation of the first phase planned to target about 20,000 daily commuters with a 20-minute frequency from 6 am to 6:30 pm. The company has amended the schedule several times and reduced the frequency of service to meet commuter demand.

Fig 2.15: Yangon Water Bus Service *Source: YUTRA Report*

Source: YRTA

Source: Study Team

2.7 Technical issues in Yangon's Water Transport Service

Monkey Point, where three rivers meet at a cross-junction, is an especially dangerous area. In 1986, a capsized accident involving Tine Lone Kyaw occurred as a result of strong winds during the monsoon. Such an accident highlights the importance of designing a suitable route and finding a location that takes into account the natural conditions of each river, including the water depth, current, wind, and river water flow rate. The current speeds of existing deteriorated ships were adopted to calculate travel times via water transport. Future travel times were estimated using high-performance vessels. Based on the results obtained from these calculations, it was concluded that high-performance vessels (such as speed boats for passenger transport and tugs with marine engines for cargo transport) should be introduced to shorten operating time.

Table 2.10: Travel Time Comparison of Transport Modes *Unit- Hour*

	Taxi	Bus	Railway	Water Bus
Pansodan to Hlaing Tharyar	1.25-1.75	1.5-2.0	1.5	1.0-2.5
Pansodan to Thanlyin	1-1.5	1.0-1.5	1.0	0.8-1.5
Nyaung Tan to Dagon	1.0-1.5	1.0-1.5	1.5	1.2-3.0

Table 2.11: Fare Comparison of Transport Modes *Unit- Kyat*

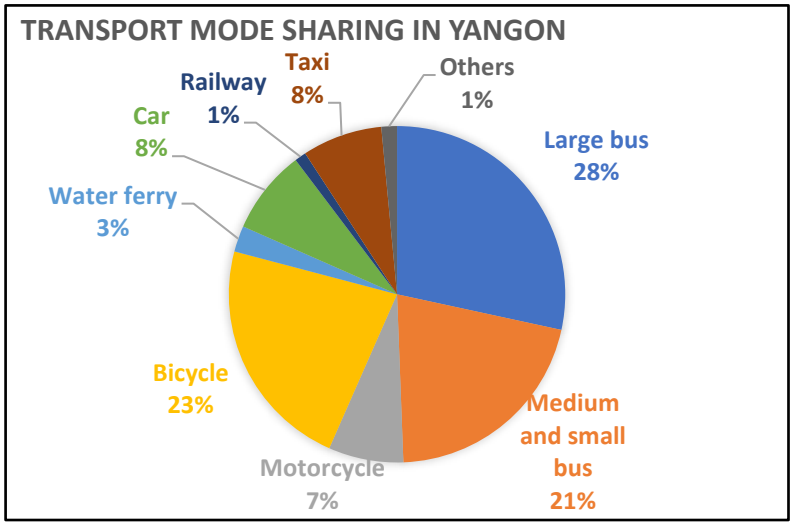
	Taxi	Bus	Railway	Water Bus
Pansodan to Hlaing Tharyar	5000-10000	300-500	100-300	400
Pansodan to Thanlyin	6000-8000	300-500	100-300	250
Nyaung Tan to Dagon	5000-8000	300-500	200-500	550

Table 2.10 and 2.11 indicate the estimated travel time and fares for passengers on various modes. To provide a competitive fare for water transport, it is necessary to set it at the same level as existing transport modes, such as the public bus.

2.8 Transport Mode Share

The average number of trips per person per day in Yangon is estimated to be 2.042. This figure takes into account all trips but excludes walking (JICA 2014). According to YUTRA, the average trip rate in most Asian cities ranges from 2.0 to 2.5, which suggests that mobility in Yangon remains on the lower end of the spectrum. Buses, branded under the Yangon Bus Service System Scheme, account for around half of the total trips (excluding walking) by modal share in Yangon (Figure 2.16).

Fig 2.16: Urban Transport Mode Share of Yangon in 2014



Ref: YUTRA 2019

2.9 Current Transport Issue

Public bus is the most popular transport mode in Yangon (Fig 2.16). The lower fares offered by the bus and railway make them accessible for daily use by most commuters. The majority of users prefer the bus to the railway, as the bus service offers a more frequent, reliable, convenient and higher quality service.

The main causes of traffic congestion in the Inner Urban Ring and CBD area include the following:

(i) Lack of traffic management at bottlenecks, such as schools and shopping centres; illegal on street parking by taxis; and the presence of roadside vendors.
(ii) Increasing number of private cars.
(iii) Excessive, disorderly, and illegal roadside parking, including on street parking.
(iv) Poor driving manners.
(v) Uncoordinated traffic signal cycle times; lack of traffic flow control at intersections, both for vehicles and pedestrians.
(vi) Picking up/ dropping off of passengers by buses and taxis disturbs traffic flow on streets.
(vii) Poor walking environments and jaywalking, with a lack of investment in pedestrian facilities.
(viii) No separate bicycle lanes, leading to clashes with motor vehicle lanes.
(ix) Lack of large-truck traffic management.
(x) Lack of enforcement capacity.
(xi) Unclear policies for on street car parking.

CHAPTER 3: DATA COLLECTION APPROACH FOR SUTI

3.1 Introduction

The Sustainable Urban Transport Indicator (SUTI) is a quantitative tool for member states and cities of the Asia-Pacific region to compare their performance on sustainable urban transport systems and policies with peers. The tool helps to identify additional policies and strategies required to improve the urban transportation systems and services. It includes ten indicators in system, economic environmental and social domains. The results from SUTI will go towards assessing the transport sector's contribution towards the Sustainable Development Golds (SDGs). The ten SUTI indicators are shown in Table 3.1.

Table 3.1. The ten SUTI indicators

Indicators	Description
1	Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes
2	Modal share of active and public transport in commuting
3	Convenient access to public transport service
4	Public transport quality and reliability
5	Traffic fatalities per 100,000 inhabitants
6	Affordability – travel costs as share of income
7	Operational costs of the public transport system
8	Investment in public transportation systems
9	Air quality (pm10)
10	Greenhouse gas emissions from transport

3.2 Data collection approach for different indicators

Indicator 1

Indicator 1 was analysed based on the most recent transport plans which cover public transport, intermodal facilities and infrastructure for active modes. Urban planning in Yangon has largely followed a report issued by YUTRA in 2019. The Yangon Regional Transport Authority (YRTA) recently pioneered a pilot project for the city's public buses which involved replacing cash fares with a prepaid card system Between 2019-2020, Yangon City Development Committee (YCDC) Road and Bridge authorities constructed a new flyover and overhead pedestrian bridge with escalators. In addition, UN Habitat facilitated improvements for pedestrian travel on Seikkanthar Road (Myoe Lan Thar), Pansodan Road and Kyun Taw Road, with further projects in the pipeline.

Indicator 2

Data was collected based on a YUTRA study report in 2019 which investigated the travel mode share of active and public transport commuting trips in Yangon city. The average number of trips per person per day in Yangon is estimated at 2.042 (JICA 2014).

Indicator 3

Convenient access to public transport services is based on an estimation of the number of inhabitants living within 500-meter buffer zones around stations and bus stops. Moreover, trains and buses must be within a 20 minute or more scheduled service interval. Site visits to relevant stations and bus stops were carried out along the north to south, east to west public transport railway and bus routes. Population density was calculated based on a national census in 2014.

Indicator 4

440 responses were collected through a satisfaction survey and questionnaire distributed to railway and bus users in July 2020.

Indicator 5

Data from traffic accident reports in 2019 were retrieved from Yangon City Traffic Police Department and Yangon Regional Government.

Indicator 6

To calculate the monthly travel cost as a share of income in Yangon city, the rate of a monthly public bus ticket was taken out of the average monthly income of Yangon professional citizen.

Indicator 7

The fare box ratio indicator, collected from The World Bank Urban Transport in Yangon and Mandalay Report, was used to calculate operational revenue and operation costs.

Indicator 8

The World Bank Urban Transport in Yangon and Mandalay Report, together with information obtained from the Yangon Regional Transport Authority, was used to calculate recent investments in Yangon's public transportation system.

Indicator 9

Air quality is continuously monitored by a monitoring station in Yangon city and is controlled by the Environmental and Cleansing Authority. YCDC provided the necessary air quality records.

Indicator 10

Myanmar Oil and Gas Enterprise provided data regarding yearly petrol, diesel and CNG for Yangon city.

CHAPTER 4: ANALYSIS OF DATA

This following chapter offers a discussion of the data analysis obtained by the 10 SUTI indicators.

