



MYANMAR TRANSPORT
SECTOR POLICY NOTE
URBAN TRANSPORT

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Foreword

Myanmar is at a historic milestone in its transition into a market economy and democracy. After decades of isolation and stagnation, the country has, since 2011, been undergoing a fundamental political, economic, and social transformation at unprecedented speed and scope. Achieving the country's high growth potential will require continued reforms and structural transformation, especially in advancing major investments in infrastructure, developing relevant capacities and skills, and enhancing the business environment. This will enable Myanmar to reach the ranks of upper middle income economies by 2030.

Due to massive underinvestment and neglect in recent history, Myanmar's infrastructure lags behind its Association of Southeast Asian Nations neighbors, and hinders access to markets and social services. High transport costs and associated limited access to markets and services are among the main causes of poverty and regional inequality. Twenty million people still live in villages without access to all-season roads. The questions then are: how can basic transport services be provided to all? What does it take to improve the quality of the transport infrastructure and services for the private sector? How can Myanmar reduce the economic and social costs of transport?

The Government of the Republic of the Union of Myanmar is committed to addressing these questions, and the underlying issues. Toward this end, the government has commissioned from the Asian Development Bank (ADB) the preparation of a *Transport Sector Policy Note*. The *Transport Sector Policy Note* takes stock of the transport sector challenges, provides a strategic framework for reforms that could assist Myanmar's policymaking, and identifies the areas where international financial and technical assistance could make the highest contribution to the development of Myanmar's transport sector.

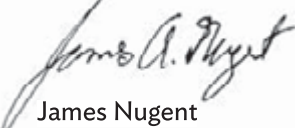
The *Transport Sector Policy Note* is composed of nine reports, including this one, and a summary for decision-makers. The first two—*How to Reform Transport Institutions*, and *How to Reduce Transport Costs*—provide an overview and framework for policy reform, institutional restructuring, and investments. These are accompanied by separate reviews of key subsectors of transport: *Railways*, *River Transport*, *Rural Roads and Access*, *Trunk Roads*, and *Urban Transport*. These reports summarize and interpret trends on each transport sector to propose new initiatives to develop them. The thematic report *Road Safety* builds a first assessment of road safety in Myanmar. The thematic report *How to Improve Road User Charges* is a stand-alone study of cost-recovery in the road sector.

The research was organized by ADB and the then Ministry of Transport, with the active participation of the Ministry of Construction and the then Ministry of Railway Transportation. A working group comprising senior staff from these government ministries guided preparation. The work stretched over the period of 24 months, and was timed such that the final results could be presented to the new government that assumed office in April 2016, as a contribution to its policy making in the transport sector.

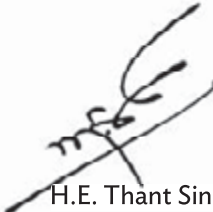
As the *Transport Sector Policy Note* demonstrates, Myanmar can, and should, develop a modern transport system that provides low-cost and safe services, is accessible to all including in rural areas and lagging regions, and connects Myanmar with its neighbors by 2030. The government has the determination to doing so, and can tap the support from development partners, the private sector and other stakeholders. It can take inspiration from good practices in the region and globally.

The *Transport Sector Policy Note* provides a rich set of sector data, is meant to be thought-provoking, presents strategic directions, and makes concrete reform recommendations. It stresses the need to strengthen the role of planning and policy-making to make the best use of scarce resources in the transport sector. It highlights the need to reexamine the roles of the state—and particularly state enterprises—and the private sector in terms of regulation, management, and delivery of services in the sector. It identifies private sector investment, based on principles of cost-recovery and competitive bidding, as a driver for accelerated change. Finally, it aims at a safe, accessible, and environmentally friendly transport system, in which all modes of transport play the role for which they are the most suited.

We are confident that the *Transport Sector Policy Note* will provide value and a meaningful contribution to Myanmar’s policymakers and other key stakeholders in the transport sector.



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Abbreviations

ADB	-	Asian Development Bank
BLC	-	Bus Line Committee
BSC	-	Bus Supervisory Committee
BRT	-	bus rapid transit
CBD	-	central business district
JICA	-	Japan International Cooperation Agency
km	-	kilometer
km/h	-	kilometer per hour
MCDC	-	Mandalay City Development Committee
MK	-	Myanmar kyat
MOTC	-	Ministry of Transport and Communications
SUDP	-	Project for the Strategic Urban Development Plan of the Greater Yangon
TA	-	technical assistance
YCDC	-	Yangon City Development Committee
YUTRA	-	Project for Comprehensive Urban Transport Plan of the Greater Yangon

Currency Equivalents

(as of December 2014)

Currency unit	=	kyat/s (MK)
MK1.00	=	\$0.0001
\$1.00	=	MK1,000

Executive Summary

Overview

This note presents a review of Myanmar's urban transport. It focuses on the country's main cities, Yangon and Mandalay, where issues are most severe, to also help solve similar problems in secondary cities. Yangon and Mandalay probably account for more than 50% of Myanmar's gross domestic product (GDP). The efficiency of urban transport systems in Yangon and Mandalay will determine their productivity and attractiveness to investments and labor, and will have a direct impact on the country's economic growth.

Myanmar's urban transport worsened rapidly after 2012. The floating currency and reduction in restrictions on car and motorcycle imports in 2012 caused the number of vehicles to double within just 3 years. Public transport systems failed to adjust and lost ground to personal modes of transport. Traffic congestion, which was largely unheard of before 2012, is now prevalent in Yangon, where speed at peak hours has been cut by more than half.

This note aims to shed light on what has happened in the last 3 years and to identify short-term directions to follow in this rapidly changing situation. In Yangon, the government has received technical assistance (TA) from the Japan International Cooperation Agency (JICA) to prepare a long-term urban transport master plan. The base data and intellectual contribution of this plan is gratefully acknowledged.

A Tale of Two Cities

It is hard to consider a more different urban transport setting than in Yangon and Mandalay.

Yangon

Yangon used to be a city of buses. It has more than 5 million people, with a high population density in the inner city. Its transport system is characterized by (i) a well-developed radial road network supporting the inner city, but with gaps in the new suburbs; (ii) a very narrow secondary road network; (iii) a private-public bus transport system which has kept a market share of more than 50%; and (iv) an outdated railway system of about 50 kilometers (km) which only caters to 1% of trips and operates at a loss. Motorcycles, bicycles, and trishaws are banned in the Yangon city limits, which is uncommon in Southeast Asia. Until 2012, importation of cars was limited, so that buses were the only alternative.

This bus system, albeit of low quality, has functioned rather efficiently and required no subsidy. Two types of local buses have coexisted under the regulation of the Ma Hta Tha Central Committee. About 5,000 small or individual operators have been managed under bus control committees and bus line committees.

These nonprofit organizations have controlled entry in the sector and supervised quality. In parallel, two large bus companies—the Golden City Link and Bandoola Transportation—have been operating. Bus companies are sizeable, familiar with operations, and likely earning some profits. While their services are not entirely customer-focused and their fleets are outdated, they are considered a good base for developing more demand-responsive quality-controlled services.

This transport system is experiencing a quick breakdown. The number of cars doubled from 160,000 by the end of FY2011 to 320,000 by April 2015. Bus services have been steadily losing customers at a rate of 10% a year, so that volumes as of 2015 are only half of those in 2007. Congestion is picking up quickly. The Yangon City Development Committee (YCDC) estimated that in 2007, even at peak hours, vehicle speed reached 30 kilometers per hour (km/h), which is the free flow speed. By 2015, this may have dropped to 10–15 km/h. In 2013, when the Yangon urban transport master plan was prepared, congestion was only during peak hours at a few intersections. By 2015, congestion has spread beyond traditional peak hours in many arterial streets.

If current trends continue unchecked, Yangon’s urban transport could become a major constraint on economic growth. If current population and vehicle ownership trends continue over the next 5–10 years, the strain on the transport infrastructure will be substantial. While buses are well-used, they are of low quality and not responsive to demand. As such, an increasingly affluent population is likely to reject low-quality transport modes in favor of private transport. Because of the motorcycle ban, motorization rates are still very low by international standards. Car ownership could further rise 10 times if unchecked. This would dramatically degrade bus transport conditions and push more users to shift to cars. Traffic that used to flow seamlessly just 5 years ago would grind to a halt. This transition has adverse impacts on the economy and is socially regressive, as it penalizes the vast majority who cannot afford cars.

Mandalay

Mandalay used to be a city of bicycles; it is now a city of motorcycles. It has 1.2 million people (1.7 million including the Mandalay district), with moderate density throughout the city and large unused lands nearby. One million two-wheelers account for more than 90% of trips. While bicycles are still commonly seen, motorcycles are now twice as many, and may account for 70% of trips. Car ownership is progressing, but from a very low base. Buses are used by less than 3% of people and slowly losing what remains of their market share. Bus efficiency is low. While a typical bus in Yangon does 10 daily trips and carries 400 people a day, similar buses in Mandalay do only three trips and carry only 120 people at a time.

Mandalay’s road infrastructure is sufficient and uncongested. Its street network pattern that is on a dense grid has multiple lane avenues (with large but often obstructed sidewalks) and wide secondary roads. At the time of writing, the road network is largely uncongested except at a few intersections at peak hours and even then queues cleared quickly.

The city center requires special attention to ensure that it can function efficiently. It is a small area that must accommodate intense activity. It is occupied primarily by retail stalls and offices. Virtually all public transport routes terminate in the city center and vehicles tend to stay for a considerable time. The area also attracts motorcycles. Motorcycles, public transport vehicles, and delivery trucks all park on the streets, restricting roads to a single lane in many instances, and thus causing congestion, conflict, and much stress and frustration. Junctions are not able to work effectively, including the ones with stoplights, as both their entry and exit points are blocked by parked vehicles. In transport terms, the area is functioning but is on the edge of breaking down.

Motorcycles provide excellent individual mobility but threaten city sustainability in the long run. Overall, Mandalay's transport issues are well managed. However, the dominance of motorcycles and absence of efficient public transport pose a long-term threat. For a cost-sensitive population seeking to increase its mobility, the motorcycle is the ideal mode of transport because (i) it is inexpensive (particularly with hire purchase agreements readily available); (ii) it is economical to run (it is fuel-efficient and easy to maintain, and insurance is not compulsory); and (iii) it offers point-to-point travel for three (sometimes four) people. For the individual, the motorcycle seems ideal, but for the city, it worsens air and noise pollution. In addition, the presence of a large number of motorcycles on the streets is difficult to manage (they tend to intrude on sidewalks to circumvent heavy traffic and disregard designated one-way traffic streets) and is a major source of accidents. As such, sustained motorcycle growth does not ensure a sustainable city.

Ownership of motorcycles in Mandalay is not yet at saturation point. Thus, there is sufficient opportunity to influence the travel habits of a population that has yet to subscribe to the motorcycle culture. It is this population and the existing public transport users that should form the new public transport users. Existing motorcycle users will be difficult to persuade, given that the culture of use is already established and that the investment in the motorcycle has already been made. This user group may be persuaded over time but, taking Taipei City (Taipei, China) as an example, it would require a quality public transport system over the whole network before this user group is persuaded.

Strategic Review: Yangon

The government has begun to take steps to address the growing congestion. YCDC successfully implemented a series of traffic management measures, including overpasses at selected intersections, which helped make traffic flow smoothly. In early 2015, the regional government launched an initiative to restructure bus operators on main corridors into a joint venture company that would operate higher quality buses under the concept of bus rapid transit (BRT) Lite. With support from JICA, the Ministry of Transport and Communications (MOTC) and YCDC also prepared a first urban master plan (2013) and urban transport master plan (2014), which have not yet been approved as of 2015. With the JICA loan, Myanma Railways (MR) also procured new coaches to operate the Yangon Circular Railway (YCR).

However, the impact of these changes has not yet been perceived. The Project for Comprehensive Urban Transport Plan of the Greater Yangon (YUTRA), supported by JICA, is comprehensive in its approach and sets out a multimodal transport network that recognizes the role of mobility in the city's economic and social health. Being comprehensive, its implementation can be daunting and requires significant change within the government, large-scale funding, and much planning and management. At the heart of the YUTRA plan is a mass transit network consisting of rail and BRT, supported by improvements of the conventional bus network. Given the mobility constraints and anticipated growth, it is clear that the transport sector requires immediate action.

The following paragraphs highlight elements of short- to medium-term strategy that the government could consider when it implements the YUTRA plan.

Traffic Engineering

Increase traffic carrying capacity through low-cost traffic management schemes. Traffic engineering such as putting up signs, signal lights, and barriers; improving turning areas; channelization; on-street parking removal; better management of street vendors; and others, should be aggressively pursued. These measures

will increase vehicle throughput capacity and improve safety but may only moderately delay the coming congestion, as each new car user takes 6.5 times more street space. Among all urban transport strategy elements, investments directed at improving traffic management and enforcement are likely to have the highest short-term benefits at the least cost.

Demand Management

Limit rise in car travel through transport demand management. The government could reconsider imposing limits to car usage, since cars are the most inefficient user of road infrastructure. Traffic demand management measures aimed at increasing the passenger throughput capacity would be the most efficient. The most quickly feasible measures include (i) charging for parking and aggressive reduction of on-street parking, particularly in the central district; (ii) extensive development and enforcement of bus lanes; and (iii) formalization of bus stops and improvement of interchanges.

While politically more difficult, the following measures restricting car usage or ownership seem necessary in the medium term:

- Current car purchase taxes, which are high, should be maintained. Annual registration fees may be raised. A capping system may be considered, but the risks of corruption seem very high.
- The costs of running vehicles should be increased to reflect externalities, i.e., through a fuel tax.
- Physical restrictions to discourage the use of low-occupancy vehicles (i.e., car) by banning their use or parking in selected areas or at specific times should be piloted.

Road Network Development

Selectively invest in urban road construction and maintenance. Even with considerable traffic engineering and demand management, Yangon will need to invest in its road network. This should include (i) development of new roads in the newly developed areas; (ii) improvement or upgrading of the secondary road network, which will inevitably require acquisition of right of way—a process that should be made fair and transparent but without lengthy procedures; and (iii) increasing road rehabilitation to repair potholes and pave roads.

At this stage of development, focusing on the development of arterial highways or urban expressways would simply add to the congestion in the medium term while consuming very large resources. Because the secondary network is not able to accommodate the traffic, new urban arterials would simply dump far more traffic than it currently does into the city center.

Bus Reform

Facilitate bus reform but keep focus on regulatory objectives. The bus system needs to be the main transport solution in Yangon. An ambitious objective would be to maintain its current 50% share of public transport by becoming more efficient, convenient, and comfortable to appeal to the growing middle class who would otherwise shift to cars and taxis.

The first steps toward reform should be to acknowledge that the current system has remarkably well served the needs of Yangon transport users, and that it constitutes a good basis for reforms. Regulation could usefully focus on enhancing safety, limiting undesirable behaviors (such as illegal stops), and improving incentives to

drivers. Regulation and consolidation of all routes are not recommended, as it would strongly reduce system flexibility; the regulatory restrictions could be simplified instead. Full-scale bus reform—i.e., consolidation of companies following market competition—could be implemented gradually, starting with major arteries. In doing so, the government should refrain from directly investing in a system which has so far functioned without subsidies, but rather concentrate on providing the needed road and bus stop infrastructure and regulatory environment.

Mass Transit Development

Prioritize cost-efficient bus rapid transit on main arteries. There is a need to provide transport facilities to move a large number of people at higher speed with limited land use. This requires segregating public transit from arterial street traffic. Before costly investments, developing lower-cost improvements not requiring construction of new infrastructure should be prioritized. Segregated busways (BRT) would come at a low cost (\$5 million per km) and could be deployed quickly where demand is high.

Fully modernizing the existing circular railway line for commuter and urban transport would come at a high cost (\$20 million per km), while the base demand is low. The system is unlikely to become financially sustainable, and so it would require permanent subsidies to operate. Before committing large resources—a full upgrade may require resources equivalent to a decade of road investments—lower-cost measures such as rehabilitation should be considered until a higher rail patronage is reached.

Institutional Development

Create an overarching authority for transport in Yangon. The current institutional system is fragmented across agencies, jurisdictions, and levels of government. It acts as a constraint on implementing traffic management and the BRT. The YUTRA proposition to create an urban transport authority should certainly be considered. Placing responsibility on either YCDC or the regional government is an alternative.

A New Bus Rapid Transit Initiative

The government could consider developing a BRT pilot corridor along the priority areas identified by YUTRA. In contrast to the current government approach of “BRT Lite,” this would likely be a segregated BRT line requiring a combination of road-based infrastructure (lanes and bus stops), services (buses), systems, and institutional restructuring.

Developing a BRT pilot corridor would take approximately 3 years from concept to operation. It would start with a prefeasibility study to establish the support for and worth of the project, followed by full feasibility, design, and implementation. This would allow institutional structures to be explored including the desire for change of the public transport industry. The first initiative would establish principles, qualities, processes, and structures that could be rolled out across the city. The key project risks are political will and operator response.

A 10-km segregated BRT line would cost \$50 million–\$100 million, depending on the concept. This report has examined the early phase of BRT proposals within YUTRA and identified BRT 2 (Phone Gyi Street–Pyay Road) as possessing the necessary characteristics—primarily manageable levels of risk—of a pilot corridor.