4.1 Indicator 1: Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes

Yangon city's urban transport modes include bus, railway and taxi, and private car. Before 2012, under the conventional car import policy, Yangon city's urban transport sector was relatively evenly balanced between motorised and non-motorised vehicles. Trishaw, walking, railway, taxi, private car and bus helped to balance a car population that remained under 150,000 in Yangon city. Pedestrian users were able to use the wide platform, cycling users shared routes with moving motorised vehicles, and there was enough car parking space - even in Yangon's Central Business District. However, after 2012, in part due to the new car import policy, Yangon city's car population underwent exponential growth. Numerous changes were observed. Roadside car parking orientation changed from parallel orientation to perpendicular parking to the road kerb, obstructing the pedestrian facilities on the platform with parked cars. Pedestrian users were forced onto the road due to lack of space on the platform. Roadside car parking, illegal car stopping and buses stopping in middle lanes for boarding and alighting purposes added to the challenges. Moreover, the introduction of a brand-new bus service with air conditioning, and more frequent bus schedules, led many users to switch from bicycle to bus as their regular transport mode of choice. Railway users also switched to the bus service, deterred by the inconvenience of the railway stations, with their poor access and connectivity. As a result, bus service has become the dominant transport mode in Yangon City.

4.1.1 Data Analysis

The indicators incorporate the following four aspects:

1. Walking
2. Cycling
3. Intermodal Transfer Facilities
4. Public Transport.

To analyse these four aspects, three additional factors have to be considered:

I, Each aspect must have clear goals and a vision

Ii, Each plan must have designated infrastructure and facilities in its plan

Iii, All facilities require a breakdown of funding and budget

Both YUTRA's final report (2019) and the Strategic Urban Development Plan of Greater Yangon (JICA 2013) prioritise these aspects as part of their assessment of the public transport system in Yangon. The Traffic and Transport Study for the Development of New Yangon City's Master Plan (2019) outlined an Urban Transport Planning of the new Yangon city area to include the Tuntay and Dala regions. Two new river cross bridges are now under construction. The plan is to serve daily commuters on Yangon Thanlyin Bridge Number 3 and Yangon Dala Bridge, linking the CBD and new Yangon City to the developing southern area.

The connection between the CBD, Yangon Airport and Mandalay express way, known as the Yangon Elevated Expressway (YEX) PPP, is in its first phase. Yangon Regional Government set the deadline for resettlement claims and other compensation as 6th May 2019. Yangon Urban Mass Rapid Train UMRT 2 routes, which start from Hlaing Thar Yar to North Dagon Myothit along the Parami Road connection network.

The UK Foreign and Commonwealth Development Office (UK FCDO) and the United Nations Human Settlements Programme (UN Habitat) have collaborated with Prosperity Fund's Global Future Cities Programme (GFCP) to improve walking facilities in Yangon city. Their aim is to support a range of transformative urban interventions in cities in emerging economies. The objective of the GFCP is to develop projects in the fields of urban planning, resilience and transport towards sustainable, inclusive prosperity. An improvement project at Seikkanthar Road in Kyauktada township was completed in 2019 and two additional projects at Pansodan Road in Kyauktada township and Kyuntaw Road in Sanchaung township are in the planning stage.

The Road and Bridge Authority of YCDC currently manages an urban walkway rehabilitation programme. The programme includes Kan Yeik Thar Road in Bahan township, U Wisara Road in Sanchaung township, Kabaraye Pagoda Road in front of Myanmar Plaza, Bahan township, Anawhtayata Road in Latha township and Shwe Dagon Pagoda Road. There are also plans to improve traffic flow with an underpass pedestrian improvement program and shopping centre at Pyay Road, near the Grand Guardian Life Insurance Building. YCDC has improved pedestrian facilities and road user safety with pedestrian bridges in the CBD and other highly populated areas. This includes pedestrian bridges at Insein Road and Pyay Road, Kamaryut Township, Pyay road in Mingalardone township, Kannar Road in Lanmadaw Township and Kannar and Pansodan Junction at Kyauktada township, Sulay Pagoda Road and Anawyahta Road intersection in Kyauktada township, Hledan road and Bayint Naung road intersection in Kamaryut township and Yamonar Road in Dawpon township.

4.1.2 Scoring procedure

After identifying the different plans, a review was conducted by a panel of experts. The panel revised and scored the aspects under the provided guidelines by UN ESCAP. In the following table, the marking on these four aspects and an explanation are provided:

Table4.1. Scoring Analysis for Indicator 1

Aspects	Explanation	Score
Walking Networks	- YCDC & UN Habitat are conducting pedestrian walkway improvements - YCDC is managing pedestrian rehabilitation / walkway facilities improvement - Yangon Regional government is planning and implementing overpass bridges and underpass pedestrian ways to improve road user safety	2
Cycling Networks	- YCDC & UN Habitat are conducting cycling ways in the CBD, one project has been implemented - YCDC implements bicycle lanes with road marking along the Waizayanda Road - There is an unclear vision/goals for a cycling **network** - There is no specific budget	1

Intermodal Transfer Facilities	- Little designation for transfer facilities at airport, high way terminals, highway vehicle gates and railway stations - Unclear budget and ongoing feasibility study for highway terminal transit facilities and improvement - Future planning for TOD development at YUTRA report	1
Public Transport	- Ambitious goals are set. Yangon city area will be extended and future YEX Phase 1 and 2, UMRT 1 & 2, Transport Demand Management, Improvement of existing circular railway line in 2020. - Plan for construction of outer ring road (No. 7 Main Road, from Thilawa to Mandalay Expressway)	3

Table 4.2: Final analysis result for Indicator 1

Indicator	Value	Year	Comments
Same score value to enter in data sheet for indicator 1	7	2019	Score is based on current ongoing projects and planning of YRG YUTRA report

4.1.3 Conclusion

The above scores are based on an ongoing project under the Yangon Regional Government and UTRA report for future urban transport guidelines. For the future urban transport network, the measures require the following improvements:

- Clear and safe walk way strategy without obstruction/parked cars
- Numbered street and named roads in CBD
- On street car parking without obstruction of pedestrian path.
- Introduction of a bicycle lane network along arteria roads and commuting roads to increase bicycle users
- Under pass and underground car parking should be provided in the CBD area to improve traffic flow, to increase off street car parking facilities and pedestrian facilities
- Transit Oriented Development (TOD) and J walk connection scheme to commercial / business area should be implemented.
- Improve facilities of Circular Railway Stations to change commuters' mode choice preference to mass rapid transport system.

4.2 Indicator 2: Modal share of active and public transport in commuting

As an emerging megacity of a developing country, Yangon city should focus on making its transportation system more sustainable. Various projects to make the road transport system efficient and faster are in the implementation phase, but the projects and policies tend to neglect the sustainable issue. This degrades the conditions for walking and cycling. Yangon city is moving towards

a public transport-based city. However, the overall efficiency of Yangon's public transport system needs improving. SUTI, Indicator 2 is defined by the percentage of modal share of public and active (bicycle and walking) transports. This section covers the data analysis, interpretation and measures to improve the public and active transport mode share.

4.2.1 Data analysis

The estimated travel demand for 2016 was calculated from UTRA report. The number of trips by walk, bicycle, motorcycle (outer ring roads), car, taxi and public transport (bus + railway) are analysed in this indicator. All the modes were categorised into three sections, as defined in the SUTI guideline by UN ESCAP. Walking and cycling were considered as active transport. Private cars, taxi, motor cycle and 4-wheel drives were categorised as motorised transport. The percentage of modal share was calculated from the grand total of all categories. The population in the urban area is 5065534 across 33 townships.