Strategic Review: Mandalay

Mandalay has not yet received the level of international attention that Yangon has had. Basic transport planning information on household transport patterns and congestion is missing. The Mandalay government has efficiently implemented traffic engineering such as signal control, but has been facing difficulties reviving its public transport system. In this context, there may be a temptation to await the development of a citywide transport master plan. However, this would be a time-consuming and costly exercise and of only limited value for a fast-changing city on a steep development curve.

At this stage, Mandalay does not require large-scale transport projects, and may not actually be able to make full use of them. Urban road development in an uncongested city is likely to be premature. Mass transit systems are difficult to consider because (i) the current public transport system is not a good base to build it on, (ii) international experience suggests it is very difficult to make people shift from motorcycles to buses, (iii) transport patterns are not well known and will be quickly shifting, (iv) the road grid pattern makes traffic forecasting unreliable, and (v) large investments are likely to be unaffordable to the Mandalay government.

Potential for Short- and Medium-Term Initiatives

The government could consider two pragmatic initiatives—a corridor-based improvement initiative and a city center transport strategy and improvement—that will enable the establishment of a structure and skill base to prepare for citywide application of a sustainable transport strategy. Both will have significant impact, do not prejudice grander long-term plans, and can be developed and implemented quickly.

A Corridor-Based Improvement

There is a potential to develop a demonstration transport corridor along one of the main arterial roads in the city, for example 78th Street. The transport corridor initiative would include

- a review of road space utilization;
- development of bus services including operational performance standards, effective operator engagement, regular headways and hours of operation, as well as complimentary infrastructure such as passenger shelters and depot;
- improving pedestrian facilities such as sidewalks and crossing places;
- improving bicycle facilities such as segregated lanes and parking; and
- developing parking management, off-corridor parking, and pricing strategies.

Such initiative would improve transport conditions in a sustainable manner along the corridor, as well as establish a framework for institutional restructuring. Key benefits would be

- (i) proving that buses are a viable alternative to motorcycles,
- (ii) testing the potential for institutional change within the government and the bus industry,
- (iii) introducing transport management techniques,
- (iv) testing traffic and parking management options,
- (v) establishing principles of prioritizing people over vehicles, and
- (vi) demonstrating how road capacity can be maximized.

The corridor improvements must start with a thorough evidence-based definition of the components that make up the project. At present, little data exists and only scant information on origins, destinations, and user needs is known. It is important to get a clear understanding of user needs so that improvements can focus on addressing them. Significant change could be instigated within 2–3 years, including feasibility study, detailed design and implementation.

City Center Transport Strategy

An urban transport planning study of the city center is recommended. This would be a multidisciplinary study of the city center driven by land use and economic function to understand the baseline performance of the area, its constraints, and opportunities. Through this assessment, transport might be considered either a constraint in its current form, or an opportunity. In replanning the city center, a consultative approach should be used to fully understand how it is currently used and what its functions will be in the replanned version. The potential to establish a town center group made up of local businesses could be explored.

The development of an optimized transport plan for the city center would examine the following:

- intersection and road capacity management;
- parking management;
- penetration, access, and circulation of public transport;
- pedestrian facilities;
- bicycle facilities; and
- traffic management.

The primary output would be an early comprehensive transport plan for the city center that is rooted in an understanding of land use and the economic function and future of the center. It should further seek to develop an understanding of urban management issues among government entities and to establish a consultative approach to its future development, perhaps centered on a city center management group. A 3–4 year time frame could be sufficient to complete the strategy and implement it.

Introduction

This note presents an overview of urban transport issues in Mandalay and Yangon. As the Asian Development Bank (ADB) was tasked to carry out a broad review of transport in Myanmar (the Transport Sector Policy Note), it initially focused on the national and rural transport issues. This was because in 2013, the Japan International Cooperation Agency (JICA) had already initiated far more extensive studies on urban planning and urban transport planning in Yangon. However, by the end of 2014, the transport situation in the Yangon area had deteriorated considerably while the JICA studies had shown the need for large investments. This meant that a large share of transport investments in Myanmar should be concentrated in Yangon, and required the support from several development partners. ADB commissioned a short study to provide an overview of the transport situation.

In Mandalay, transport issues are still far less severe than in Yangon. Transport solutions in Mandalay need to be part of comprehensive urban transformation projects. ADB has been supporting urban development planning in Mandalay, and prepared a first urban services project in 2015.

Myanmar's urban transport issues are concentrated in Yangon and Mandalay. Naypyitaw, with a population of more than 1 million, is a special case because of its atypical urban layout, wide roads, and large floating population. Traffic congestion in Mandalay is a remote perspective. Besides these three cities, there are eight state or region capitals with a population of about 300,000–500,000 (Table 1). These cities are experiencing congestion in their respective central business districts; and while the case of Mandalay may present similarities, a separate review may help characterize common issues and solutions.

The first draft of this note was the product of three missions of ADB consultants, which were then complemented by inputs from ADB staff. While it benefitted from discussions with government officials and feedback from a larger audience during presentations, it remains an external viewpoint. The study has limitations, especially when compared with the Yangon Urban Transport Master Plan study completed in 2014. However, this note, together with the rest of the Transport Sector Policy Note, can cast a new light on Myanmar's upcoming urban transport challenges and suggest how to address these challenges.

Table 1: Population Size of Cities and State or Region Capitals

City or Capital	Population ^a
Yangon	5,209,541
Mandalay	1,225,133
Naypyitaw	1,158,367
Bago	491,130
Hpa-an	421,415
Taunggyi	380,665
Monywa	371,963
Myitkyina	305,347
Magway	288,883
Mawlamyine	288,120
Patheingyi	286,684
Sittwe	149,348
Loikaw	128,837
Dawei	125,239
Hakha	48,226

^a Population in townships that officially make up the city or capital.

Source: Ministry of Immigration and Population. 2014. *Population and Housing Census of Myanmar*. Naypyitaw.

PART I

Review of Urban Transport in Yangon

1 Yangon Transport System

1.1 City Context

Yangon is the ex-capital of the Republic of the Union of Myanmar. It is the country's largest city and its most important commercial center. Yangon is under the administration of the Yangon City Development Committee (YCDC). As of 2013, Yangon City had about 5.2 million people in an area of 598.76 kilometers (km). The city is set in the Yangon region, a wider administrative area with a population of 7.36 million. The annual growth rate of the city population has been about 2%.

A large share of commerce and services are in the inner part of the city, which includes the historic central business district and the urban area immediately to the north. Manufacturing development is happening in the new suburbs of the city in the northwest and northeast (Figure 1). The central business district is at the southern part of the city adjacent to the merging point of Yangon River and Bago River. Administratively, the city is divided into 4 districts (north, east, west, and south) and 33 townships.

The Project for the Strategic Urban Development Plan of the Greater Yangon (SUDP) supported by the Japan International Cooperation Agency (JICA) defined the development vision for Greater Yangon as

- an international hub city,
- a comfortable city,
- a well-managed infrastructure city, and
- a city of good governance.

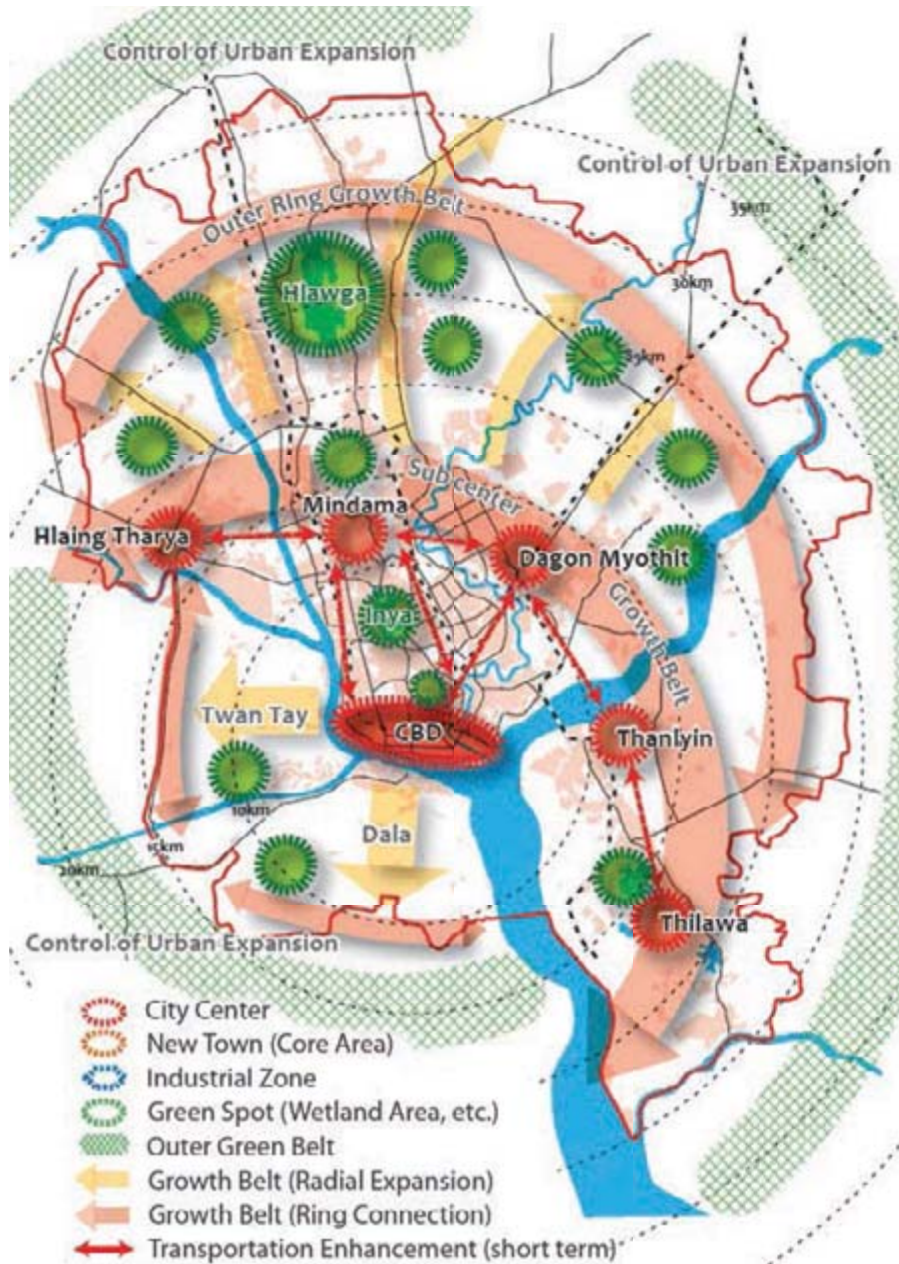
The desirable urban structure was defined as “Sub-center with green isle system (Decentralized urban pattern).” Figure 1 shows the proposed urban structure, which includes subcenters created at areas within a 10–15 km radius of the central business district (CBD).

This vision provided context for the Project for Comprehensive Urban Transport Plan of the Greater Yangon (YUTRA) that was commissioned by Yangon Regional Government and JICA with the objective to

prepare a comprehensive urban transport plan in line with the Strategic Urban Development Plan, so as to provide efficient, safe, comfortable and environmentally friendly services to the people of Greater Yangon, in order to contribute to its balanced, inclusive and sustainable growth.¹

¹ Japan International Cooperation Agency. 2013. *The Project for the Strategic Urban Development Plan of the Greater Yangon*. Final Report. Yangon.

Figure 1: Proposed Urban Structure of Yangon



Source: Japan International Cooperation Agency. 2013. *The Project for the Strategic Urban Development Plan of the Greater Yangon*. Final Report. Yangon.

The study formulates an urban transport master plan for Greater Yangon until 2035 and conducts prefeasibility studies for identified priority projects. The final report has been submitted to the Yangon Regional Government, but it has not yet been endorsed at the time of writing. The review below draws from the extensive surveys carried out by the YUTRA study in 2013.

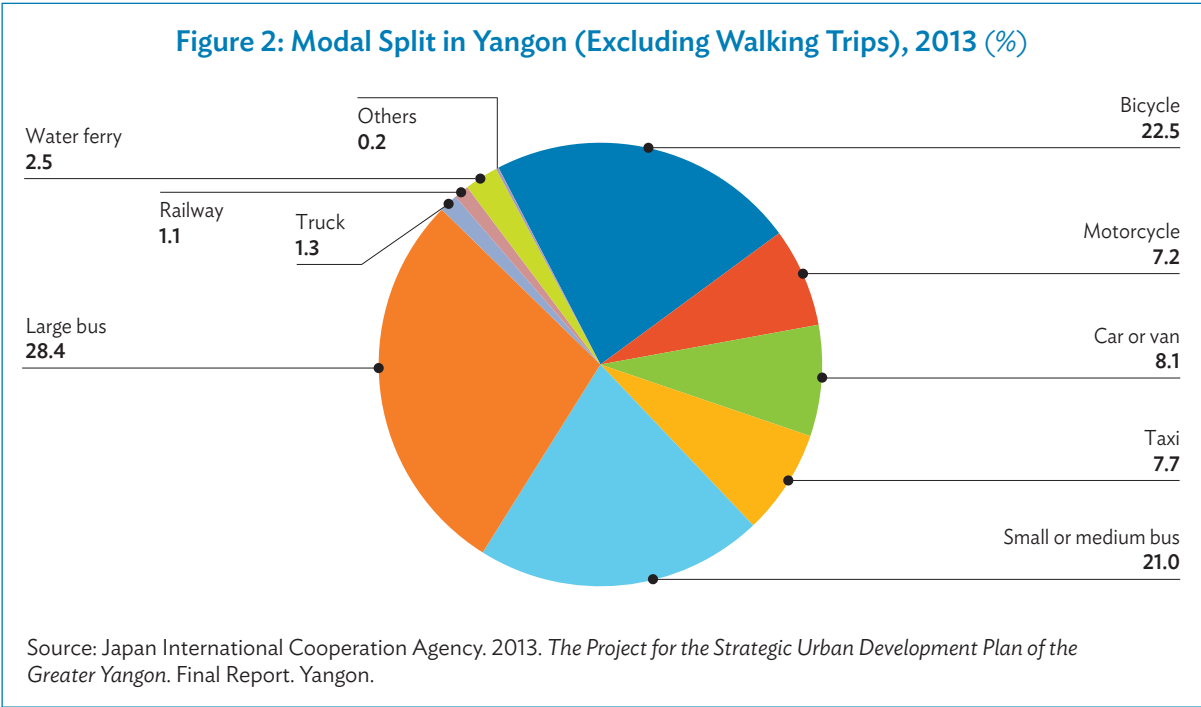
1.2 Transport in Yangon

Mobility Patterns and Trends

The people of Yangon make an average of 2.04 trips per day (1.18 excluding walking).² This puts Yangon in line with international norms, just slightly below the levels of Bangkok, Kuala Lumpur, or Manila.

Buses are the dominant transport mode in Yangon, accounting for nearly 50% of all trips (excluding walking). In contrast to Mandalay, motorcycles account for a very small share because they have been prohibited from entering the central city area. In 2013, cars and taxis accounted for 15.8% of trips. The Yangon circular railway plays a minor role, serving only 1% of all trips.

Car ownership, more than income, is a main determinant of mode choice. Among non-car-owning households, high-income people are more likely to use the bus than poor-income people. Car-owning households rely on cars or taxis for more than 50% of their trips. Poorer people mainly walk and bike, while more affluent people rely more on buses, taxis, or cars.



Women are slightly less mobile (1.9 trips, 0.9 trips excluding walking) than men (2.2 trips, 1.5 trips excluding walking). Women walk more often (51.6% of trips) than men (33%), and mainly rely on public transport (58% of trips excluding walking). Men have greater access to bicycles, motorcycles, cars, and taxis (33% of trips) than women (18%). Overall, men and women equally rely on buses (29% of trips for men, 28% for women).

² Footnote 1.