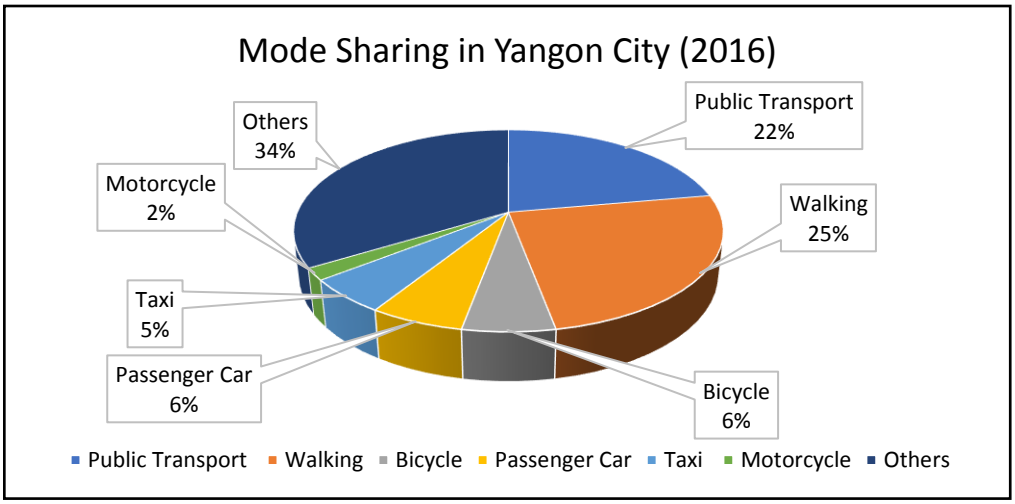
Table 4.3: Mode share of active and public transport in Yangon

Mode	Number of Trip	Percentage
a. Scheduled bus & mini bus		
b. Circular Railway		
c. Public Transport	4132000	0.82
d. Walking	4624000	
e. Bicycle	1091000	
f. Active Transport	5715000	1.13
g. Passenger car	1118000	
h. Taxi	1019000	
i. Motorcycle	357000	
j. 4+ Wheel modes	6269000	
k. Individual motorized	8763000	1.73
l. Total	18610000	3.67
m. Public and active	9847000	1.94
n. Modal share of active and public transport		**52.9%**

Table 4.4: Final result for indicator 2

Indicator	Value	Year	Comments
Mode share of active and public transport trips in commuting (%)	52.9	2016	Data is based on UTRA report study team 8-1

Fig 4.1 Yangon Transport Mode Sharing (2016)



The results show that the people of Yangon city depend on public transport due to its affordable fares. The share of walking is 25% and bicycle 6%, which indicates that people prefer to use active transport mode to balance their financial constraints and avoid the traffic congestion in peak hours. Motorcycles are a restricted transport mode in Yangon city area but their use is allowed in new satellite towns including: North Dagon, South Dagon, Dagon Seikkan, Shwe Pyi Thar, Thanlyin and Hlaing Tharyar.

4.2.2 Conclusion

Due to the modal split in Yangon city, bus demands a higher share in comparison to railway transport mode. Bicycle mode share is the third largest demand and indicates that people prefer to use active transport mode in their daily commuting trip. To integrate the system, the railway service must improve its frequency, punctuality, safety, hygiene, and access. Station environments must be clean and display digital information signage. Overheard bridges or crossings should be built for passengers. Toilets and ticket counters will also make the railway a more attractive transport mode.

4.3 Indicator 3: Convenient access to public transport services

Population size and other socioeconomic features inevitably change in line with changes to land use. Transport terminals should be built to complement these changes. The CBD is located in the south of Yangon city, and is the base for most government offices, International Port, business and commercial activities, hotels and the central railway station. Commuters reach the CBD from the north, east and west for work, school, recreation, business and shopping, with many using the bus, railway, taxi and private car road transport modes. Due to fare constraints, bus and railway mode sharing is higher than other transport modes. The Yangon Circular Railway line, the north to south arteria roads, and east to west arteria roads are important access routes to the CBD. Commuting figures and population density provide key data for Indicator 3, which reflects the percentage of people with proper accessibility to public transport in Yangon city.

4.3.1 Data Analysis

The Circular Railway route plays a key role in serving many of Yangon's townships. North to south and east to west arteria roads also pass through the same townships. An urban road network is defined as a system connecting local streets to secondary roads, and eventually the national highway. All bus routes in Yangon operate on primary roads with nearly 500-meter distance interval bus stops. Bus commuters can access the nearest bus stop within 20 minutes for each township. Circular railway stations are located in the Myanmar Mee Yahta Area but there remains a key challenge in narrow access to the stations. A relatively small proportion of passengers use the railway for their business purpose. Data for daily commuter riding routes and population density were collected and calculated in Table 4.5.

Table 4.5: Selected Township Data within 500m Buffer Zone of Commuting Trips

Township	**Coverage area within a radius of 500m (km2)**	**Pop. Density(inh/km2)**	**Inhabitants**
Mingalardone	128	2582	330496
Insein	29.8	10233	304943.4
North Okkalarpa	27.7	12026	333120.2
South Okkalar	8.21	19635	161203.4
Thinguangyun	13.1	15989	209455.9
Mayangone	27	7342	198234
Bahan	8.46	11430	96697.8
Yankin	4.78	14829	70882.62
Hlaing	10.2	15780	160956
Kamaryut	6.46	13087	84542.02
Kyeemyindaing	4.45	25062	111525.9
Ahlone	3.37	16443	55412.91
Lanmadaw	1.31	36041	47213.71
Pabedan	.617	54012	33325.40
Kyauktada	.701	42568	29840.17
Pazundaung	1.07	45459	48641.13
Mingalar Taung Nyunt	4.94	26846	132619.24
Tarmwe	4.98	33209	165380.82
Tharketa	13.4	16424	220081.6
Daw Pon	3.11	24241	75389.51
San Chaung	2.4	41501	99602.4
Dagon	4.89	5131	25090.59
Latha	.603	41526	25040.18
			3019695
		Total Population	5065534
		% within 500m buffers	**59.61**

Data Ref: https://www.citypopulation.de/php/myanmar-admin.php

Table 4.6: Final value for indicator 3.

Indicator	**Value**	**Year**	**Comments**
Convenient access to public transport services	59.61	2019	The data based on 2014 population census in areas within 500m access of main roads and circle railway line

4.3.2 Conclusion

Indicator 3 reveals that 60 percent of people have good accessibility to public transport in the region of North - South, East - West daily commuting area across 23 townships. New satellite towns (Hlaing Tharyar 1 &2, Shwe Pyi Tha, North Dagon, South Dagon) were left out of the analysis and will require access to the transport network. It will be key to improve access in order to meet the transport demands of Yangon's growing population size, and plans should be implemented according to the UTRA Study Report (2035).

4.4 Indicator 4: Public transport quality and reliability

Reliability and quality are two important factors for daily commuters. A reliable public transport service is one that adheres to a schedule, with vehicles that run on time together with proper information regarding routes, fare levels and frequency of buses. At the same time, quality can be ensured through providing safety, comfort, cleanliness and trained service operators. SUTI Indicator 4 provides information regarding reliability and quality through the following aspects: frequency of buses, punctuality, comfort and cleanliness, safety of vehicles, convenient location of bus stops, information availability, personal courtesy and fare level. The percentage of commuter satisfaction regarding these aspects would provide an overview of reliability and quality of public transports in Yangon city.

4.4.1 Data analysis

The data for this indicator was collected through a field survey. The survey was conducted at bus stops and railway stations in the downtown area. Public transport users were asked to answer a survey. Out of the 420 passengers interviewed, 277 were female and 143 were male.

Fig 4.2: Survey Responses: Respondent Occupation

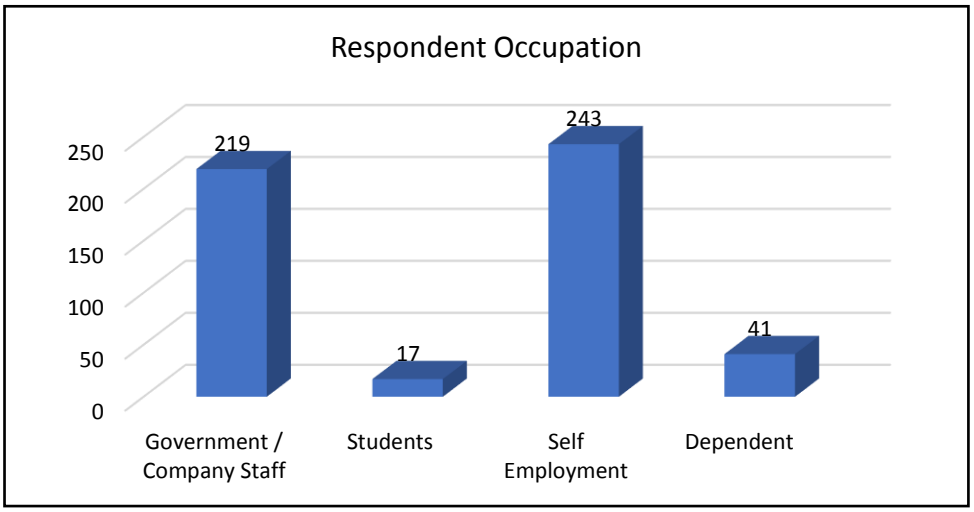
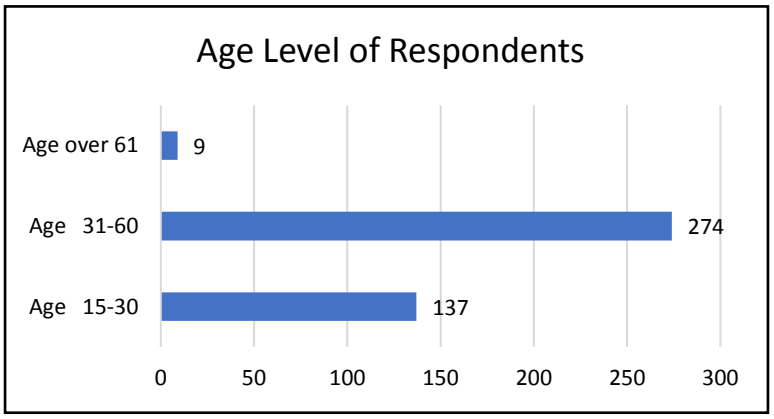