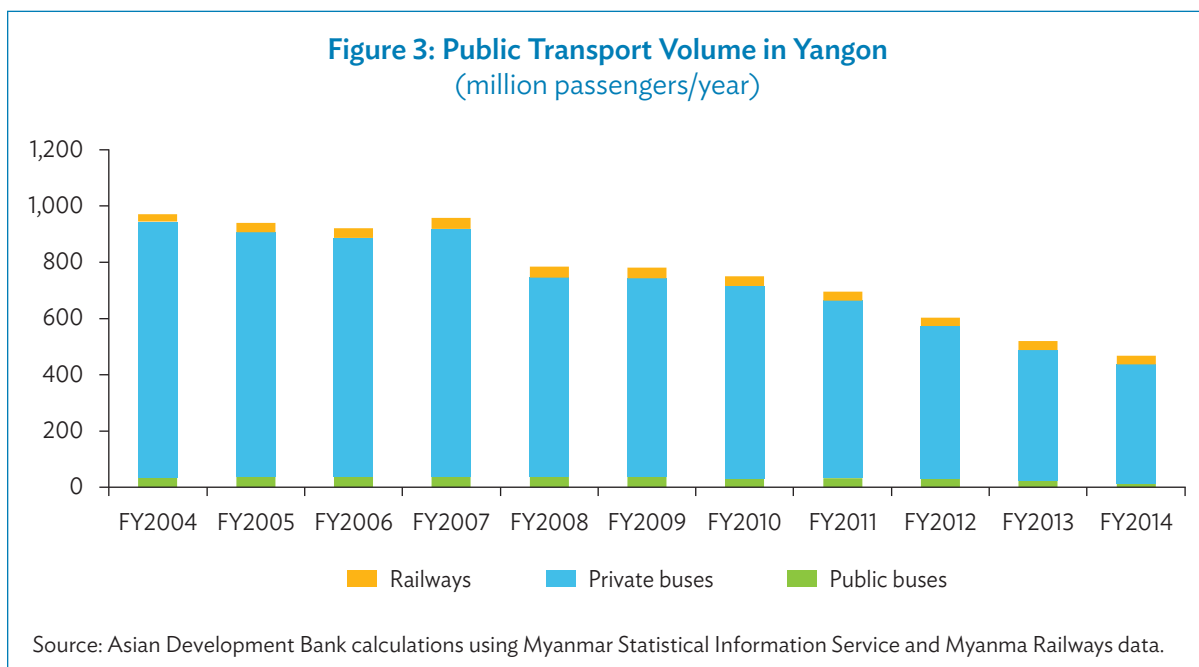
Table 2: Modal Share by Gender in Yangon (%)

Transport Mode	Modal Share Including Walk			Modal Share Excluding Walk		
	Male	Female	Average	Male	Female	Average
Walk	33.0	51.6	42.2			
Bicycle	16.6	9.4	13.0	24.8	19.3	22.5
Motorcycle	5.8	2.6	4.2	8.6	5.3	7.2
Car/Van	6.2	3.1	4.7	9.3	6.5	8.1
Taxi	5.6	3.2	4.4	8.4	6.7	7.7
Bus	29.0	28.0	28.5	43.4	57.9	49.4
Truck	1.1	0.4	0.8	1.7	0.9	1.3
Railway	0.7	0.6	0.6	1.0	1.2	1.1
Ferry	1.8	1.1	1.4	2.7	2.2	2.5
Others	0.2	0.1	0.1	0.3	0.1	0.2

Source: Japan International Cooperation Agency, 2013. *The Project for the Strategic Urban Development Plan of the Greater Yangon*. Final Report. Yangon.

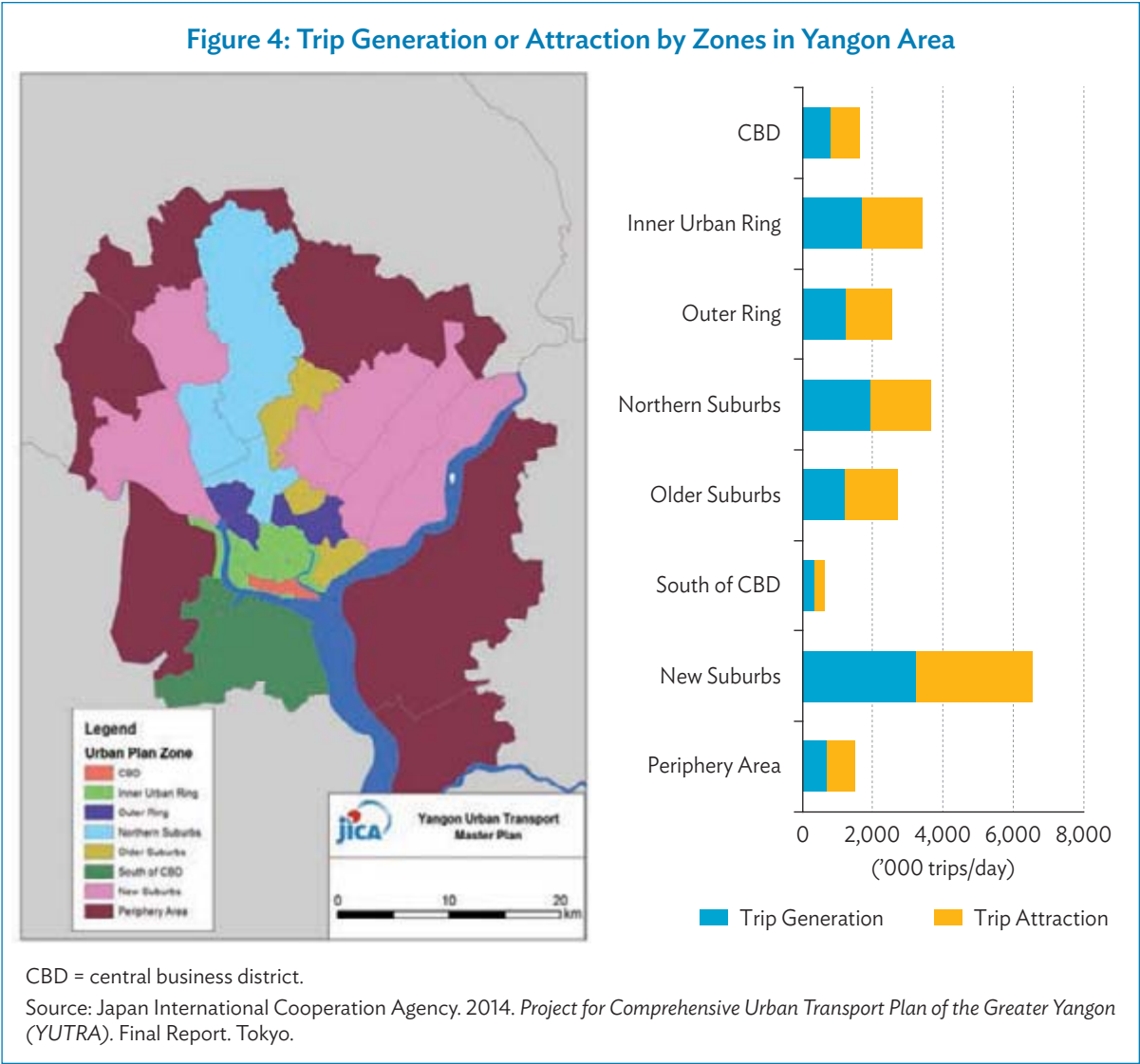
In what appears to be an uncontrolled hemorrhage, public transport has been quickly losing market share and volumes (Figure 3). According to official statistical data, public transport moved about 466 million passengers in 2014–2015. This is only 60% of the volume transported 5 years before, and less than 50% of the volume 10 years before. Public transport volumes have been decreasing at 10% a year since 2007.

Clearly, public transport plays a major role in Yangon's mobility and accessibility. The still low car ownership rate, together with the increasing affluence of a growing population, establishes a scenario whereby the existing high public transport mode share should be protected to ensure the city's future sustainability.



Transport attraction or generation is well distributed within Yangon area. The historic central district of Yangon does not emerge as a major attractor, and is actually more of a place where people live rather than work. The newer suburbs generate and attract a much larger population (Figure 4).

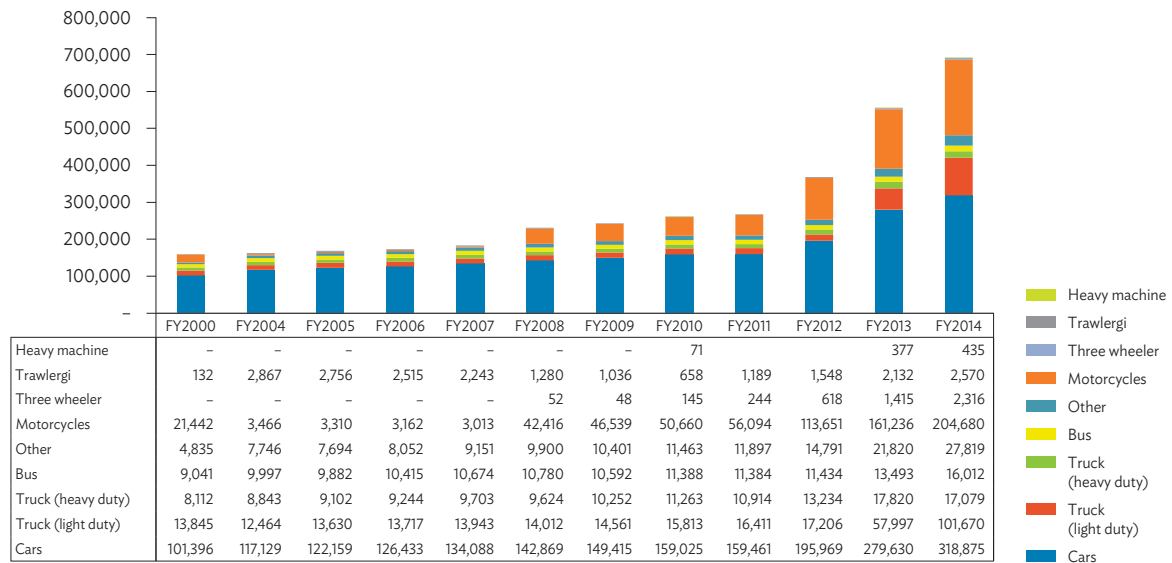
Figure 4: Trip Generation or Attraction by Zones in Yangon Area



Vehicle Fleet

The vehicle fleet has been growing at a fast pace since 2012. Until 2011, the vehicle fleet remained small. There were 174,379 vehicles in the Yangon Region in 1995, and only 267,594 in 2012, a 2.7% annual growth rate. In 2012, the government lifted several restrictions regarding the import and licensing of vehicles. During 2012–2015, the vehicle fleet in the Yangon Region has grown 37%. By April 2015, the number of vehicles in the Yangon Region reached 691,021. The number of cars doubled in 3 years. The number of light trucks increased by six times over the same period (Figure 5).

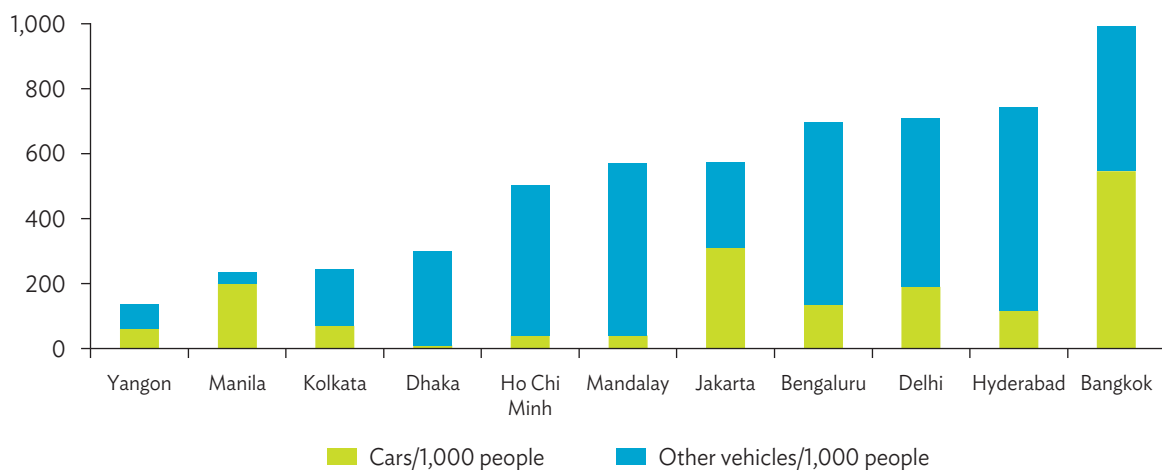
Figure 5: Vehicle Fleet in Yangon



Source: Road Transport Administration Department.

In 2015, the car ownership rate in Yangon urban areas was 62 cars per 1,000 people. This is well above Myanmar’s average (8.5); the Yangon region accounts for 72% of the national car fleet. However, because of the motorcycle ban, total vehicle ownership remains low. It stands at 135 per 1,000 people, against more than 500 in Mandalay. International comparisons with other car-intensive cities (e.g., Bangkok, Jakarta, Manila) suggest that car motorization rates could ultimately rise 5–8 times if left unchecked (Figure 6).

Figure 6: Motorization Rates—International Comparisons



Sources: Road Transport Administration Department for Yangon and Mandalay, and others.

1.3 Infrastructure

Streets. Yangon street network can be characterized by the following:

- There is a low proportion of space devoted to streets, but only moderately below that of Bangkok and Beijing (Table 3 and Figure 7).
- The street density and street space per person are within international average.
- The road network is dependent on a limited number of major roads (i.e., four North–South roads) connected by a fine network of narrow and winding streets (except in the city center) with an average road width of only 4.6 meters, which is exceptionally low by international standards.
- Parking on the streets is prevalent despite restrictions (not strictly enforced). There is barely any off-street parking space.
- The historical city center is dilapidated and characterized by a well-structured grid network but most of its secondary streets are blocked by vendors and parked vehicles.
- Congestion is rapidly worsening. In 2007, the average speed of cars in Yangon at peak hours was 38 kilometers per hour (km/h), and for buses 30 km/h. In 2013, only selected intersections were found to be choke points, while vehicles were in free flow in between. Car speed on the main axes has already fallen to 24 km/h at peak time, and buses to 17 km/h. Anecdotal evidence suggests that by mid-2015, average travel speed on the main corridors may have fallen to 10–12 km/h at peak hours.

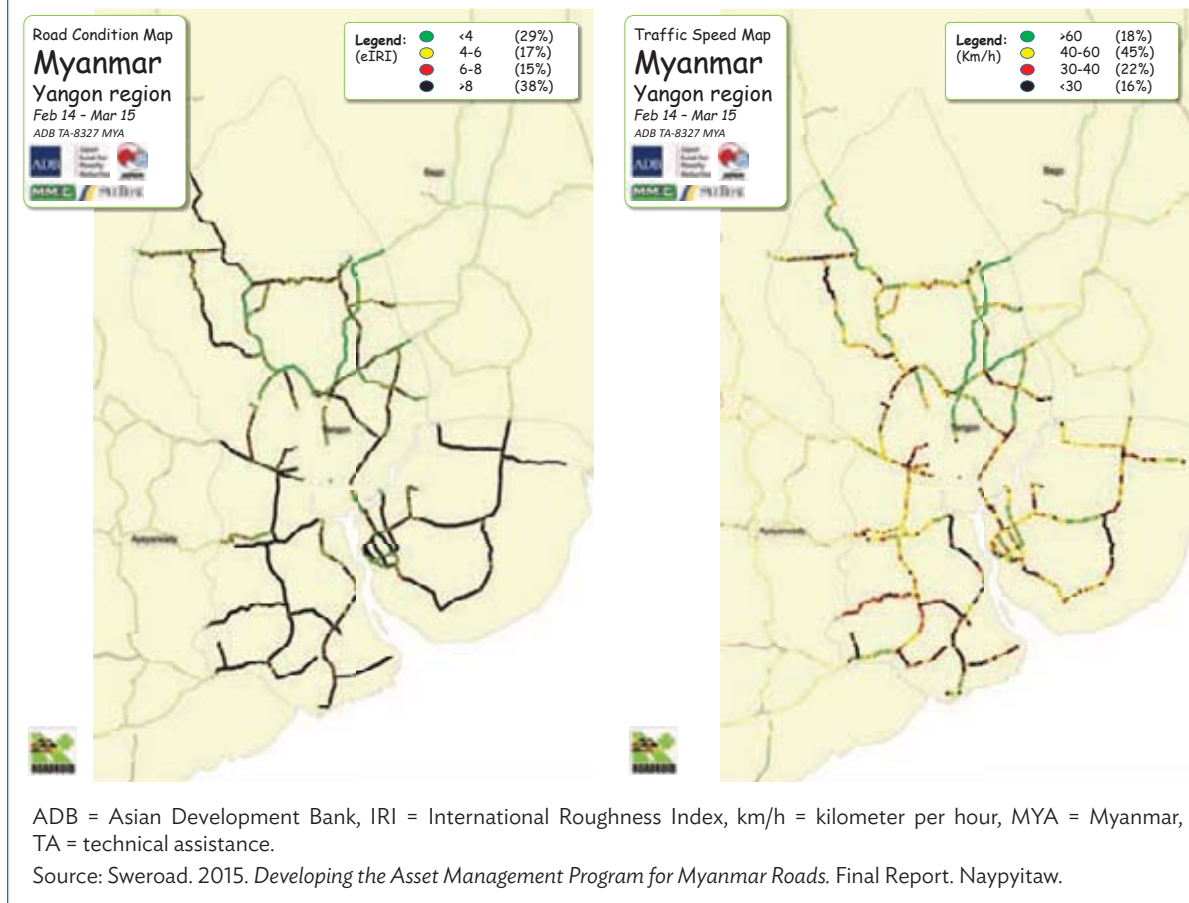
Table 3: Street Patterns in Urban Area—International Comparison

	Area (km ²)	Population (million pop)	Population Density (pop/km ²)	Total Streets Area (km ²)	Total Street Length (km)
Accra	257	2.6	10,012	18	1,780
Addis Ababa	274	3.0	10,839	24	2,541
Athens	730	3.4	4,658	107	10,529
Bangkok (metropolitan region)	2,566	8.5	3,313	162	14,837
Barcelona	1,147	5.5	4,784	168	12,848
Beijing	2,368	16.0	6,757	154	11,089
Dakar	266	3.0	11,278	27	3,561
Guadalajara	686	4.4	6,472	128	9,860
Jakarta	656	8.7	13,300	48	7,650
Medellin	194	3.6	18,557	32	2,299
Nairobi	238	3.3	13,866	20	1,703
Seoul	605	10.2	16,800	80	8,174
Singapore	615	5.2	8,455	63	5,555
Yangon City	829	5.1	6,200	43	9,945

km = kilometer, km² = square kilometer, pop = population.

Sources: Japan International Cooperation Agency. 2013. *The Project for the Strategic Urban Development Plan of the Greater Yangon*. Final Report. Yangon; UN-Habitat. 2013. *The Relevance of Street Patterns and Public Space in Urban Areas*. Nairobi.

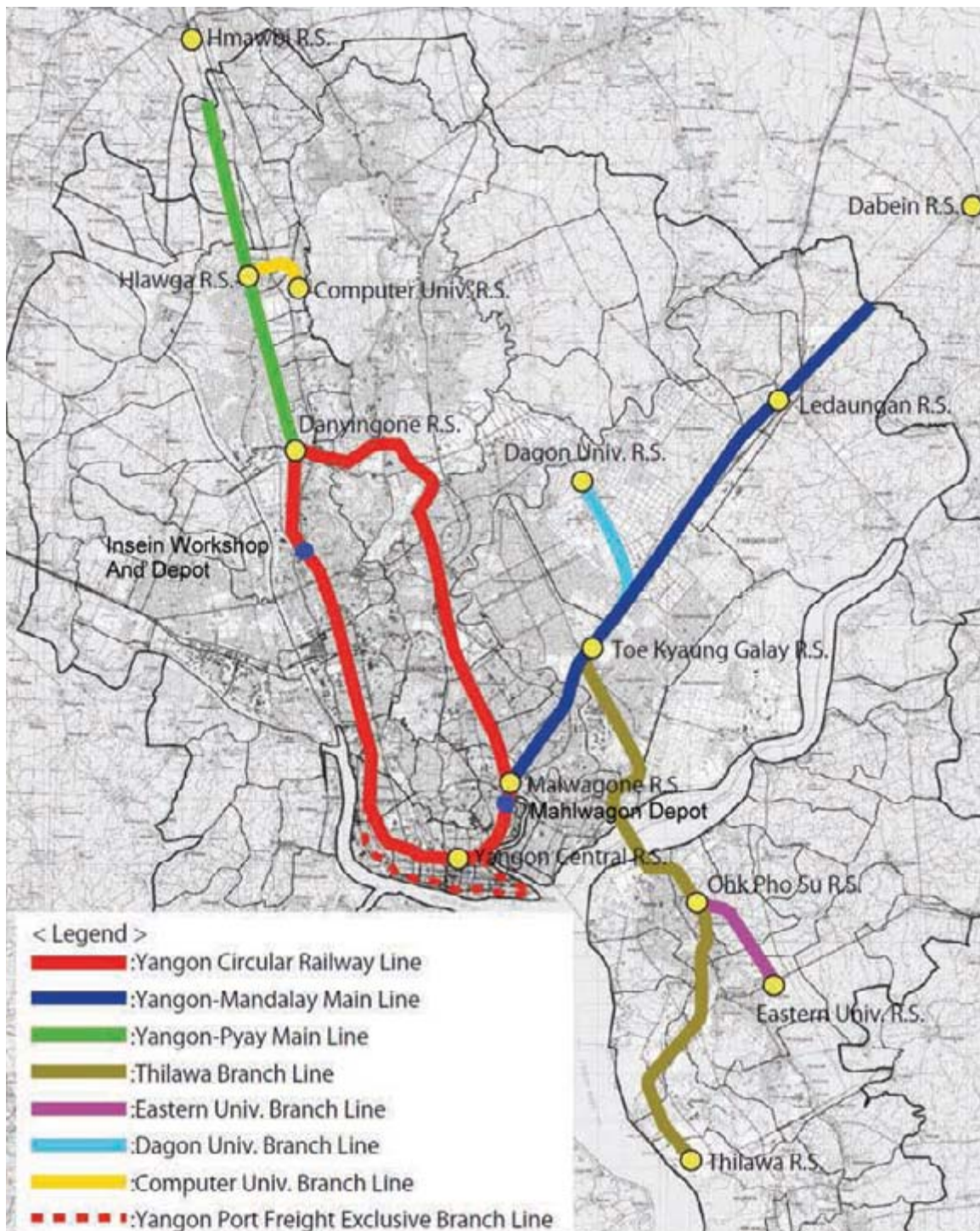
Figure 7: Condition and Speeds on Highways in Yangon Region



Highways. In 2014, more than 50% of highways connecting with Yangon were found to be in poor condition. They receive limited maintenance, as do the rest of the network under the control of the Ministry of Construction. Even though the highway network around Yangon constitutes a large share of national traffic, it only receives limited investments. Thus, most highways near Yangon (except the expressway) have exceeded capacity and are frequently congested (Figure 8).

Rail network. There are 148.3 km of railway lines and 58 rail stations in the greater Yangon area. This includes the Circular Railway—a large 47.5 km loop around the city, two main lines to Pyay and Mandalay with commuter rail functions (about 50 km), and single track branch lines. This network is extensive but only the main lines run frequent services. The low quality services and the poor condition of track and rolling stock attract only a small share of demand despite the low fares.

Figure 8: Yangon Railway Network



R.S. = Railway Station, Univ. = university.

Source: Japan International Cooperation Agency. 2014. *Project for Comprehensive Urban Transport Plan of the Greater Yangon (YUTRA)*. Final Report. Tokyo.

1.4 Public Transport Operations

As of early 2013, there were 11,413 buses registered in the Yangon Region (16,012 in 2015), of which 6,473 were providing local bus services in Yangon City. These bus services included the following:

- 595 city buses operated by one of the two private bus companies, Myanmar Golden City Link (80 city buses as of January 2013) and Bandoola Transportation (415 city buses). These companies own the buses and pay salaries to their drivers.
- 5,003 large and medium buses owned by individual operators (possibly owning 1–10 buses each) and controlled by one of the five Bus Supervisory Committees (BSCs). The BSCs are nonprofit organizations that monitor and supervise operation (e.g., with dispatchers) and charge a 2% management fee.
- 975 mainly smaller buses (Dyna or Hilux) and controlled by one of the ten Bus Line Committees (BLCs), which fulfil similar functions as the BSCs.

There are about 5,000 bus owners. Since early 2014, the government has banned Hilux trucks from carrying passengers and introduced a program to replace the traditional Dyna trucks by minibuses. These changes were met with resistance from operators and only partly implemented.³

Bus services are regulated by the Yangon Region’s Central Supervisory Committee for Motor Vehicles and Vessels, also called Ma Hta Tha Central. This committee is a permanent structure under the Yangon Regional Transport Minister; decisions are taken by a board comprising government and private operator representatives. The committee charges a 5% management fee for the BSCs and BLCs and a 0.1% management fee for the private companies. It does not provide subsidy. The main regulations are as follows:

- Fares are controlled by the Ma Hta Tha Central. Two systems are in use: (i) distance-based fare from MK50 to MK300 depending on the number of stops, and (ii) flat “special” fares of MK200 or MK300 (as of June 2013) mainly used by the private companies. The committee has the power to change the fare system and approve special fare systems.
- Market entry rules: (i) all buses must belong to one of the BSC or BLC, except for the private companies; (ii) buses and operators must first be registered with the national Road Transport Administration Department and receive operating license from the national Transport Planning Department; and (iii) operators must first submit an application to the BSC or BLC which endorses it (ensuring some self-regulation) and then formally submit it to the board of Ma Hta Tha Central, which will review it (no stated criteria for approval).

This process seems rather cumbersome and heavy and, combined with the restrictions on the types of buses, could limit the responsiveness of the bus system and its ability to serve the lowest income passengers.

Buses in Yangon are generally urban buses from 9 meters (m) (midi) to 12 m (standard) in length. In general, they are over 10 years old. Many of the older vehicles have doors on the left requiring passengers to board or alight on the highway. A conductor collects fares either inside or at the entrance of the bus.

³ Win, A. N. 2014. No relief in sight for weary commuters. *Myanmar Times*. 7 April. <http://www.mmtimes.com/index.php/in-depth/10088-no-relief-in-sight-for-weary-commuters.html>

Figure 9: Public Transport in Yangon



Conventional urban bus



Midibus



Bus stops in the city center can accept multiple services.



On radial routes, bus stops are smaller but offer shelter and seating.

Photos by Integrated Transport Planning.

Issues associated with the bus system and typical of informal bus services are as follows:

- Generally, services are of low quality—boarding is unsafe, there are long waiting and travel times, schedules are irregular, and passengers must endure discomfort while traveling.
- Limited planning leads to below optimum route structure.
- Insufficient revenues (as fares are maintained low by the government) limit possibility to maintain and improve vehicle fleet and services.
- Controlled entry by bus operators limit competition (regulations are in favor of existing operators).
- Bus driver incentives to maximize fare revenues lead to a race for passengers, lengthened layovers, and reckless driving.

Because of low-quality bus services, some users who can afford it opt to purchase cars. This improves their comfort but creates congestion, which further reduces the quality of bus services.

1.5 Institutions

As often the case in developing cities, the institutional setting for Yangon's transport is fragmented and characterized by overlaps and duplications. The main agencies are the following:

- Yangon City Development Committee (YCDC), which is in charge of local roads and urban planning;
- Yangon Regional Government, which chairs the Ma Hta Tha Central in charge of transport services;
- Ministry of Transport and Communications (MOTC), which oversees the Myanmar Railways and the Road Transport Administration Department, and has legal responsibilities regarding public transport licensing, which it chooses to enact through Ma Hta Tha Central;
- Ministry of Construction, which is in charge of national and state highways but, in practice, does not prioritize the Yangon region; and
- Ministry of Home Affairs, which oversees the traffic police.

Fragmentation limits the possibility of efficiently (i) developing and implementing multimodal plans since there is no approval authority; (ii) designing complex transport solutions, such as bus rapid transit (BRT), which require infrastructure improvements as well as service restructuring; and (iii) implementing organized traffic management. Actors communicate and coordinate generally well for routine tasks, but ambitious initiatives seem difficult to implement. For instance, since 2013, MRT, the regional government, and YCDC have each launched BRT initiatives. In April 2015, the regional government announced it would create a new public bus company consolidating operators and procuring modern buses under a “BRT Lite” approach. While this is a positive step, the concept lacks important features of BRT, namely segregated lines and stations ensuring that the buses run fast and at high capacity. At a strategic level, the Yangon Urban Transport Master Plan, completed in early 2014, was not yet approved when this report was drafted.

The setting—and particularly the lack of a clear leading organization—is bound to make it hard to implement efficient traffic management and multimodal transport plans, and to develop BRT. Government staff resources also need to be developed, e.g., traffic engineers, transport planners, and bus regulators.

Limited financing is another issue. In FY2014, YCDC had an overall budget of slightly less than \$250 million (about \$100 million in 2012–2013), of which only a small share is for transport. For highways, the Yangon Regional Government and Ministry of Construction allocated about \$250 million in FY2015 for the Yangon Region. MRT has also been in discussion with JICA about financing an upgrade of the circular railway line and has been inviting private developers to improve the rail stations. While these investments are a significant increase over the past years, they are still well below medium-term needs estimated to be about \$700 million annually for 2015–2025 by the YUTRA master plan.

2 Strategy Review

2.1 Strategic Options

This brief review of Yangon's transport system has emphasized the following points:

- Yangon transport system is bound for breaking down, unless car ownership is severely curtailed again.
- The opportunities for making short-term low-cost improvements lie in traffic engineering and demand management, particularly parking control.
- A well-planned road building program is necessary to develop the missing secondary road network, before or at least in parallel to the arterial network.
- The bus system is what moves the largest number of people; it needs modernization and better organization.
- Given the growing congestion, public transport needs to be partially or completely segregated from street traffic on arteries, starting with the most cost-efficient solutions.

These points are discussed briefly below, followed by a discussion of the draft Yangon Urban Transport Master Plan.

Immediate Future: Growing Congestion

It is highly likely that vehicle speed will further slow down in Yangon in the coming years as the number of cars and other vehicles rises. As the government used to ban both motorcycles in Yangon and car imports nationwide, people's mobility needs were severely curtailed. Since car import controls were lifted in 2012, the number of cars has doubled to more than 300,000 in early 2015. This was the situation in Bangkok in the late 1970s. Bangkok now has 3 million cars and as many motorcycles. When compared with the number of users moved, buses and taxis in Yangon take 6.5 times less street space. Cars and taxis in Yangon move 18% of people and take up 48% of street space, while buses move 48% of people and take up only 20% of space. As more people shift from buses to cars, street space will become even scarcer and traffic will grind to a halt.

This transformation has negative social and economic impacts. It would adversely affect the situation of the relatively poorer bus users, who will face increasingly long commutes and reduced accessibility to work and other places of interest. By reducing the supply of workers available, it would also limit the economic competitiveness of the Yangon area.

However, congestion in Yangon is not a straightforward result of low street capacity and the growing vehicle fleet. It also arises from on-street parking; street vendors; uncontrolled operations of delivery trucks; buses and taxis which often wait, load, board, or alight at improper points; and lack of sidewalks, which push pedestrians to the carriageways. These issues are particularly important in the city center.

Traffic Engineering and Demand Management

Traffic engineering measures such as putting up signs and signal lights, barriers, and turn points, channelization, on-street parking removal, better management of street vendors, etc. should be aggressively implemented. These measures will increase vehicle throughput capacity and improve network safety. They will only moderately delay the coming congestion since each new car user takes 6.5 times more street space than a bus rider.

Traffic demand management measures aimed at increasing the passenger throughput capacity would be the most efficient. The most quickly feasible measures include (i) charging for parking and aggressively removing on-street parking particularly in the central district; (ii) extensive development and enforcement of bus lanes; and (iii) formalization of bus stops and improvement of interchanges.

While politically more difficult, measures that restrict car usage or ownership seem necessary in the medium term. These measures are the following:

- Current car purchase taxes, which are high, should be maintained. Annual registration fees may be raised. A capping system may be considered, but the risks of corruption seem very high.
- The costs of running vehicles should be increased to reflect externalities, i.e., through a fuel tax.
- Physical restrictions on the use of low-occupancy vehicles (i.e., car) by banning their use or parking in selected areas or at specific times should be piloted.

Road Network Development

Even with considerable traffic engineering and demand management, Yangon will need to invest in its road network. This should include (i) development of new roads in the newly developed areas; (ii) improvement or upgrading of the secondary road network, which will inevitably require acquisition of right-of-way—a process that should be made fair and transparent but should avoid lengthy procedures; and (iii) increased road rehabilitation to repair potholes and pave roads.

At this stage of development, focusing on the development of arterial highways or urban expressways would simply add to the congestion in the medium term while consuming very large resources. Because the secondary network is not able to accommodate the traffic, new urban arterials would simply dump far more traffic than it currently does into the city center.

Bus Reform

The bus system needs to be the main transport solution in Yangon. An ambitious objective would be to maintain its current 50% share of public transport by becoming more efficient, convenient, and comfortable to appeal to the growing middle class who would otherwise shift to cars and taxis.

The initial steps taken by the regional government to consolidate individual private operators into a public-private company are meant to overcome the limitation of the current atomized, profit-driven, and only modestly competitive system. The risk in creating a large monopoly public transport operator is that it may not have the right incentives to be efficient.

The first steps toward reform should be to acknowledge that the current system has remarkably served the needs of Yangon transport users well, and that it constitutes a good basis for reforms. Regulation could usefully focus on improving safety, limiting undesirable behaviors (such as illegal stops), and improving incentives to drivers. Regulation and consolidation of all routes are not recommended as it would strongly reduce system flexibility; the regulatory restrictions could be simplified instead. Full-scale bus reform—i.e., consolidation of companies following market competition—could be implemented gradually, starting with the major arteries. In doing so, the government should refrain from directly investing in a system which has so far functioned without subsidies, but rather concentrate on providing the needed road and bus stop infrastructure and regulatory environment.

Mass Transit Development

Given the growing severity of congestion combined with the negative impact on public transport, there is a need to start providing transport facilities to move a large number of people at higher speed with limited land use. This requires segregating public transit from arterial street traffic. The YUTRA plan discussed below considers the provision of elevated urban expressways, as well as surface and underground rail transit. If all of these are implemented, they would severely strain government resources, and it would take many years before benefits accrue. Before costly investments, developing lower-cost improvements not requiring construction of new infrastructure should be prioritized. Segregated busways (BRT) would come at a low cost (\$5 million per km) and could be deployed where demand is high.

Fully modernizing the existing circular railway line for commuter and urban transport would come at a high cost (\$20 million per km), while the base demand is low. The system is unlikely to become financially sustainable and so it would require permanent subsidies to operate. Before committing large resources—a full upgrade may require resources equivalent to a decade of road investments—lower-cost measures such as rehabilitation should be considered and a higher rail patronage should be reached. Full-scale suburban rail or metro would come at a much higher cost, so their planning should be considered only when the patterns of demand are well known.