Table 4.7: Calculation of 8 aspects representing transport quality and reliability

Dimension	Dissatisfied			Neutral	Satisfied			Resp	Av Score	Percentage of Satisfaction
	Very		Partly		Partly		Very			
	1	2	3	4	5	6	7			
Frequency of Service	17	52	40	15	124	166	6	420	4.20	70.48
Punctuality	15	56	24	14	122	179	10	420	4.62	74.05
Comfort & Cleanliness	11	73	41	12	124	150	9	420	4.75	67.38
Safety of Vehicles	24	34	83	29	105	135	10	420	3.38	59.52
Convenience of Information	11	65	20	13	128	169	14	420	4.91	74.05
Availability of Information	5	68	8	73	116	146	4	420	4.54	63.33
Personal Courtesy	24	53	78	19	95	140	11	420	2.54	58.57
Fare level	0	4	1	8	249	103	55	420	5.77	96.90
Total	107	405	295	183	1063	1188	119	3360	4.34	70.54

Fig 4.3: Age Level of Respondents



The data shows that personal courtesy receives the lowest satisfaction level at 58 percent. People feel generally satisfied about public transport services and fare levels. To provide a brief comparison point, the cost of a fare to Insein Township, about 23 kilometres from the CBD, is about 200 kyats (0.15 USD) by bus and (up on negotiation) about 9000 kyats (6.7 USD) for a Taxi. The Taxi should be shorter than the bus service by about 20 minutes. Most therefore choose the bus service for regular and non-emergency journeys.

Table 4.8: Final result of indicator 4

Indicator	Value	Year	Comments
Public transport quality and reliability	70.54	2020	Base on satisfaction survey on Inner ring and outer ring area bus and railway service

4.4.2 Conclusion

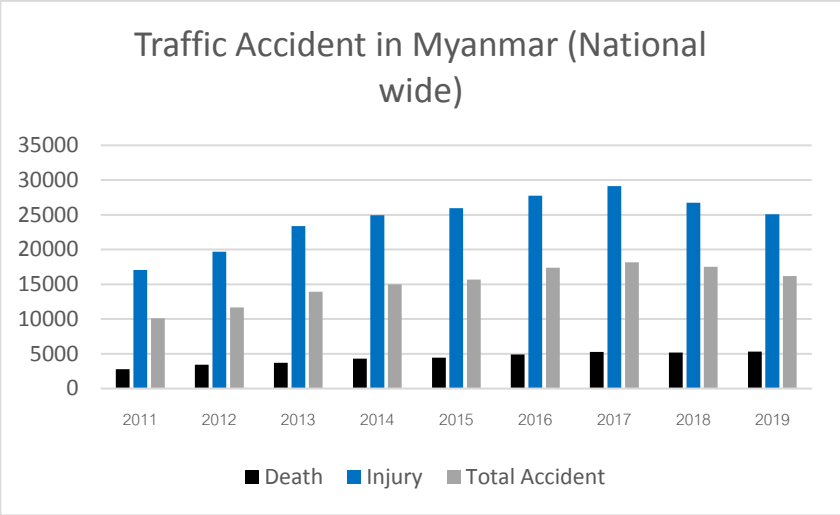
Based on the above result, public transport users overall feel satisfied with the quality and reliability of the system. Passenger safety and bus driver behaviour should be improved in future by the following measures:

- Prevent passengers from boarding and alighting in the middle lane of primary roads (safety and bottleneck issue).
- Manage driver behaviour (improve the manners and attitudes)

4.5.1 Data collection and processing

The National Road Safety Council (NRSC) issued a report including nationwide traffic accident data on 1st February 2020 using traffic accident data from Yangon Traffic Police Department from 2019.

Fig 4.4: National wide traffic accidents in Myanmar.



Nationwide road accidents increased to the highest rate in 2017. The fatality rate was highest in 2019 (Fig 4.4). Most of accidents were caused by poor driving, drivers with no driving license, and driving over the speed limit.

Fig 4.5: Root causes of traffic accidents

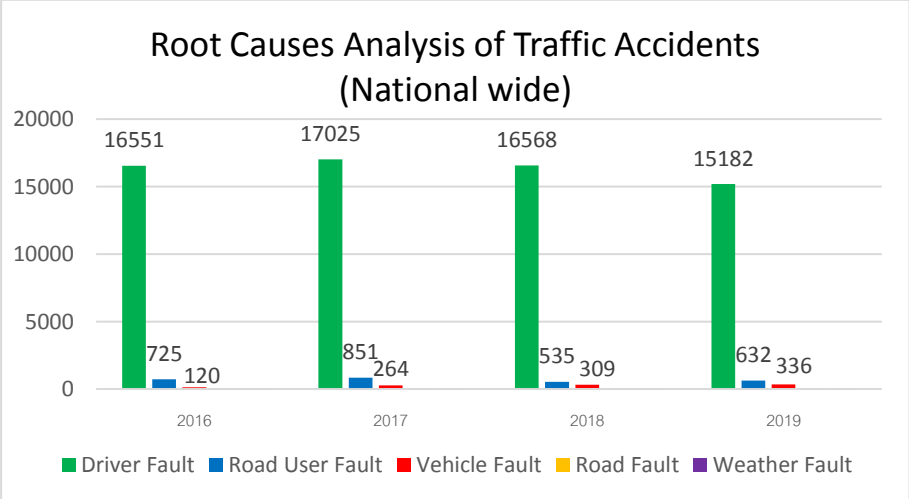


Fig 4.6: Yangon City's Traffic Accidents (Yearly)

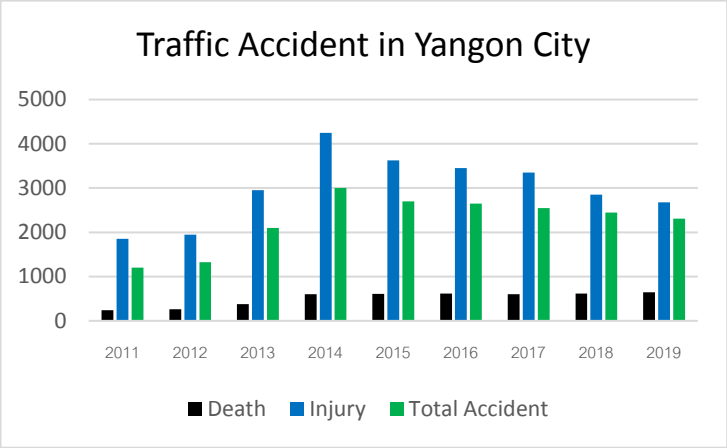


Fig 4.7: Yangon City Traffic Accidents (Monthly @ 2019)