2.2 Review of the Transport Master Plan

Project for Comprehensive Urban Transport Plan of the Greater Yangon (YUTRA) Strategy

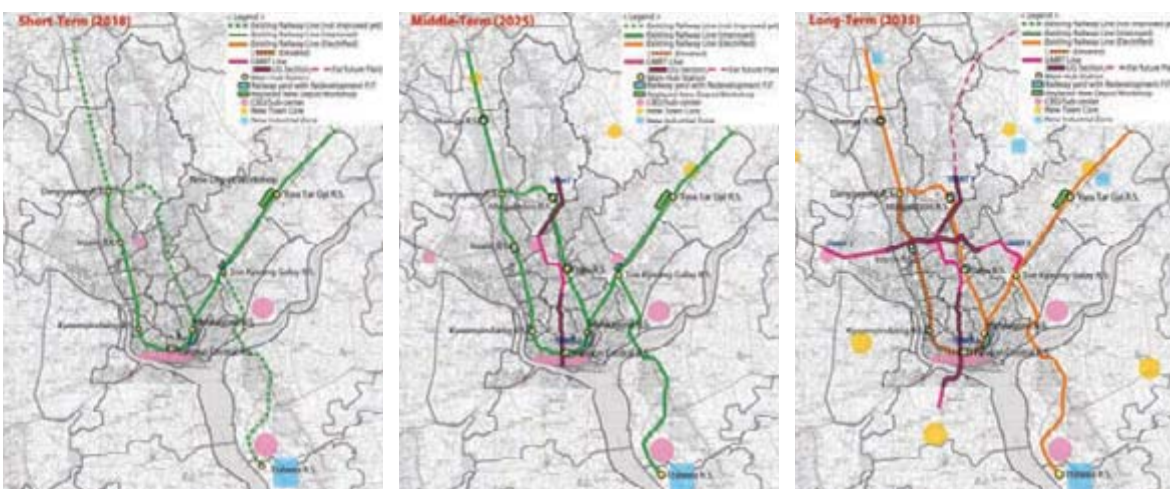
The YUTRA transport strategy includes the following elements:

- policy coordination with the Greater Yangon area through the creation of an urban transport authority—this authority to be created by a new law would coordinate planning and supervise the implementation of the main programs, including the BRT;
- authorization of city and transport master plans;
- promotion of integrated urban and transport development particularly transit-orientated development;
- development of urban expressways and ring road;
- development of a hierarchical mass transit system;

- early introduction of an integrated public transport system (BRT) to maintain public transport share;
- upgrading the present rail system;
- development and improvement of bus transport system, including reform of management systems and the business model; and
- promotion of public transport use and expansion of services.

The upgraded urban rail system provides the major mass transit mode with secondary routes being developed as a bus rapid transit (BRT) system and a reformed and remodeled urban bus network supporting both. Figure 10 shows the short-, medium-, and long-term rail network; Figure 11 shows the short-, medium-, and long-term road network; and Figure 12 the proposed BRT network.

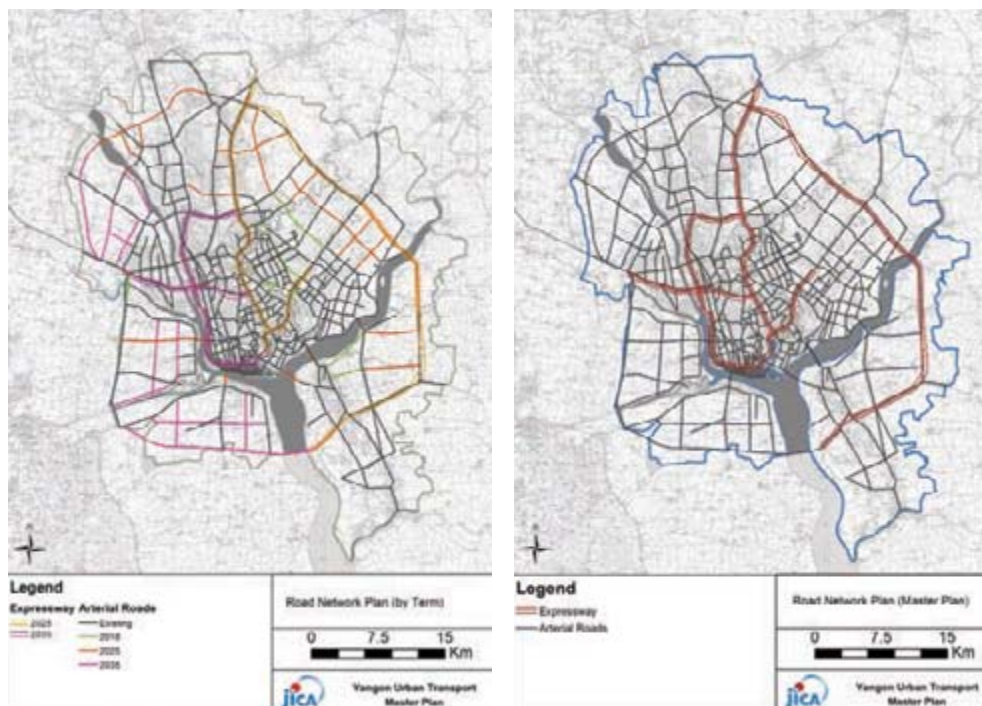
Figure 10: Project for Comprehensive Urban Transport Plan of the Greater Yangon— Short-, Medium-, and Long-Term Rail Network



Source: Japan International Cooperation Agency. 2014. *Project for Comprehensive Urban Transport Plan of the Greater Yangon (YUTRA)*. Final Report. Tokyo.

Figure 13 shows the proposed implementation schedule for the BRT routes, which is supposed to take place during 2014–2018. YUTRA estimated the implementation of the whole 244.9 km BRT network to be \$472 million, which is equivalent to \$1.9 million per km.

Figure 11: Project for Comprehensive Urban Transport Plan of the Greater Yangon— Short-, Medium-, and Long-Term Road Network



Source: Japan International Cooperation Agency. 2014. *Project for Comprehensive Urban Transport Plan of the Greater Yangon (YUTRA)*. Final Report. Tokyo.

2.3 Discussion of the Urban Transport Master Plan

Project for Comprehensive Urban Transport Plan of the Greater Yangon Proposals

Yangon suffers from increasing levels of congestion as a result of population growth, the expanding mobility of its residents, and rising private vehicle ownership. Action is required to plan the city's sustainable future. The bus network is essential to the city's mobility and, as such, its economic and social health. The plans promoted in the YUTRA study recognize the importance of a future robust public transport network for the city and advocate a hierarchical approach with strengthening the existing rail network as the primary mass transit mode, and the light rapid transport, BRT, and a remodeling of the conventional bus network in supporting roles.

Achieving the idealized transport network requires a comprehensive reform of the transport network itself and the institutional or regulatory structure that will plan and support it. This process is at a very early stage with the YUTRA plan, which is yet to be adopted by the government. The level of change advocated will require substantial effort and political subscription together with high levels of finance. As such, the supported approach can feel daunting in the face of escalating transport problems and pressure from many quarters to take an early initiative to improve the network.

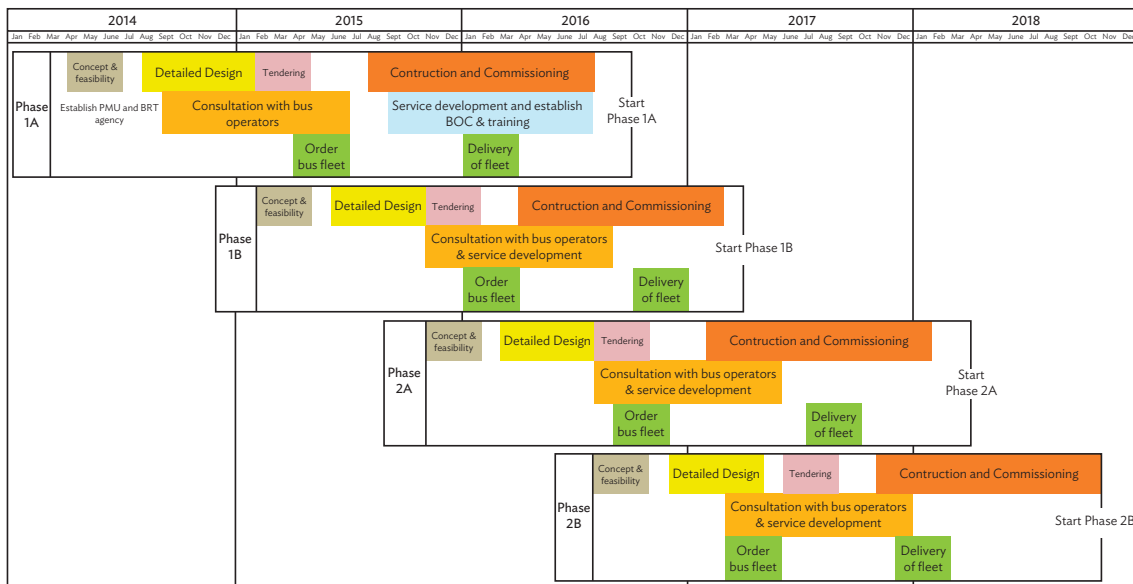
Figure 12: Project for Comprehensive Urban Transport Plan of the Greater Yangon— Bus Rapid Transit Routes



CBD = central business district.

Source: Japan International Cooperation Agency. 2014. *Project for Comprehensive Urban Transport Plan of the Greater Yangon (YUTRA)*. Final Report. Tokyo.

Figure 13: Project for Comprehensive Urban Transport Plan of the Greater Yangon— Program for Implementing Bus Rapid Transit Route



Source: Japan International Cooperation Agency. 2014. *Project for Comprehensive Urban Transport Plan of the Greater Yangon (YUTRA)*. Final Report. Tokyo.

The YUTRA report does, in part, recognize the scale of change necessary and advocates a sequential approach essentially consisting of the following actions:

- approve master plan,
- establish Yangon Urban Transport Authority,
- identify and secure government funding, and
- launch short-term projects.

The program offered within YUTRA for development of the BRT network (Figure 13) is clearly no longer achievable within the original time frame. Instead of being considered light solutions providing temporary fixes until a rail-based system is implemented, BRT projects should be considered permanent features and possibly become the backbone of a future transport system. Their implementation should be gradual because it will need to be in parallel with bus system reform.

Working Toward a New Bus Operating Context

The way in which public transport is currently planned and regulated places emphasis on the willingness of the private sector to enter the market. The high levels of demand, low levels of supply, negligible maintenance, and a system that makes it difficult for new entrants to the public transport market would indicate that significant profits are being secured by existing bus operators. While a thorough investigation into the status and modus operandi of existing operators has not been possible, it is anticipated that operators would be naturally averse to change, unless their position is secured in any new operating regime. As such, any proposed change in how bus operations are regulated, managed, and delivered will require comprehensive consultation with existing operators supported by a thorough understanding of the nature of their operations.

Instigating change in operations will require political mandate and a dedicated unit with YCDC that is empowered and able to manage change. The YUTRA advocacy of a strategic transport authority that is able to plan, regulate, and evaluate across all modes is sensible in this respect.

3 Potential Short- and Medium-Term Actions

The development of improved bus operations in key strategic corridors would enable reform to be focused on the routes that are most intensive in terms of public transport demand and that have the most congestion problems. The Project for Comprehensive Urban Transport Plan of the Greater Yangon (YUTRA) bus rapid transit (BRT) network defines those strategic routes and sequencing in terms of action.

The form of BRT advocated is not fully developed in YUTRA, as this will be the focus of downstream feasibility studies. However, the costing at \$1.9 million per kilometer (km) (indicated in YUTRA) would suggest a very light form of BRT, which may not provide a solid long-term foundation. A higher cost would likely be needed to provide sufficient throughput.

3.1 Developing the First Bus Rapid Transit Corridor

YUTRA is a strategic document, and much thought needs to be given in sanctioning the action required to build the defined strategy. The two primary areas of emphasis are building institutional capacity and implementing improvements.

The YUTRA study sees institutional restructuring as a precursor to development of the transport network. While this approach is understood and supported, implementing a new institutional structure in the government to plan and develop and in the private sector to operate requires fundamental change in thinking and approach. This will require much debate on the implementation risk and the securing of political support. It would be disappointing if such potential for inertia was to halt progress in the transport sector. Thus, it is suggested that institutional change be tested in a controlled environment through developing a single pilot BRT corridor.

Concentrating on an initial BRT corridor would not affect high level debate on governmental restructuring aimed at delivering integrated and sustainable transport approaches, but would allow—at a local level—government departments to come together to understand and develop an integrated approach. It would further represent an opportunity to work with a discrete part of the public transport industry to understand its potential for change into an industry that is contracted for service delivery providing quality user-oriented services.

Selecting an Appropriate Corridor

Using the YUTRA master plan as context, it is recommended that the choice of corridor should consider the following criteria:

- **Demand.** High levels of demand would ensure that many will benefit and can become advocates of change across the network.

- **Supply.** Simplicity in terms of the number of affected operators minimizes potential social impacts and simplifies the change in operating structure.
- **Operations.** This refers to the ability to develop an operational service plan that establishes the principles of quality user-orientated transport reaching a significant sector of the city and containing a mix of user types.
- **Physicality.** This would ensure that high levels (approaching 100%) of segregation from other traffic can be accomplished to protect and achieve preferential bus run times.
- **Development.** This refers to the relationship with future land use change to increase ridership and limit car ownership. Land development is also a possible funding source for infrastructure and maintenance.
- **Management of impacts.** Wide roads with the potential for carriageway reallocation would reduce the need for land acquisition and expensive civil works, but have impact on private car users who might be strong voices of opposition.
- **Deliverability.** Affordability is key. Equally important are identifying potential funding sources and ensuring that the design concept sits within the available funding envelope. An early assessment of risks is required along with careful monitoring of key risks and identification of mitigation plans. Key risks include political will, opposition from operators and road users, issues with land acquisition, and environmental and social impacts.

With these issues in mind, two YUTRA-proposed BRT corridors have been subjected to preliminary investigation—BRT 1 and BRT 2 (Figure 13). Table 4 contains a high level appraisal of the routes.

Table 4: Headline Appraisal of Bus Rapid Transit 1 and Bus Rapid Transit 2

Item	BRT 1	BRT 2
	Sule Pagoda Road–Zoological Garden Road– Bahan Road	Phone Gyi Street–Pyay Road
Demand	Major radial corridor with high demand	Major radial corridor with high demand
Supply	Many existing bus services with high levels of patronage	Many existing bus services with high levels of patronage
Operations	Some diversity of land use and potential to offer services beyond the corridor	Connections with Yangon university and a diversity of land use types Potential to offer services beyond the corridor
Physicality	Mainly a wide corridor but with some width constraints and congestion at key junctions	A wide corridor where continuous segregation is achievable
Development	Potential for new development along corridor	Potential for new development along corridor
Management of impacts	May require road widening	Largely road space reallocation where there is some spare capacity
Deliverability	Need to work with multiple operators Land acquisition increases delivery risk	Need to work with multiple operators

BRT = bus rapid transit.

Source: Authors.

BRT 2 is the preferred pilot route as it is considered to possess lower delivery risk. BRT 2

- is largely wide and without severe regular congestion,
- is already served by buses,
- has a high demand,
- is an important radial route, and
- has potential for patronage growth and integration with wider network.

3.2 Bus Rapid Transit 2 (Phone Gyi Street–Pyay Road)

The route is a major radial running between the central business district (CBD) and northern townships. The road is generally wide with two or three lanes in each direction with an occasional ornamental central reserve. Land use is mixed. A review of the main features of BRT 2 alignment is in Figure 14.

3.3 Central Business District

Three BRT routes proposed in YUTRA converge on the CBD, including BRT 2. This area is particularly important in terms of developing the transport network.

The CBD consists of a grid network of streets serving a relatively dense development mix of government buildings, offices, residential properties, and retail spaces (Figures 15 and 16). There are several route choices for mass transit in this area, with need for an area traffic management plan that

- establishes key origins and destinations;
- reviews parking and forms of parking management;
- examines traffic flow and defines a hierarchy of streets that determines optimal use of streets by mode and purpose;
- determines most appropriate and deliverable BRT, bus terminal, or interchange locations;
- allocates lanes for exclusive bus use, taking full account of the service frequency both for early implementation and the eventual full network of routes;
- considers the effective control of intersections and identifies the needs for an area traffic control center; and
- takes into account access modes such as walking and cycling.

As of 2015, the area has capacity in excess of demand although, as a result of various factors such as ad hoc parking and lack of traffic management, some areas suffer from congestion during the peak periods and beyond.

Figure 14: Review of Bus Rapid Transit 2 Alignment



Typical street view on Pyay Road, showing some off-street parking. There is potential to dedicate one lane to bus use. Initial views suggest segregated lanes should be placed in the median, but more detailed study is required.



Bus shelters are provided and most often well maintained.



Roundabouts along the route are sources of congestion but do not result in extended queueing traffic outside of peak hours.



The Yangon University represents a very large potential catchment area for BRT and may justify joining of BRT 1 and BRT 2 using University Avenue Road.



University Avenue Road experiences regular congestion throughout the day.

BRT = bus rapid transit.

Sources: Map data © 2014 Google Maps; Photos by Integrated Transport Planning.

Figure 15: Yangon Central Business District Area



Source: Map data © 2014 Google Maps.

Figure 16: Yangon Central Business District Streets

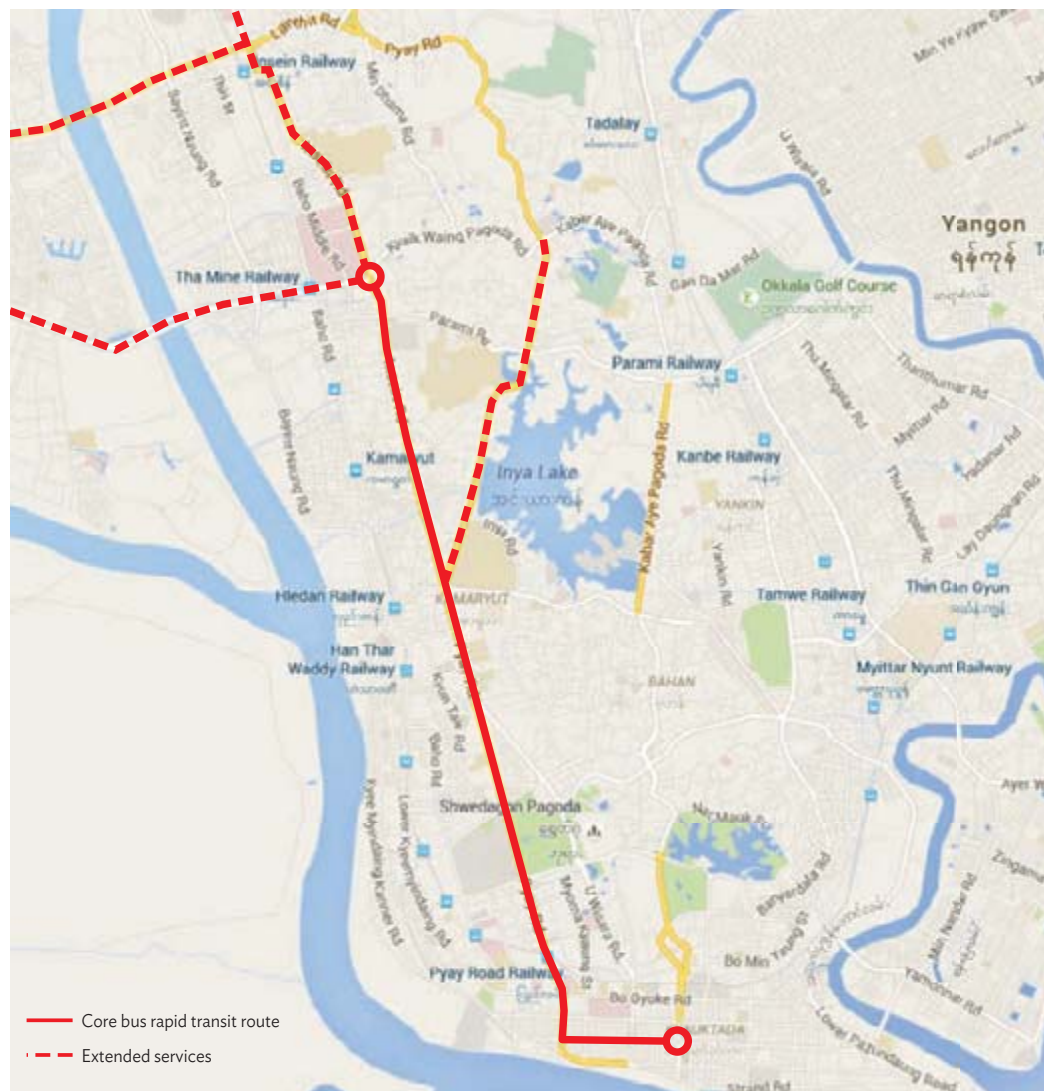


Central business district streets are wide and flanked with parking. Buses stop at curb side but, as many have doors on the left, passengers are forced to embark and disembark in the center of the road.
Photo by Integrated Transport Planning.

3.4 Developing a Bus Rapid Transit Pilot Route

While only very preliminary investigation has been undertaken, it is suggested that the initial BRT route could be a 10-km segregated section between the CBD and the junction of Insein Road and Kyaik Waing Pagoda Road. An “open” service plan that sees BRT standard services using the segregated lanes, then continuing “mixing with traffic” until their ultimate destination, appears feasible. This approach enables investment to be focused where it is most needed, to overcome congestion, to provide reliable journey times, and—at the same time—to enable service to other areas where demand is significant. Figure 17 shows the BRT core route and potential extended services. These extended services may be converted to BRT at a later date when the concept is proven and accepted.

Figure 17: Potential Bus Rapid Transit Corridor and Extended Service Pattern



Sources: Map data © 2014 Google Maps; possible alignment by Asian Development Bank consultant.

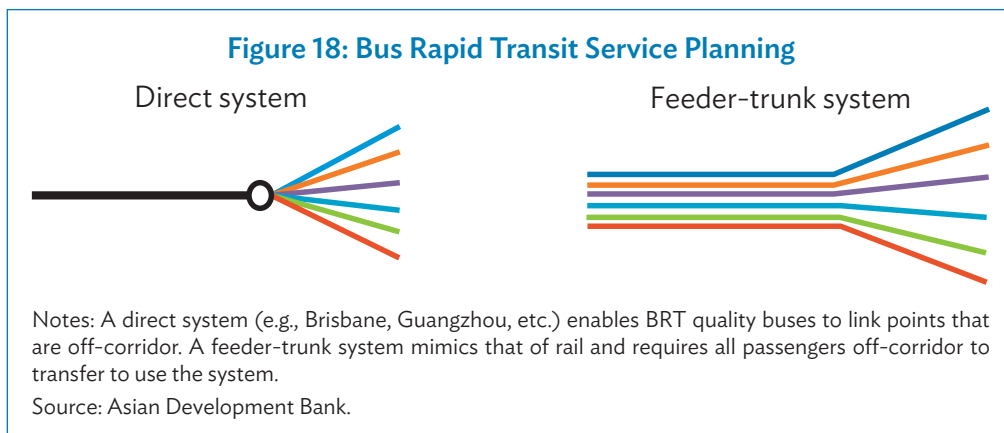
As a means of mass transit, BRT would change the way in which public transport is delivered throughout the corridor. Development of BRT would need to consider the following issues.

Demand Forecasting

There is a need to understand the origin-destination and scale of demand for BRT. This will include the potential transfer from existing public transport and the potential for mode shift. It will consider future growth. In terms of tools, either the TransCAD model used within the YUTRA study could be used or a cordoned area of this model could be used within another modelling package.

Service Planning

Existing bus services should be replaced by BRT. Through demand forecasting, the BRT and complimentary services planning should be optimized. It has been suggested that an open service plan for the BRT is optimal, which means that services go beyond the terminal points of BRT infrastructure (Figure 18). In addition, there may be a need for feeder services consisting of conventional buses and rerouting and/or termination of other existing services.



Infrastructure

A provisional review of the corridor would suggest that a median segregated BRT lane (Figure 19) might be achievable within the existing road cross section and preferable in that it simplifies interaction with other traffic (does not affect side road access). Terminal facilities would require consideration and could be developed either as interchange facilities or a simple bus turnaround. The need for bus layover (for timetable adherence) and extended layover (for driver breaks or shift changes) would need to be accounted for. Depot facilities would need to be designated.

Operational Planning

The restructuring of public transport within the corridor to accommodate BRT will require (i) a detailed understanding of the structure and capabilities of the existing transport providers and (ii) plotting their transition to a new structure and means of engagement. This is closely related to institutional planning and the determination of the means by which service providers are engaged.

Systems Management

There will be a need to define the role played by intelligent transport systems in systems management. This will include intersection control, fleet monitoring, passenger information, and fare collection technologies.

Institutional and Regulatory Planning

The means of supporting the development of BRT, its implementation, contracting its services, monitoring performance, and planning further development need to be considered. The level of institutional development required is consistent with wider institutional reform for the development, provision, and management of transport. A key consideration is the division of responsibilities between the private sector and public sector.

The regulatory structure would require review to ensure efficiencies in the designation and approval of routes and the means by which operators are engaged.

Appraisal

Project appraisal would examine social and environmental impacts together with economic and financial performance. Social impacts are most likely to be dominated by those on the existing public transport sector. Environmental impacts would include those on landscaping within the corridor and be offset by improvements in emissions. A mitigation and management plan would be required for both.

Project Process

In broad programming terms, the following would be required to implement a BRT project: (i) prefeasibility study, (ii) feasibility study, (iii) detailed design, (iv) operator engagement, (v) implementation.

Figure 19: Median Bus Rapid Transit Lane in Bangkok



Source: Integrated Transport Planning.

The starting point would be a prefeasibility study that would address all the issues above in outline form with the aim to

- define the extent of a BRT project;
- establish if there is justification for a project in economic, environmental, and social terms;
- determine if there is sufficient support for the project by those that would be instrumental to developing and implementing it; and
- identify funding mechanisms.

The study would be underpinned by effective and comprehensive engagement of the transport industry to determine its structure, issues, and potential for change. A steering group that involves representatives of all decision makers would be established.

Upon acceptance of the prefeasibility study, a full feasibility study would be conducted with the aim to

- define and cost infrastructure in precise terms including outline engineering drawings,
- identify and determine the cost of the service plan in precise terms,
- undertake independent environmental and social impact studies resulting in management plans, and
- conduct a thorough economic and financial appraisal to establish the project's benefits to society and the financial structure for delivery.

The timing and scope of subsequent project stages will depend on the definition and outputs of the feasibility study. In taking the project through implementation, the primary risks are political will, the need for institutional restructuring, and the ability to effectively engage the existing public transport industry. The critical path activity is likely to be operator engagement rather than infrastructure development. Such a study could be completed in 8–10 months.

The cost of implementing a BRT project depends on the BRT concept—typical cost ranges from \$5 million to \$10 million per kilometer. As such, the cost of the BRT corridor would be \$50 million–\$100 million.

Project Outputs

The BRT initiative as defined would

- demonstrate a significant improvement in the way public transport is delivered, offering a greater level of integration and user focus;
- establish the concept of mass transit;
- demonstrate that buses can be a quality means of transport, and reduce the rate of car ownership;
- provide a context for sustainable land use development;
- explore through a corridor approach an optimal relationship between public sector as a planning and contracting authority and the private sector as service provider;
- establish appropriate institutional and regulatory structures that can be extended citywide;
- demonstrate principles of environmentally friendly transport; and
- increase the capacity of the city in planning and managing transport.

Conclusion – Part I

Yangon is growing, supported by a mature public transport industry that serves about half of the trips within the city. Despite Yangon's circular rail line and wide radial routes, negative signs of increased mobility is starting to show with congestion extending beyond the traditional peak hour. While buses are well used, they are not reflective of demand and are of low quality. An increasingly affluent population is likely to reject a low-quality transport mode in favor of private transport. As motorcycles are prohibited within the city, car ownership will inevitably increase, which is already happening. Now is the time for intervention to establish a transport system that can support city growth, greater mobility, and affluence.

The Project for Comprehensive Urban Transport Plan of the Greater Yangon (YUTRA) study supported by the Japan International Cooperation Agency (JICA) is comprehensive in its approach and sets out a multimodal transport network that seeks to address the city's needs, taking into account planned growth. Being comprehensive, its implementation is daunting and requires significant change within the government, large scale funding, and much planning and management.

At the heart of the YUTRA plan is a mass transit network consisting of rail improvements and a bus rapid transit (BRT) system, supported by improvements in the conventional bus network. This requires immediate action. This report has examined the early phase of BRT proposals and identified BRT 2 as possessing the characteristics and primarily manageable levels of risk for a pilot corridor to establish principles, qualities, processes, and structures that could be rolled out across the city.

Developing a BRT pilot corridor would take approximately 3 years from concept to operation. It would start with a prefeasibility study to establish the support for and worth of the project, followed by full feasibility, design, and implementation. This would allow institutional structures to be explored including the desire for change of the public transport industry. A 10-kilometer segregated BRT line would cost \$50 million–\$100 million, depending on the concept. The key project risks are political will and operator response.

PART II

Urban Transport in Mandalay

1 Overview of Transport in Mandalay

1.1 Mandalay City Context

Transport Policy: Aims and Objectives

The National Transport Vision is “to develop an efficient, modern, safe, and environmentally-friendly transportation system in a coordinated and sustainable manner that embraces all transport modes for the benefit of the country and people of Myanmar.”⁴

This vision implies an integrated approach to development of the transport network and one that seeks to control the growth of private vehicles. It further recognizes that transport should play a role in economic growth, facilitating social networks and well-being of the people. Ultimately, this concept provides a context for the approach to be adopted in Mandalay.

At a regional level, the Mandalay City Development Committee (MCDC) is responsible for land management, planning, and delivery of urban services. Its mission is “to keep the city clean, to make the city beautiful and to enable the city dwellers to enjoy a pleasant life.”⁵

City Growth

The Mandalay City Development Concept Plan considered three alternative growth scenarios ranging from 1.01% to 2.1% per year. The scenario considered most likely (by MCDC) is that the population—then estimated to be 1.3 million—will grow to more than 3 million by 2040.

The 2014 Population and Housing Census of Myanmar showed a population of 1.25 million in the official city boundaries, and 1.73 million in the Mandalay District, which includes the five central townships (Aungmyetharzan, Chanayetharzan, Mahaangmye, Chanmyatharzi, and Pyigyidagun) and two suburban townships (Amarapura and Patheingyi), as well as 325,000 households (4.9 people on average per household) and 150,000 people living in institutions.⁶

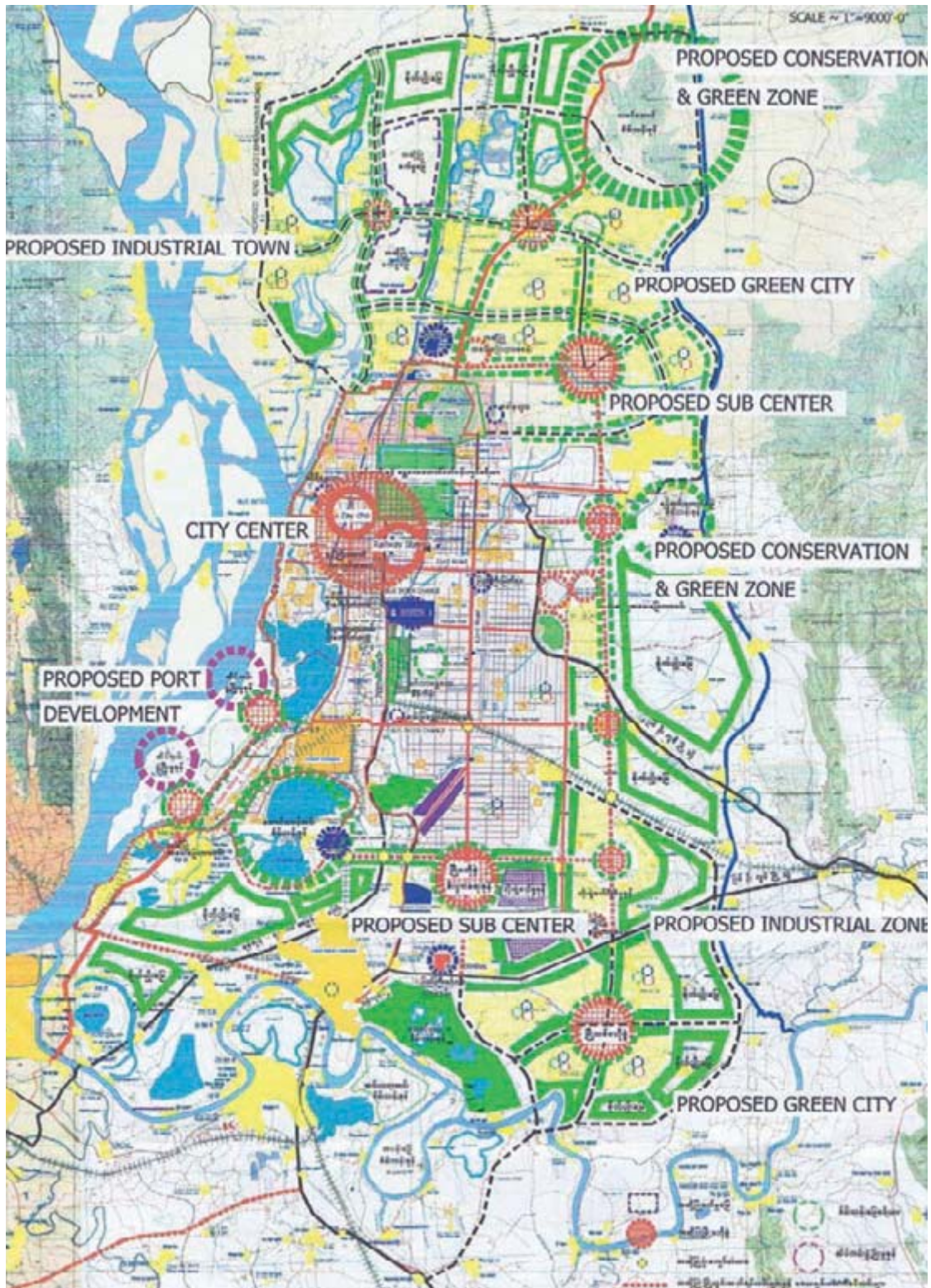
Growth will be accommodated through the development of Mandalay as a “multinodal” city (polycentric) with three new subcenters (Figure 20).