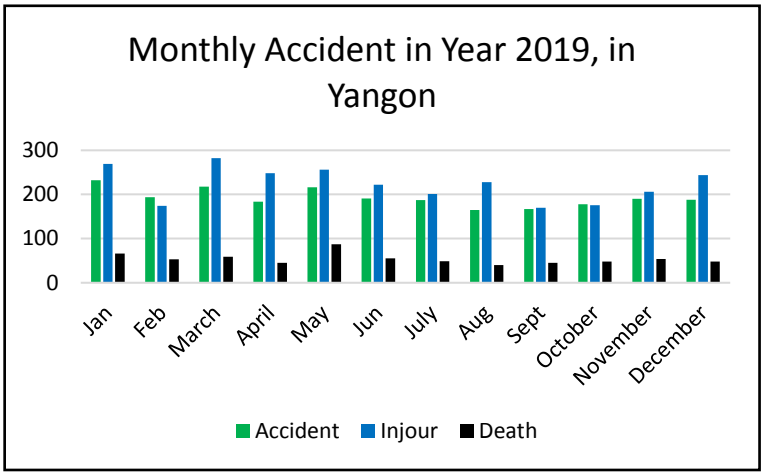
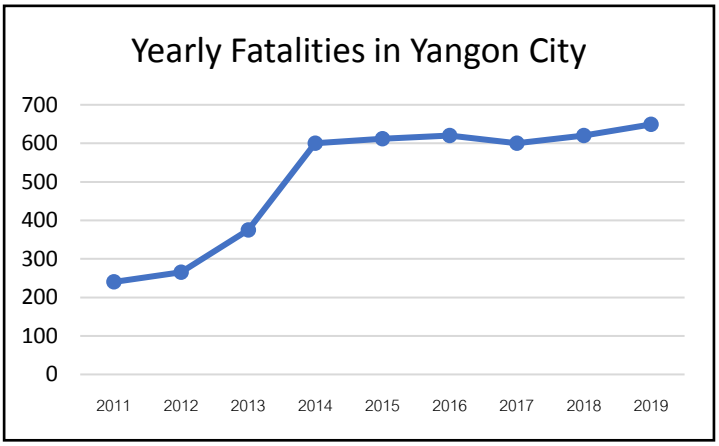


Fig 4.8: Yearly fatalities by traffic accidents

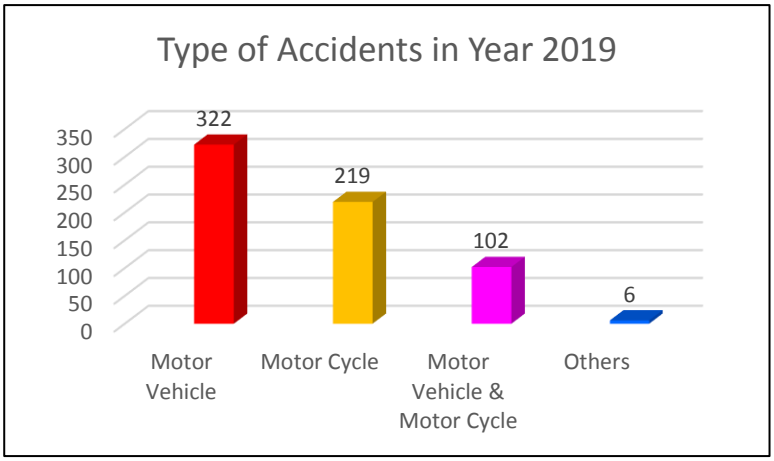


4.5.2 Data Analysis

Table 4.9: 2019 Monthly Accidents in Yangon

Month in 2019	Accident	Injury	Death
Jan	232	269	66
Feb	194	174	53
March	218	282	59
April	184	248	45
May	216	256	87
Jun	191	222	55
July	187	201	49
Aug	165	228	40
Sept	167	170	45
October	178	176	48
November	190	206	54
December	188	244	48
Total	**2310**	**2676**	**649**

Fig 4.9: Type of Traffic Accidents in Year 2019



The number of fatalities in 2019 was 649. 2676 were injured by 2310 traffic accidents in Yangon city. Of these fatalities, 322 were caused by motor vehicle accidents, 219 by motorcycle, 102 by mixed vehicles and 6 fatalities by other. The population of all 44 townships in the Yangon Regional Area is about 7,525,195. Both the population and fatality data were calculated using the following formula:

$$\text{Fatality Rate, } FR_i = \frac{F_i \times 100{,}000}{I_i}$$

Where

FR_i is the fatality rate per 100,000 inhabitants in year i

F_i is the number of total fatalities (for all modes) in years

I_i is the number of total inhabitants in year i

Calculation for Year 2019

No. of fatalities, F_{2019} = 649

Total inhabitants, I_{2019} = 7,525,195

$$\text{Traffic fatalities per 100,000 Inhabitants, } TF_{2019} = \frac{F_{2019} \times 100{,}000}{I_{2019}}$$

$$= (649 \times 100000)/ 7525195$$

$$= 8.62$$

The traffic accident fatalities per 100,000 inhabitants of Yangon city was 8.62 (Table 4.10).

Table 4.10: Final result for indicator 5.

Indicator	Value	Year	Comments
Traffic fatalities per 100,000 inhabitants	8.62	2019	Based on collected data from Yangon Traffic Police Department.

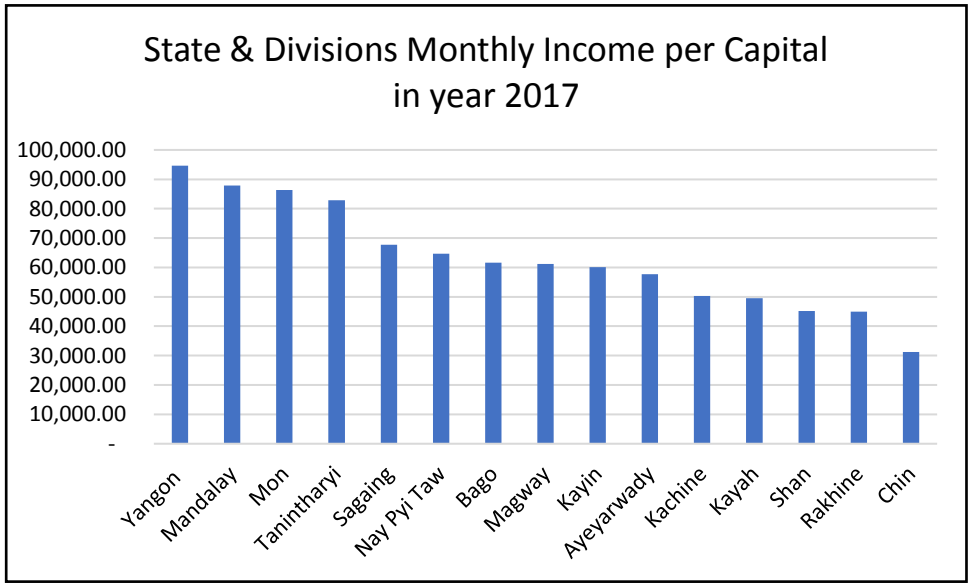
4.5. Conclusion

Data collected from Yangon city Traffic Police Department and National Road Safety Council was published in February 2020. The high level of traffic accident fatalities in either Yangon or Myanmar regional areas indicated a need to improve road safety, and the education and awareness of road safety. Only competent and skilled bus drivers should be employed and allowed to drive public buses. Bus driver behaviour must also be improved, and the method of payment onboard buses should be made more efficient for daily commuters.

4.6 Indicator 6: Affordability: travel costs as part of income

Measuring the affordability of a transport service's fare system is important when designing a strategic transport policy. In developing countries, it is important to monitor and understand public transport expenditure patterns because they help to develop the best travel strategies for low-income and mobility-constrained people. Notably, there was a government policy to move the administrative capital to Naypyitaw and make Yangon city the commercial hub of Myanmar.

Fig 4.10: National wide monthly income level in Year 2017 *(Currency = Kyat)*



The following table provides an overview of bus and railway fare levels in Yangon city:

Table 4.11: Bus & Railway Fare in Yangon

Mode	Minimum Fare level	Distance of route (km)
Railway	100 Kyat or .074 USD	23
Bus (Large Bus)	200 Kyat or .15 USD	23

1USD = 1350 Kyat

The average number of trips per person per day in Yangon is estimated as 2 (World Bank Urban Transport in Yangon Report). According to the report, the cost by bus of 2 trips is about 0.3 USD of an individual's daily expenses. For railway users, the cost is 4.5 USD for the user's monthly commuting trip. The Government of Myanmar issued an order for the standard daily wage to be set at 4800 Kyats (3.6 USD) in 2019. The basic level of monthly income for an individual is about 3.6 x 30 days (108 USD) in Yangon city.

Table 4.12: Calculated monthly transport and income

Description	Amount (USD)
Monthly Income for basic level	108
Monthly Transport Expense	9

The data represents the average wage level for the lower-income group, where public transport service expenditure is about 9 USD for monthly expenses. Monthly ridership for the bus service is about 56,396,640 passengers, and for the railway service it is about 3,300,000 passengers.

Table 4.13: Final result for indicator 6.

Indicator	Value	Year	Comments
Affordability travel cost as part of budget	8.1	2019	The result is based on fare and income level calculation (2019)

4.7 Indicator 7: Operational costs of the public transport system

Operating costs in the transportation sector include three major sections: running costs (fuel cost, driver wages and staff welfare), maintenance costs, and other fixed costs. Group travel, tour trips, and company trips allow for additional incomes. This indicator is defined by the percentage of operational costs covered by the fare and is usually termed as a fare box ratio.

4.7.1 Data analysis

Data was collected from World Bank staff based on interviews with bus operators (Urban Transport in Yangon & Mandalay, Report). One bus operator, who manages a fleet of about 340 commercially active buses, reported daily average ridership levels of around 450 passengers per bus per day, which is about 250,000 daily passenger trips for the company.

Table 4.14: Estimation of operational expenses

Description	Cost (Myanmar Kyat)/Bus/Day	% of Total
Fuel	15,000	19
Wages and stipend	26,000	32
YRTA fee	4,000	5
Company fee	2,000	2
Maintenance & Others	34,000	42
Total operating cost	81,000	

Table 4.15: Estimation of daily revenue

Description	Revenue (Myanmar Kyat)/Bus/Day
Average passengers per bus per day	450
Average fare	170
Total revenue per day	76500
Active fleet, 2019(Bus)	6550

Source: World Bank Report 2019

Table 4.16: Estimation of operation cost and expenses

Total Costs and Revenue	MMK, Day
Operating cost (Expenses)	530,550,000
Operating Revenue (Fare Revenue)	501,075,000

Source: World Bank Estimation 2019

Table4.17: Monthly and Daily Ridership

Description	City Bus	Minibus	Small Vehicles & Microbus	Total
Registered vehicles	4,758	1,253	539	6,550
Monthly operating vehicles	106,214	21,995	7,581	135,790
Daily operating vehicles	3,542	733	252	4,527
Average number of trips per month	385,579	81,704	27,848	495,131
Average ridership per month	54,166,651	11,073,108	156,920	65,396,697
Average ridership per day	1,505,555	369,103	5,230	1,879,888

Table 4.18: Final result of indicator 7.

Indicator	Value	Year	Comments
Operational cost of the transport system	94.44	2019	The data from World Bank Report for Urban Transport for Yangon & Mandalay, based on inter views with bus operators

Yangon Regional Transport Authority operates a daily transport service with 6550 registered buses and a daily active flee of about 4500 buses for the of Yangon city. Average ridership is about 1,880,000 passengers for daily commuting trips (Table 4.17). This was calculated as the ratio of farebox revenue to operating cost and the percentage of operating expenses of the system covered by the fare, which is likely to be above 1.1. This means that from each 100 Kyats collected from fare revenues, 110 Kyats are spent in operating expenses.

4.7.2 Conclusion

Yangon bus transport service is operated by Yangon Regional Transport Authority and the railway service is operated by the Ministry of Transport and Communication (MOTC) (Myanmar Railway). The Circular Railway's operational cost is born by MOTC and all of railway services use government resources. This means some analysis will be inaccurate due to invisible expenses and government fixed assets. For this reason, the railway service operational expenses and operational revenue have been omitted and the indicator value 94.44 for only the bus service calculation.

4.8 Indicator 8: Investment in public transportation systems

Investment in the transportation sector is key to urban mobility. Recent investments have been seen via changes to economic policy in Yangon city, future urban transport plans for UMRT lines, YEX 1&2 express ways, a BRT system, the improvement of circular railway projects, interest from foreign investors, oversees development aid, and loan projects targeted for 2035.

4.8.1 Data analysis

The indicator is derived from two basic datasets:

- Investment in public & active transport system and facilities within the last 5 years
- Investments in total transport sector (both public and private)

Table 4.19: Yearly Cost for Total Transport, Public Transport Facilities in Yangon.

Investment	2014/15	2015/16	2016/17	2017/18	Average
Public Transport Facilities	-	-	-	70	70
Total Transport Facilities	366.241	471.209	505.692	424.281	441.856

Ref by: World Bank Report, Urban Transport in Yangon & Mandalay *(Myanmar Kyats in Billions)*

The government has committed to reform the bus transport system. In January 2017 it initiated a restructuring of bus routes and organisations. New buses were introduced to replace old ones. Improvements to bus terminals and bus stops also commenced in 2017. Public transport investment is therefore collected starting from the budget year 2017/18. Based on data analysis, the final result of investment was calculated to be 16 percent.

Table 4.20: Final Result of Investment

Indicator	Value	Year	Comments
Investment in public transport system	16	2017/2018	Based on World Bank Report for Urban Transport in Yangon and Mandalay, 2019.

4.8.2 Conclusion

As shown in Table 4.19, investment in public transport represents only 16 percent of total transport investment. To increase this, investments should be directed towards Bus Rapid Transit, Bus Transit Terminals, Transit Oriented Development, and Circular Railway improvements. More potential opportunities should be created for private sector participation in Yangon's urban transport service.

4.9 Indicator 9: Air quality (PM10)

Traffic is a major source of air pollution in cities and causes significant health problems. Air pollution, including particulate matter (PM), poses health risks to humans. Particles smaller than 10 micrometres in diameter pose the greatest risk because they can get deep into the lungs, and some may even get into the blood stream. Motor vehicles are among the main contributors to PM pollution in urban areas.

4.9.1 Data collection in Yangon City

The YCDC Pollution Control and Cleansing Authority collects and provides data for air quality analysis in Yangon city.

Table 4.21: Yangon City Air Pollution Data for Year 2019

S/No	Station	Location	PM10 Year means	Population In study area
1	City Hall	Kyauttada township	134.2	29853
2	Bet; Maechent & Maharbandoola	Botahtaung Township	134.6	40995
3	Yaekyaw Pazundaung	Pazundaung Township	86.2	48455
4	Thein Gyi Zay	Pabedan Township	101.9	33336
5	Yangon General Hospital	Latha	127.1	25057
6	Infront of Nursing University	Lanmadaw	101	47160
7	Ahlone Vehicle Section	Ahlone	120.5	47160
8	Aung San Stadium	Mingalar Taung Nyunt	102.2	132494
9	Tarmwe Bridge	Tarmwe Town Ship	48	165313
10	Myanmar Plaza	Yankin Township	45.8	70946
11	Koke Kaing Bridge	Bahan Township	78.9	96732
12	Myay Ni Gone Bridge	San Chaung Township	52	99619
13	Hledan Bridge	Kamar Yut Township	41.4	84569
14	Inyar Kan Bridge	Hlaing Township	52	160307
15	Thamine Junction	Mayan Gone Township	63.7	198113
16	Bayint Naung Tower	Mayan Gone Township	70.9	198113
17	Aung Min Ga Lar Highway	Mingalardone	34.8	331586
18	Air Port	Mingalardone	35.7	331586
19	Dawpon	Dawpon Township	70	75325
20	Shukinthar	Tharketa	93	220556
21	Thuwunna Stadium	Thingangyun Township	37	209486
22	Infront of Parami HW Terminal	South Okkalarpa	35	161126
23	Aung Zay Ya Bridge	Insein Township	42.4	305283
24	Shwe Pyi Thar Bridge	Shwe Pyi Thar Township	38.2	343526
25	Hlawgar National Park	Hmaw Bi	38.2	244607

		Total city population		3701303

Most of the monitoring stations are situated in Yangon city. The mean level of fine particular matter (PM10) in the Central Business District area and inner ring townships have the highest level of PM10 (Table 4.21).

4.9.2 Data analysis

The average PM10 value in 2019 was calculated as 55.31 (Table 4.22).

Table 4.22: Analysis result for SUTI indicator 9

Indicator	Value	Year	Comments
Air Quality (PM 10)	55.31	2019	Data of continuous monitoring from YCDC

4.9.3 Conclusion

The calculated value is within the allowable range prescribed by the SUTI tool. However, the inner and outer ring areas are higher and should be reviewed by the UTRA report proposal for 2035.

4.10 Indicator 10: Greenhouse gas emission (CO2eq tones/year)

CO2 emissions are a significant part of greenhouse gas emissions, and the transport sector is shares responsibility for the emission of CO2. In Yangon city, there were 5,533,776 registered motor vehicles in 2018. Motors are operated with Premium Diesel, Diesel, Octane 92 Rom, Octane 95 Rom, Gasoline and natural gas (CNG). In Yangon city fossil fuels are imported and compressed natural gas (CNG) is obtained from local resources.