⁴ Government of Myanmar. 2014. *National Transport Development Plan*. Naypyitaw.

⁵ U Tun Kyi, MCDC Committee Member No. 1. 2013. Environmental Issues of Mandalay City, Needs for Cooperative Engagements. PowerPoint presentation. Mandalay. Quoted in ADB. 2014. *Scoping Study for a Strategic Development Plan for Mandalay*. Final Report. Manila (TA 8251).

⁶ Government of Myanmar, Ministry of Immigration and Population. 2014. *Population and Housing Census of Myanmar*. Naypyitaw.

Figure 20: Mandalay City Concept Development Plan



Source: Asian Development Bank. 2014. *Scoping Study for a Strategic Development Plan for Mandalay*. Manila (TA 8251).

Green City Concept

An initiative supported by the Asian Development Bank (ADB) developed the concept of the *Green City for Mandalay*, which is consistent with the draft Urban Development Concept Plan developed by MCDC.⁷

The Green City concept is cross-sectorial and seeks to achieve sustainability, inclusiveness, and competitiveness. In terms of transport, the following action is noted: “Minimizing the carbon footprint of transport by integrating transport planning with land use planning and by encouraging and facilitating public transport and the use of nonmotorized transport.”⁸

In terms of developing and managing spatial and transport planning, the report highlights the following barriers:

- There is little or no tradition of planning and spatial planning.
- The city is not responsible for preparing a transport plan; this lies with the regional government. There is no capacity at either level.
- The city has no position for a transport planner.
- There is a total lack of reliable statistical information.

The following actions for transport planning were noted:

- Prepare a public transport plan for the city.
- Prepare an urban mobility plan for the area around the Golden Palace.

The Green City document, particularly through its adoption within the Urban Development Concept Plan, provides a useful guiding document for any transport intervention.

1.2 Transport in Mandalay

Transport in Mandalay is dominated by motorcycles. It is estimated that two-wheelers account for 92% of trips, excluding walking (Table 5). Urban bus services play a minor role.

Table 5: Vehicle Fleet and Modal Share

Vehicle	Number	Transport Modal Share (%)
Motorcycle	688,000	70.2
Bicycle	300,000	21.6
Car	54,000	5.6
Bus	450 ^a	2.6

^a This refers to daily operations.

Sources: Road Transport Administration Department and Asian Development Bank estimates.

⁷ Asian Development Bank. 2014. *Scoping Study for a Strategic Development Plan for Mandalay*. Manila (TA 8251).

⁸ Footnote 4.

The Mandalay region has 30% of the country’s motorcycle registrations with 688,652 registered motorcycles in 2014 in the city alone (1,182,691 across the region). This equates to 2.12 motorcycles per household (0.16 for cars and 0.92 for bicycles), and a motorcycle ownership rate of about 400 per 1,000 population.⁹ The motorcycle ownership rate might appear high, but international comparisons indicate that it could still grow by 50% before saturation point is reached (Box 1). Considering that the city population is likely to double by 2030, the number of motorcycles may triple.

Box 1: Motorcycle Ownership—International Comparison

Motorcycle ownership has exploded rapidly in Asia. In Viet Nam’s Ho Chi Minh City, vehicle ownership by household is 2.01 motorcycles, 0.76 bicycle, and 0.09 car (total 2.86), with an average household size of 3.6 persons. Ownership levels are roughly similar in Ha Noi, and the average ownership levels of the two cities shows a motorcycle ownership of 560 per 1,000 population. In 2007, the number of registered motorcycles in Denpasar, Bali was 390,000 of the total 457,000 registered vehicles. Motorcycle ownership in Taipei,China is slightly higher at 600 motorcycles per 1,000. Motorcycle ownership in Taipei,China has remained constant for the last 2 years and, as such, could be considered to have reached saturation point. By comparison, Ho Chi Minh City and Ha Noi are also close to saturation.

Source: Authors.

Use of Transport by Purpose

The motorcycle dominates all trip purposes as illustrated below.

Table 6: Main Modes of Travel for Different Trip Purposes

Work	Shop	School	Recreation
1. Motorcycle	1. Motorcycle	1. Motorcycle	1. Motorcycle
2. Bicycle	2. Walk	2. Walk	2. Car
3. Walk	3. Bicycle	3. Bicycle	3. Bus

Sources: Household survey; Asian Development Bank. 2014. *Scoping Study for a Strategic Development Plan for Mandalay*. Manila (TA 8251).

The dominance is greater when considering that four times as many people travel to work by motorcycle than by bicycle and twice as many go to school by motorcycle than by walking. The motorcycle is therefore extremely dominant as a transport mode for all purposes within the city with public transport playing a negligent role.

⁹ Road Transport Administration Department.

Box 2: Modal Share—International Comparison

Many cities of similar gross domestic product throughout the world have high public transport modal share, 75%–85% in the region. However, in some Asian cities such as those in Viet Nam and Taipei, China, motorcycles in particular compete strongly with public transport and consequently have similar mode shares to that of Mandalay. This has been attributed to different factors including (i) the historic dominance of bicycle as a transport mode; (ii) the absence of a public transport sector because of lack of market identification by the private sector or identification of need by the public sector; (iii) cheap imports of motorcycles with low-cost finance deals and low import duty; and (iv) the desire for personal mobility and the means of achieving it with limited income.

Source: Authors.

1.3 Public Transport

Supply

While the city has a train line and a central train station, the train line plays no urban transport function and, due to its slow and uncompetitive run times, has a limited regional or national function.

Consequently, the only means of public transport is via the 57 bus routes that are plied by a fleet of 817 buses. These are made up of

- 18 city buses (90,000 passengers per month);
- 383 Dyna (759,600 passengers per month);
- 15 Hilux (24,300 passengers per month); and
- 401 light trucks (686,700 passengers per month).

Bus routes cover the vast majority of the city. Buses carry approximately 55,020 passengers per day. They operate from 6 a.m. to 6 p.m. and generally make three trips per day. The average route length is 22 kilometers (km) with a range of 16–35 km.

Out of the 817 buses, only 450 are operating daily—approximately 3 trips and 120 passengers per day (40 passengers per trip). This is extremely low utilization. Buses are generally overcrowded (typically 25–30 people in Hilux, Dyna, or light trucks), with passengers standing on the steps at the back of the bus and often on the roof (Figure 21). The low utilization is because the number of bus trips is reduced, and the majority of passenger trips (up to 75%) are reported to be from terminus to terminus.

Buses are operated by four branches, which are nongovernment organizations (NGOs) that coordinate individual bus owners or operators. The branches are not geographic and can operate throughout the city. Most public transport vehicles use diesel with some petrol, 163 of which use compressed natural gas (161 Dyna and 2 Hilux).

Figure 21: Types of Public Transport Vehicles in Mandalay



City bus



Dyna



Hilux



Light truck

Photos by Integrated Transport Planning.

Public Transport Institutional and Regulatory Structure

A multilayered bus operation system is in place in Mandalay. It consists of the following:

- **Level 1: Bus owner or operators.** Some of them may own several buses.
- **Level 2: Bus associations.** They represent groups of individual owners.
- **Level 3: Bus Supervisory Committee.** The Bus Supervisory Committee (BSC) is a single body that controls and manages bus operations throughout the city. The BSC is elected from association members and headed by the Regional Minister of Transport.
- **Level 4: Branches.** The BSC organizes operations (and associations) into branches. There are four bus branches plus one for taxis and one for veteran operators (who own or operate three vehicles only). Each branch represents a group of townships (terminals for buses).

Buses in Mandalay are owned and operated by private entities. Bus owners must register their vehicles to ensure that they are fit for operation. The Motor Vehicle Law of 1964 requires the registration of vehicles and a transport business license. Registration and licensing is granted by the local offices of the Ministry of Transport and Communications, which act under the supervision of the Regional Ministry of Transport. Bus owners must then apply to operate a bus route to an association, which in turn submits it to the appropriate branch, which forwards it to the BSC for approval.

An application to operate might include the following:

- Details of the vehicle(s) including the registration documents
- Route proposed, including trip length, terminals, and trip time
- Days of operation
- An organization chart of the bus operation
- Map showing bus stops

The number of buses under each branch is shown below.

Table 7: Number of Buses under Each Branch

Branch	City Bus	Dyna	Hilux	Light Truck	Total
I	18	151	2	84	255
II	0	118	7	232	357
III	0	111	6	85	202
IV	0	3	0	0	3
Total	18	383	15	401	817

Source: Data gathered by Road Transport Company for the purpose of the study.

The following are origin points for bus services, with the vast majority terminating in the city center:

- A - Myayenandar (New Satellite Town)
- B - Patheingyi
- C - Industrial Zone
- D - Yadanarpon (New Satellite Town)
- E - Amarapura
- F - Myitnge
- G - Mandalay Hill
- H - Tharyargone
- I - Kywenaphar
- J - Aungpinlae (New Satellite Town)
- K - Tampawaddy

Bus fares are distance-based with a minimum fare of MK150 (\$0.15) and maximum of MK400 (\$0.40). Fares are set by the regional government and the road and local navigation transport organization. By international standards, these fares are within the normal range for a low-income country (Box 3).

Box 3: Public Transport Fares—International Comparison

In most cities, fares are distance-based, adopting the principle of correlating cost of provision with payment. The level of payment levied is dependent on many factors including affordability and transport and social policy. A subsidy is required when the mandated fare produces revenue less than the operating cost. If public transport is treated as a public good, then fares should be equitable, i.e., affordable to those without travel choices. If public transport is considered an environmentally and sustainable alternative to private transport, then fares should be set at a level that attracts those that might otherwise be enticed by private transport. Concessions for the most vulnerable travelers in the community is a key consideration. It is not known how bus fares are set in Mandalay.

A report commissioned by GTZ demonstrated that there is a general correlation between gross domestic product per capita and urban transport prices. Considering an income-based classification of countries, the average price for normal nonsubsidized fare for a 5-kilometer bus ride was \$0.20 in low-income countries, \$0.40 in middle-income countries, and \$1.60 for European countries.

Source: Asian Development Bank consultant.

Fares are collected on the bus usually by the conductor and sometimes by the driver, and handed over to the bus operator who then must allocate fares according to the following percentages:

- BSC salaries—30%
- Investment by BSC—30%
- Office management—15%
- Bonus for branch associations—10%
- Bonus for BSC members and employees—5%
- Gratuities—5%
- Donation for social purposes—5%

In addition, the branch and the BSC share MK500 (\$0.50) per bus per day. The BSC monitors bus arrivals and departures and ensures that the conditions of the licenses are met.

2 Urban Transport Assessment

2.1 Road Hierarchy

Mandalay is essentially a grid structure, tightly defined at its center and becoming more loosely defined toward its suburbs. It is a low density city with no tall buildings. In the city center—defined as the area bounded by 26th Street or 35th Street, and 78th and 84th Street—and its immediate surrounding areas, the streets have continuous, active frontage development. Outside of this area, buildings are generally set back from the road and constructed within large plots (Figure 22).

The road hierarchy is readily defined by wide major roads with multiple lanes (two or three in either direction) and with regular and occasionally wide sidewalks. In the city center, second order streets are narrower, generally with wide single lane roads (about 10 meters [m]) with occasional sidewalks. Outside of the city center, roads are wide (about 15 m) with lanes unmarked.

Major intersections are controlled by stand-alone traffic signals. They are LED signals and some are solar-powered implemented in 2011 by MCDC. Traffic police control some intersections throughout the day.

Parking of both motorcycles and cars on the roadside and on wide sidewalks is prevalent. At key trip attractors, such as shopping malls, parking is organized by security staff. In the city center, parking charges are collected by MCDC staff or agents on their behalf.

2.2 Land Use

Land use across the city is generally quite mixed although retail concentrates in the city center with additional retail on the major roads. Office development is spread across the city, as is residential, but there are greater concentrations and densities of residential development at the southern and south eastern fringes of the city. Residential development in the north and northeast tends to be low density. Industry is predominantly located in the southeast of the city.

2.3 Pedestrian Facilities

Although walking is the primary transport mode, pedestrian facilities are generally poor and largely incomplete. There are sidewalks at the main roads, but these are often planted with trees, have broken slabs revealing open drains, and are used for parking motorcycles or extending the trading beyond the shop front. Pedestrians are often forced to walk on the road, increasing conflict and the potential for accidents as well as reducing the capacity of the road. Additionally, there is a lack of protection for pedestrians crossing at intersections (Figure 23).

Figure 22: Road Infrastructure Examples in Mandalay



Typical major road



Secondary road outside the city center



Organized motorcycle parking



Photos by Integrated Transport Planning.



Example of signaled intersection

Figure 23: Pedestrian Facilities



Even outside shops, sidewalk defects are common.



Pedestrians are directed into a dangerous situation.



Motorcycle parking prevents safe walking and hinders access to businesses.

Photos by Integrated Transport Planning.

Away from the main roads and outside the city center, roads do not have sidewalks but are wide and lightly trafficked, enabling pedestrians to walk unhindered.

2.4 Cycle Facilities

Many of the major roads have cycle lanes designated by a yellow continuous line. These cycle lanes are created where it is convenient, i.e., on wide roads, but not necessarily where they are most needed. They are often compromised by parking of motorcycles and cars. Where cycle protection is most needed in the city center, there is none.

2.5 Public Transport

Buses play an extremely limited role in Mandalay's urban transport. Only the most cost-sensitive and those who have little choice use them. The vehicles themselves are extremely uncomfortable, inappropriate in size, difficult to access, poorly maintained, polluting, and noisy.

Drivers receive negligible training and are, reportedly, rude and unaccommodating to their passengers.

The bus fleet is extremely old and has doors on the left, which means that passengers have to access the bus from the center of the road and alight into moving traffic (Figure 24).

The bus routes are largely historic, serving the city center from peripheral traditional residential areas. There is no origin and destination data to enable appropriate planning of bus routes.

Figure 24: Public Transport in Mandalay

Doors on the left let off passengers into traffic.
High floor buses make it difficult to enter and exit the vehicle.



Overcrowding is uncomfortable and dangerous.

Photos by Integrated Transport Planning.

The majority of public transport vehicles leaving the city center are observed to be full, with passengers hanging onto the back rail and sitting on the roof of Dyna vehicles. If the reported two-thirds of passengers traveling between terminuses is correct, then only 33% of the 817 public transport vehicles running are able to pick up passengers en-route. This means that only 270 buses truly perform an urban function, with the remainder being a virtual suburban shared taxi. The large absence of any intermediate service might mean there is suppressed demand for public transport, but this has to be explored.

The public transport network is not appropriate for a city of this size. In addition, its quality does not convince motorcycle users that it is a viable alternative. At best the public transport network offers affordable travel between the city center and certain suburban areas for those who have little or no choice.

The institutional or regulatory structure that approves, controls, and manages public transport in Mandalay is multilayered. The initial designation of a bus route is driven by private sector desire rather than by either demand or planning strategy. The means by which public transport is then organized and paid for is cumbersome, making entry by a new operator difficult. The structure further ensures that the majority of revenue collected funds the institutional structure rather than the maintenance or improvement of service levels. There is no investment in new vehicles, effective maintenance, or training of personnel. It is a system operating at its most basic level.

2.6 Bus Terminals

Bus terminals are outside the city center, but still within the city structure. They serve intercity bus services. There are currently five terminals (Figure 26). The organization of each is similar, with a large marshalled parking area for large intercity buses of varying qualities. Some are high specification air-conditioned coaches, and others are non-air-conditioned more basic vehicles.

There are some retail and food stalls at the terminals. Parking areas and loading or drop-off points for trucks contain a mixture of passengers and goods together with motorcycle parking and access. Although they might appear chaotic, bus terminals, which are closely managed by various personnel, operate efficiently and are well-organized. Ticket sellers and staff organize parking of vehicles and assist passengers in boarding and alighting. However, access to these areas is not always easy with the presence of large vehicles, complexity of movement, ad hoc parking, and much informal retail activity.

Outside the terminals, the areas are generally chaotic. Onward journeys are made predominantly by motorcycle or shared taxi, and transfer of bulk luggage from long distant transport to trucks takes place on the street. These areas are not actively managed and, depending on location, are a major source of congestion. The land use in these areas is typically informal.

Figure 25: Bus Terminals



While appearing chaotic, terminals are carefully organized. Many retail, food, and ticket kiosks exist in bus terminals.

Photos by Integrated Transport Planning.

Bus terminals are important activity nodes attracting many people, acting as an entry point to the city and thus providing the first impression of the city to domestic and international travelers alike. More bus terminals are proposed alongside the growth of the city. These will be key nodes of access to the city and require a system of transfer to ensure passengers are able to make their onward journey swiftly and securely.

Figure 26: Location of Bus Terminals



Source: Map presented by Mandalay City Development Committee quoted in Asian Development Bank. 2014. Scoping Study for a Strategic Development Plan for Mandalay, Manila (TA 8251).

2.7 Railway Facilities

The main railway station sits on the eastern edge of the city center. It serves trains traveling to the south of the country and serves no urban distribution function. A further train station exists north of the Palace Square. The link between the two stations was severed in 1994 when the palace management was taken over by the military and the square was restored (Figure 27).

The future role of either train stations as an important transport and activity node is dependent on the upgrade of its services, which are currently unable to compete with coach services in terms of speed or comfort.