Table 4.23: Gasoline / Octane/ Diezel/ CNG Vehicle Consumption for year 2019 at Yangon Region

Month	Gasoline (Lit)	Octane 92 Rom (Lit)	Octane 95 Rom (Lit)	Octane 97 Rom (Lit)	Diesel (Lit)	Premium Diezel (Lit)
January	21839.41636	32061240.63	11383927.61	21862.14681	13138522.9	14851394.12
February	15656.73396	29332713.78	10929141.32	26117.28705	12039569.3	13714235.16
March	20402.85192	33735761.05	12003155.08	31213.45394	13774148.1	16216884.99
April	0	35336166.58	11789111.52	30126.93843	12101550.7	15936936.76
May	4077.84273	36131441.38	12829343.29	30290.59767	16049843.5	18972147.39
June	1495.66361	35820088.77	12760065.43	29881.44957	13674293.2	21158089.31
July	6450.90171	33709239.17	12235737.59	54216.66934	11652756.1	15918711.49
August	8214.78463	33540815.62	12439161.48	58408.16432	11521756	16126872.4
September	9464.95938	33710134.75	12816805.18	60140.22461	11412563.4	16078824.78
October	22894.10924	36145306.95	13644498.14	76442.50335	13156730	18068916.59
November	49616.02626	35112771.72	13285929.84	88103.2242	13063444.2	19124027.71
December	41414.8799	34876556.88	13537383.17	78251.84717	13808566.5	19203429.72
Total	201528.1697	409512237.3	149654259.7	585054.5065	155393744	205370470.4
Total	**559953079.6**				**360764214.2**	

Table 4.24: Amount of CNG sold data for 2019

Month	CNG (cu ft)
January	687821944
February	639618558
March	715012947
April	600249879
May	717022088
June	716503648
July	723201418
August	717709766
September	709012997
October	697612277
November	672278520
December	706954006
Total	**8302998048**

4.10.1 Data collection

Yangon Region's total population is about 7,523,255 persons. Its emission per capita is 1.51.

Table 4.25: Converted Data of Sold Gasoline/ Petrol/Diesel and CNG in year 2019

Fuel Type	Liter or Cuft	CO2 Factor Kg/l or Kg/cuft	Emissions Tons/year	Population	Emission/capita
Gasoline/ Petrol	559953079	2.272	1271933.42	752325500	1.51
Diesel	360764214	2.676	9654055.92		
CNG	8302998048	0.053	440058.90		

Results table based on yearly sold out petrol, diesel and CNG:

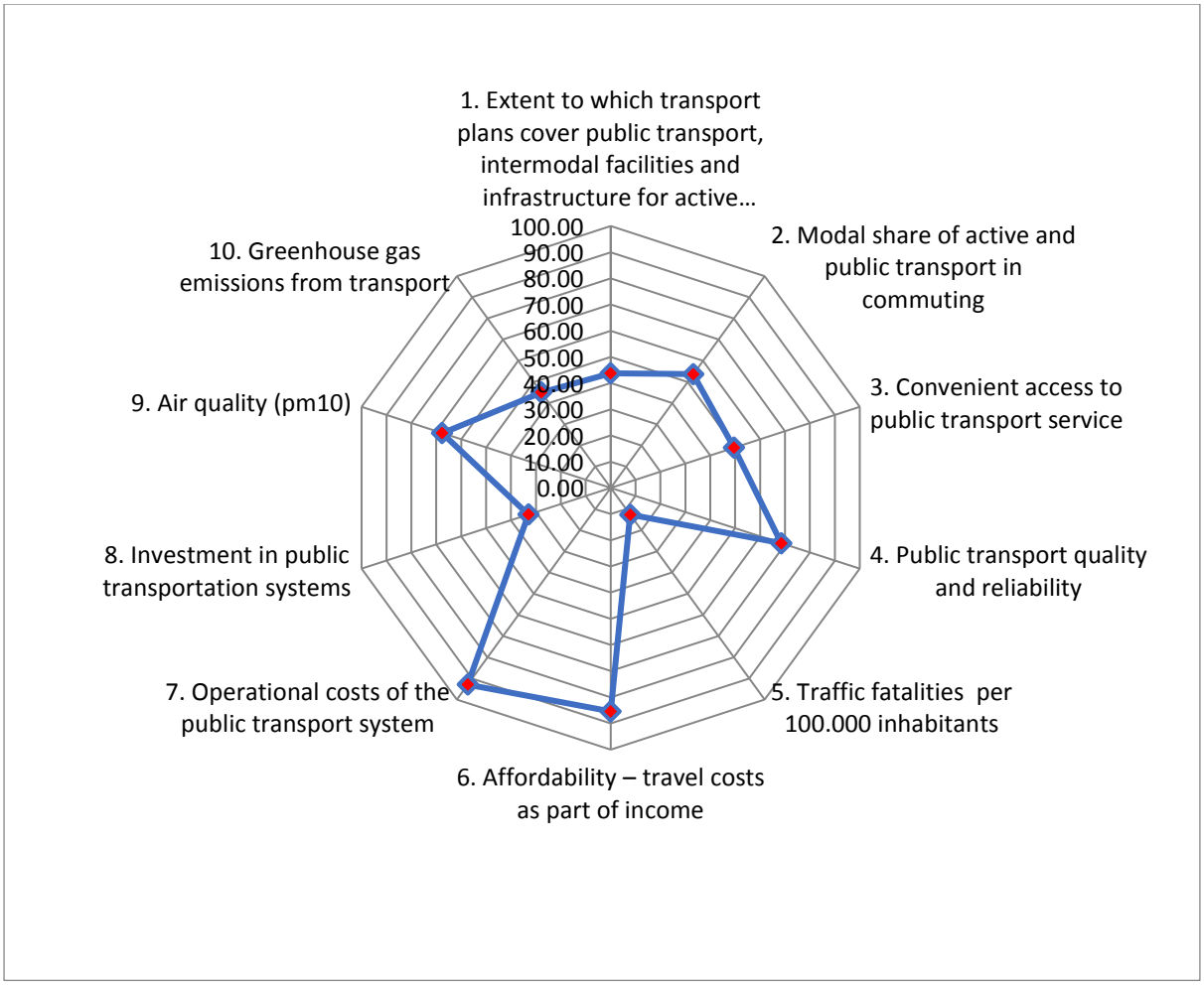
Table 4.26: Final result for SUTI indicator 10.

Indicator	Value	Year	Comments
CO2 Emissions for transport	1.51	2019	Based on Myanmar Oil and Gas Enterprise data

4.10.2 Conclusion

There are some limitations to calculating greenhouse gas emissions. 187 petrol stations and 5 CNG stations in the Yangon region were used to calculate yearly sold out petrol, diesel and CNG. The SUTI indicator revealed a 1.51 emission rate per capita. However, the majority of this is consumption is in Yangon city.

4.11 Spider diagram for Yangon City



4.12 Combined Final Result

#	Indicators	Natural units	*Weights*	Normalization		
				MIN	MAX	
1	Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes	0 - 16 scale	*0.1*	0	16	43.75
2	Modal share of active and public transport in commuting	% of trips	*0.1*	10	90	53.64
3	Convenient access to public transport service	% of population	*0.1*	20	100	49.52

4	Public transport quality and reliability	% satisfied	*0.1*	30	95	68.50
5	Traffic fatalities per 100.000 inhabitants	# fatalities	*0.1*	10	0	12.67
6	Affordability – travel costs as share of income	% of income	*0.1*	35	3.5	85.39
7	Operational costs of the public transport system	Cost recovery ratio	*0.1*	22	100	92.88
8	Investment in public transportation systems	% of total invest-ment	*0.1*	0	50	33.00
9	Air quality (pm10)	µg/m3	*0.1*	150	10	67.63
10	Greenhouse gas emissions from transport	Tons/cap	*0.1*	2.75	0	45.06
	MUST SUM TO 1		1.0			

Note: Decimal points used to allow reproduction in US format for report

B3 SUTI RESULT

INDEX	Geometric mean	49.04

CHAPTER 5: Impact of COVID-19 on Urban Mobility

5.1 COVID-19 in Myanmar

The first recorded case of COVID-19 in Myanmar was in Yangon on 23rd March 2020. The Yangon Regional Government shut down all hotels, guesthouses and non-essential shops between April 7 to 21 2020. The Yangon Regional Government Committee on COVID-19 instructed stay-at-home orders, curfews, bans on public gatherings, and closures of public events, entertainment venues, and religious institutions. After the Thingyan water festival, the COVID-19 infection rate declined slowly. Overseas travellers were instructed to quarantine. Social activities, businesses and schools reopened in line with Ministry of Health and Sport (MOHS) guidelines published in May, June and July 2020.

5.2 The Second Wave of COVID-19 in Myanmar

In the middle of August 2020, local transmisions of COVID-19 were discovered at Sittwe township. This marked the beginning of the second wave of COVID-19, with increasing outbreaks of local transmissions recorded at the end of August 2020. As the numbers began to increase, not only in Yangon but in other regions and states, in particular Rakhine State, the Government of Myanmar issues an order for people to stay at home as much as possible, to follow social distancing, and to wear the masks when going out. However, most factories for essential sectors such as foodstuffs and drinking water factories remained open under close supervision and with distancing measures.

The Government of Myanmar imposed a nationwide ban on gatherings of 30 or more people from 16th August 2020. Exceptions included work commutes for public servants, corporate employees, and factory workers, medical emergencies, shopping at permitted markets, and the delivery of goods. At the time of writing, there remains a nationwide curfew in place, from 12:00 A.M. to 4:00 A.M. The government is actively enforcing this curfew. All international and domestic flights have been suspended until November 30.

5.3 Transport in Yangon

The Ministry of Transport and Communications ordered commercial bus lines to reduce the number of passengers by half, allowing a doubling in ticket prices in compensation. Express bus line companies announced the suspension of their services until October 2020, as there were no customers due to the nationwide stay at-home order. Even after the home stay order was lifted in May 2020, regional governments continued to impose travel restrictions through night curfews. Night curfews and stringent travel restrictions in major transit hubs such as Mandalay, Naypyidaw, and Taungyi, were severely disrupted.

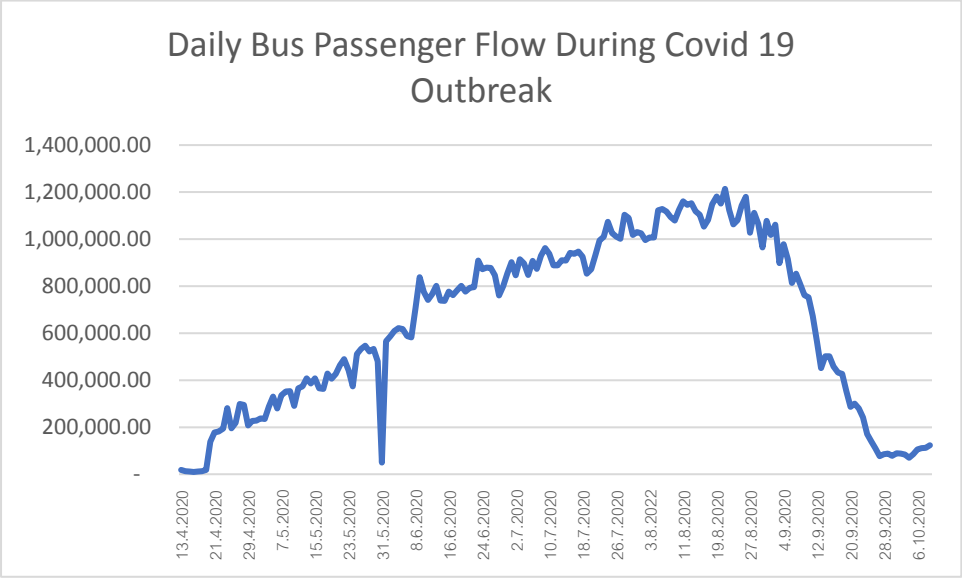
5.4 Circular Railway in Yangon

A number of inter-state railway routes were also suspended by Myanmar Railways. Yangon Circular Railway reduced the number of operational railways within the city by between 40 and 90 percent of their usual frequency. Railway runs that previously ran four times in the morning and evening were also reduced by half.

5.5 Bus Service in Yangon

The Yangon Bus Service reduced the number of buses by 25 percent during the Thingyan water festival to prevent a surge in infections. After the festival, daily commuters increased up to 1,180,829, with 3939 bus services running continuously to the end of July 2020. Following the outbreak of the second wave in August, daily ridership decreased to 94 percent. Figure 5.1 shows daily passenger flow during the outbreak. Overall, the private commercial bus lines fared the worst. Even after travel restrictions were lifted, public sentiment about nonessential travel continued to affect bus companies and it is expected that this will remain the case for the months to come. Cargo truck companies have also been affected by curfew and travel restrictions.

Fig 5.1 Daily Bus Commuter during COVID-19 Periods



Source: YRTA daily update

5.6 Taxis in Yangon

Most drivers fear operating during COVID-19 but the Grab group continues to serve people under MOHS guidelines. However, it has been difficult to generate revenue from such a small number of passengers.

5.7 Ferry Transport

Normally the ferry service operates 46 times a day. Yangon Pansodan-Dala ferries have sometimes carried more than 30,000 daily commuters. The Pansodan-Dala ferry is the only transport option for local people in southern Yangon, linking Dala, Twantay, Kawhmu, Kungyangon townships to the main city. Yangon Pansodan-Dala ferry service has reduced the crossing schedule to 30 times in weekdays from 12 September 2020 and 24 times during the weekends. The service has witnessed a drop to an average of just 6,000 commuters, particularly during weekends. Under the reduced schedule, the Dala ferry will now run between 5:00am and 9:00pm on the weekdays, and it will serve the routes between 5:30am and 8:00pm every weekend.

5.8 Airport

In order to continue to contain the spread of COVID-19 in Myanmar effectively, the National Central Committee for Prevention, Control, and Treatment of COVID-19 has decided to further extend the effective period of the temporary measures up to 30 November 2020, 2359 Hours MST by the notification issued on 26 October 2020.

5.9 Tourism Sector

The tourism sector was hit early and severely by the COVID-19 outbreak. Tourists are the dominant clientele for hotel and restaurant businesses, souvenir factories, and many other local small-scale businesses. The peak season for tourism in Myanmar is between November and May. By February, most hotel bookings and tour packages for March and April were completely cancelled. Losses in the tourism sector also impact the hospitality and restaurant business. As a result of such

losses, combined with local restrictions allowing only takeaway food from restaurants, most small- and medium-sized restaurants stopped business.

CHAPTER 6: PERSPECTIVES ON SUTI EXERCISE

6.1 Analysis of SUTI indicators revealed an overall moderate situation with a geometric mean of 49.04.

6.1.1 More active transport modes for bicycle lane and walking networks should be incorporated into the new road designs for Yangon city. Park and ride schemes should also be developed in the Yangon city area.

6.1.2 Daily commuter mode choice should widen to include the railway, para transit, car sharing and shuttle bus services.

6.1.3 Access and egress improvement should be developed for Circular Railway Stations.

6.1.4 Assign skilled drivers and train conductors to improve competency and avoid traffic accidents with motor vehicles,.

6.1.5 The Yangon Region could consider supporting YRTA's higher-level strategic planning activities by establishing a Yangon Urban Mobility Board (YUMBo), composed of delegates from the YRG, Yangon city Development Committee (YCDC), and Myanmar Railways. This would encourage higher-level sustainable urban mobility policy making. It could also provide the space for vital nongovernment stakeholders to oversee the planning, implementation, and management of an integrated public transport network that meets the needs of commuters in an efficient, cost-effective, and sustainable manner. Moreover, YRTA's regulatory roles should be strengthened and complemented with a commercial focus and use a business-like approach to maximize non-farebox revenues and minimize costs within the framework of affordable fare setting led by the regional government or YUMBo.

6.1.6 Natural gas (CNG)-operated buses and taxis are more suitable in urban transport systems. They have lower emissions and are less harmful to the environment. Myanmar is rich in natural resources and using CNG gas is more economical for the public transport sector.

6.1.7 Traffic fatalities per 100,000 inhabitants is very high at 8.62. Most accidents can be traced to poor driving. Better training and investment regarding driver and passenger safety should be made a priority.

CHAPTER 7: CONCLUSION

The overall transportation system in Yangon city was deemed to be in a moderate condition. The cost of operating the public transport system and the affordability of travel were also deemed to be of adequate levels, as illustrated by the spider diagram of Yangon city (2019). Yangon Regional Government and the Ministry of Transport and Communication (MOTC) manage an important role and provide vital subsidisation for Yangon city's public transport sector. Their contribution, however, may not be sustainable long-term as the city continues to grow. A more reliable system, without subsidisation, is vital for the transport system's future. Moreover, the pedestrian priority rule is not strictly observed. In order to reduce the number of accidents, measures such as signalised control, signalised junctions and education/advocacy of road safety should be introduced. To meet the goal of sustainable urban transport, a clear vision for Yangon should be put forward, with full integration of urban development and transport planning. This will provide access and enhance mobility, as well as reduce reliance on private transport modes. A high-quality public transport system is essential for every city in the modern era.

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