Figure 27: Old Rail Line Alignment



The rail line alignment still exists beyond the railway station and terminates at 26th Street immediately before the Grand Palace.

Photos by Integrated Transport Planning.

2.8 Taxis

There are 315 taxis licensed to operate in Mandalay City. The taxi vehicles are registered and approved by the Bus Supervisory Committee (BSC) and operated under a branch of that committee.

3 Emerging Transport Issues

3.1 Congestion

The road network is largely uncongested except during peak hours at major intersections where, in general, queues clear relatively quickly. The exception is the city center where 26th Street is congested for most of the day (Figure 28). The intensity of activity around the city center area bounded by 84th Street and 78th Street also causes congestion for most of the day.

Figure 28: Traffic Congestion due to Mixed Traffic



Off-peak congestion in the city center (26th Street) is compounded by uncontrolled junctions which are fraught with conflict.

Photo by Integrated Transport Planning.

The bigger concern is the future congestion as travel growth is intensified by population growth and an increasingly affluent population that is driving increased motorization.

3.2 Road Crashes

Road crashes in the Mandalay region are recorded by the Road Transport Administration Department. In 2014, about 400 fatalities from road crashes were projected in the Mandalay region (Figure 29). Driver's fault was considered the major cause (99% in 2013), with 75% of crashes involving a motorcycle.

Table 8: Crash Records

Type	2013	2014 (up to August)	2014 (Projected)
Damage only	1,202	860	1,290
Injury	1,943	1,256	1,884
Fatality	355	274	411

Source: Road Transport Administration Department.

Anecdotal evidence suggests that accidents are reduced at signalized intersections.

Figure 29: Motorcycle Safety Issues in Mandalay



While wearing helmets is compulsory, there is a tendency not to wear them in the evening when police are not present. There is also an absence of protection for children, who are the most vulnerable users. Photo by Integrated Transport Planning.

3.3 City Center Transport Constraints

The city center is a constrained area of intense activity, primarily retail and office. Areas specialize in certain products or services, giving identity and order. Virtually all public transport routes terminate in the city center with vehicles laying over for a considerable time.

The city center is also a key attractor of motorcycles. Motorcycles, public transport vehicles, and delivery trucks all park on streets, restricting the roads to a single lane in many instances. This causes congestion, conflict, and much stress and frustration. Junctions are not able to work effectively, including signalized ones, as both their entry and exit capacities are compromised by parked vehicles (Figure 30).

In transport terms, the city center is functioning on the edge of breaking down.

Figure 30: Transport Situation in the City Center



Public transport vehicles are often parked for several hours on 84th Street.



The city center needs access for goods to be taken in and out.

Photos by Integrated Transport Planning.

3.4 Motorcycle Culture

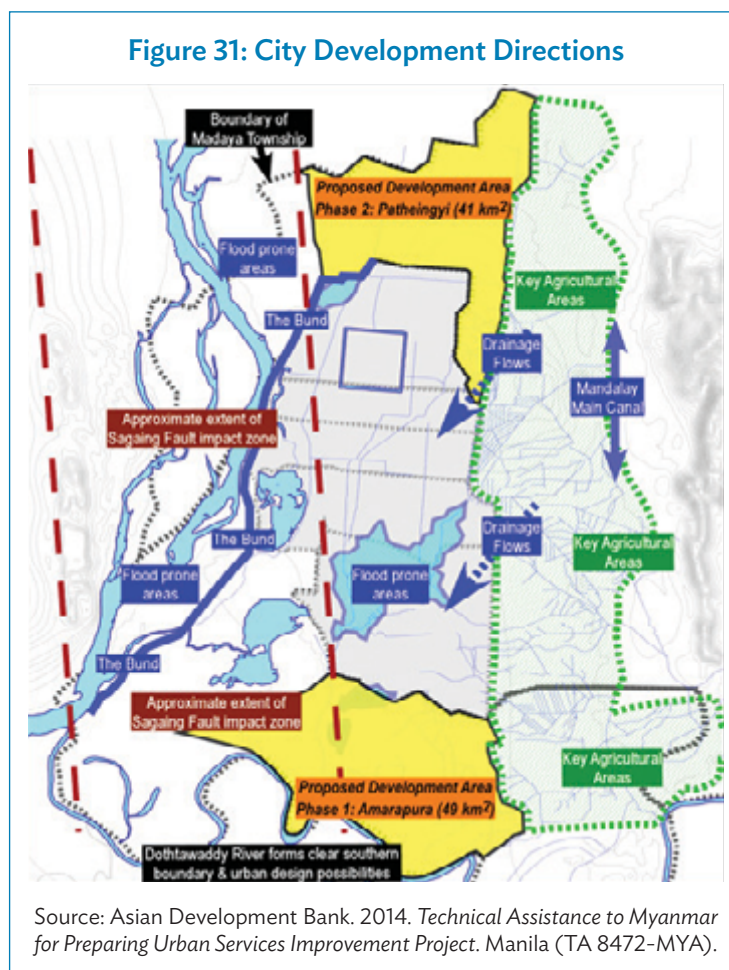
For a cost-sensitive population seeking to increase its mobility, the motorcycle is the ideal mode of transport because (i) it is inexpensive (particularly with hire purchase agreements readily available); (ii) it is economical to run (fuel is efficient, it is easy to maintain, and insurance is not compulsory); and (iii) it offers point-to-point travel for three (sometimes four) people. For the individual the motorcycle seems ideal, but for the city it worsens air and noise pollution. Further, it is difficult to manage (intrusion on sidewalks and contravening one-way orders are prevalent) and is a major source of accidents. As such, sustained motorcycle growth does not ensure a sustainable city.

Ownership of motorcycles in Mandalay is not yet at saturation point. Thus, there is sufficient opportunity to influence the travel habits of a population that has yet to subscribe to the motorcycle culture. It is this

population and the existing public transport users that should form the new public transport users. Existing motorcycle users will be difficult to persuade, given that the culture of use is already established and that the investment in the motorcycle has already been made. This user group may be persuaded over time but, taking Taipei City (Taipei, China) as an example, it would require a quality public transport system over the whole network before this user group is persuaded.

3.5 Sustainable Growth Options

The growth of Mandalay is inevitable; the only debate is by how much and where it should occur. The Mandalay Urban Development Concept Plan considered growth in all directions; however, an Asian Development Bank (ADB) technical assistance (TA) suggested modification to channel growth along a north-south axis, avoiding the geological fault zone in the west and flood-prone areas (and prime agricultural land) in the east.¹⁰ The TA suggestions are shown in Figure 31. The proposed new centers in the south and north remain with accompanying densification of the existing urban area.

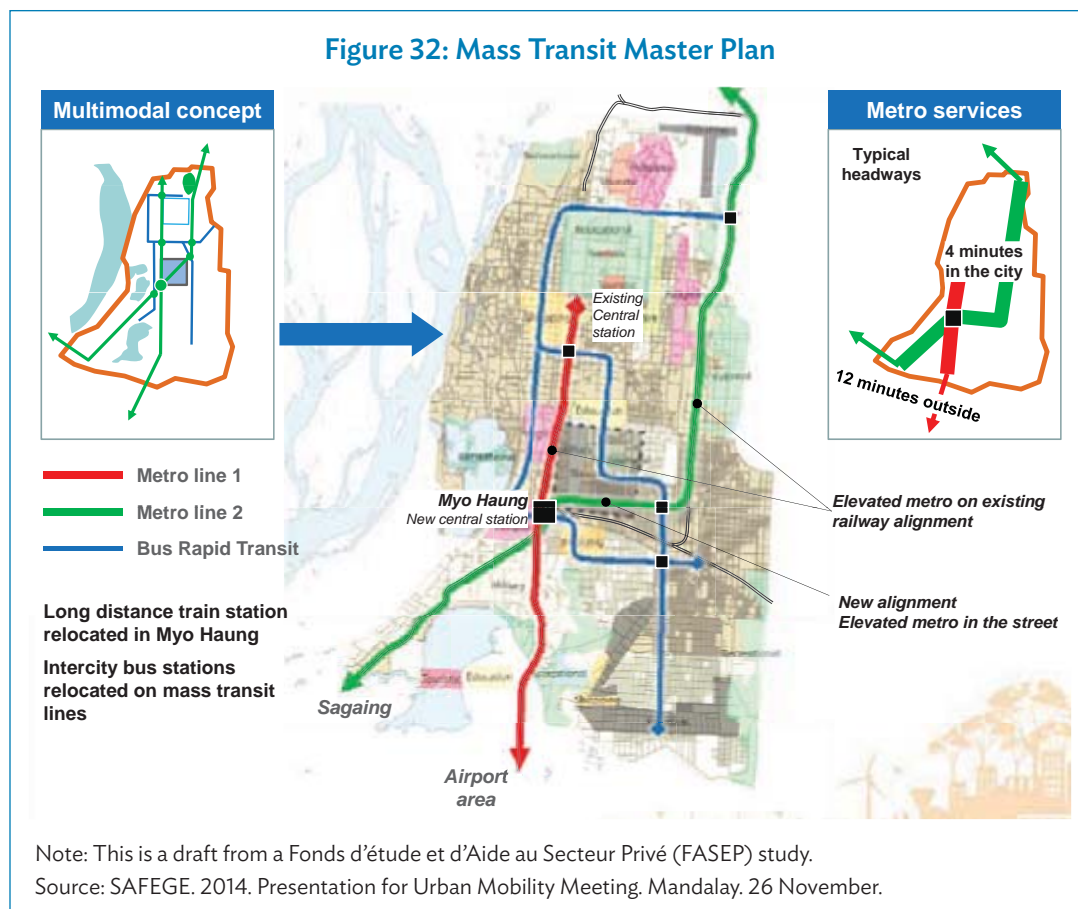


¹⁰ ADB, 2014. *Technical Assistance to Myanmar for Preparing Urban Services Improvement Project*. Manila.

The development plan appears to be logical. Currently, there is neither land use nor transport planning being undertaken at either city or regional level. The absence of public sector intervention will enable the private sector to fill the void, ensuring that development occurs where maximum return can be achieved (green field sites before brownfield sites); and transport will continue to be dominated by motorcycles. There is an urgent need for institutional restructuring with supporting legislation that enables the establishment of land use plans as a statutory document and a development control process or mechanism to oversee their implementation. There is also a need for a strategic transport department, executive, or authority that is able to plan transport and manage the network across all transport modes. Without these interventions, the plans, land use, and transport will remain moot and academic.

Mandalay City Development Committee (MCDC) identifies the lack of efficient public transport as the primary constraint on sustainable growth. Comparison with other cities would support this view. It is essential that measures are taken to address the increasing motorcycle culture within the city.

In 2014, the French Ministry of Finance funded an urban mobility study that aims to prepare a mass transit master plan for Mandalay (Figure 32). Its preparation was concurrent with this review. The plan is based on the idea of establishing a new central business district (CBD) south of the current one and linking it with the rest of the city with elevated metro and bus rapid transit (BRT).



4 First Steps Toward a Sustainable Transport Future

Potential initiatives supporting the Green City concept are discussed below. These have characteristics of normal urban transport interventions that are all interrelated and require integration beyond that of transport. Through examination of the local transport network and delivery mechanisms, two potential transport initiatives have been developed, as follows:

- A corridor-based transport improvement initiative, and
- A city center transport strategy.

4.1 Is there a Need for a Citywide Transport Plan?

The absence of a citywide transport plan aligned with the growth of the city inhibits major investment. Short- and medium-term action should lead to a fully matured city. Given the city size, its structure, and its rate of motorization, now is the time to establish principles that will safeguard a sustainable future without creating overt social and environmental impacts.

A citywide transport plan would consider the growth of the city and establish the role of alternative transport modes in supporting that growth, enabling the definition of short-, medium-, and long-term actions alongside assumed development scenarios. However, the worth of such a plan is dependent on the ability to (i) implement the plans and (ii) accurately anticipate future scenarios. The ability to implement the plans is contingent on appropriate institutional and regulatory structures. The ability to anticipate and analyze the effects of different scenarios presents a technical challenge.

A conventional four-stage modelling approach to the development of a transport plan would face the following challenges:

- The Mandalay road network is predominantly a grid pattern; there are multiple route choices between origin and destination pairs. This is extremely difficult to model.
- The sustainable green city is predicated on a mode shift from motorcycle to public transport as well as on preventing motorcycle users from becoming car users. Experience in developing models for Vietnamese cities has shown that such factors are almost impossible to model.
- The exact nature and direction of growth cannot be determined with utmost certainty.

Embarking on a multimillion dollar citywide transport study, which takes many years, may not produce the desired results and may impose delay on positive action.

The priority is the compilation of a demand matrix that can be compared with limited public transport supply, which would define the strategic direction. It is important to gather data especially on the origin and destination of users of public transport. A survey targeting 1% of households may cost about \$150,000. It should be complemented by vehicle movement surveys as well as cargo and passenger terminal surveys, the cost of which is more limited.

4.2 Institutional and Regulatory Requirements

As of 2015, the main inhibitor to transport development is the lack of clearly defined objectives at city level and clear responsibilities for planning, development, implementation, and operation. Parallel to the examination of urban transport, much debate has been undertaken on the relationship between different tiers of government and integration across disciplines within different departments for ensuring equitable and sustainable economic growth. It is not the purpose of this report to reexamine institutional and regulatory structures at city level, but it is highly relevant to the report to consider the principles and practices required within a public sector authority in charge of developing the transport network and its relationships with those responsible for its delivery.

The existing institutional structure that delivers public transport is convoluted and supports a system that is supply-oriented rather than demand-based. There appears to be a genuine desire within the government to take some form of control of public transport; but it is uncertain as to whether this should be citywide or regional and whether it should be planning, supply, contracting, or monitoring, or a combination of these issues. These issues need to be part of any project that seeks to develop the public transport network.

Box 4: Institutional Organization for Transport—Case of Seoul

The institutional framework within which public transport operates has important implications for the performance of the network. There are many good examples where restructuring of the institutional and regulatory framework has been undertaken. This must be done within the context of a vision for the city and full awareness of, and subscription to, the objectives set for public transport. A very good regional example of such reform is Seoul, Republic of Korea.

Transport within Seoul's metropolitan area had become a major issue with the rising population and congestion levels. With political support for both institutional and technical change, the Seoul Bus System underwent a complete overhaul. The Seoul Metropolitan Government increased control over bus routes, schedules, fares, and system design, altering the system from private to quasi-public management. These changes have led Seoul to become an internationally renowned exemplary case study of public transport reform.

Source: Authors.

4.3 A Corridor-Based Transport Improvement Initiative

It is clear that the whole city is challenged with growth and the difficulties that come with it. However, to seek short- and medium-term change across a city at the early stages of strategic planning is a challenge with a high risk of failure.

An alternative is to examine all elements of integrated transport to support sustainable growth within a single corridor. Such an approach would

- (i) enable debate and discussion of a long-term vision for the city through its application on a lesser scale,
- (ii) identify the steps to achieve that vision, and
- (iii) ensure that short-term action does not prejudice that vision but leads toward it.

The changes advocated would require leadership and commitment, and are physical, institutional, and legal. They satisfy objectives relating to economy, social well-being, the environment, and equity.

The main corridors of travel within Mandalay are readily defined. They are generally wide, and their capacity is compromised by parking and pedestrians in the roadway. These corridors would serve in the long term (if not in the short-term) as mass transport corridors through and within the city. However, moving directly to mass transit would be extremely problematic and potentially counterproductive, as market for public transport is currently small and there are no bodies that are able to deliver and operate a quality public transport. Further, establishing an effective mass transit would require wide-scale change that considers the roles of, and integration with, all transport modes as well as urban design and land use planning.

There is potential to develop a demonstration transport corridor along one of the main arterial roads, e.g., 78th Street. This would support the principles of the Green City project and most likely include

- a review of road space utilization,
- bus service development,
- pedestrian facilities,
- bicycle facilities, and
- parking management.

Review of Road Space Utilization

The road is a public asset which has received significant investment with the objective of ensuring accessibility within and throughout the city. However, in terms of person-carrying capacity that asset is quite significantly underutilized. This underutilization is largely due to a suboptimal mix of transport modes and parked vehicles. A corridor study must start with an understanding of the use of the corridor and the road.

Bus Service Development

Much work is needed to develop capacity and understanding within the bus industry. On the public sector side, there is a need to establish a department or unit that is able to plan, manage, and evaluate public transport including the contracting of services. The level of institutional change required has been discussed earlier.

At a corridor level, the functionality of such a department could be developed and understood, and eventually established through the early establishment of a corridor-based steering group that consists of all relevant departments at both regional and city level.

A similar level of complexity exists within service delivery with many operators of different sizes reporting through different mechanisms and providing a service that is not meeting the needs of the city or its people. Within the corridor study, it is thus recommended that a single bus branch be engaged with the following purposes:

- improving quality—vehicles and human capacity (Figure 33),
- maintenance—more reliable and clean services,
- headways—planning the bus as an urban service, and
- service level—customer care and respect.

To complement the delivery of public transport, improvements to the following should be investigated:

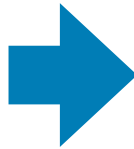
- maintenance and management of bus run times by prioritization;
- bus-related facilities, such as shelters and information provision, which are linked to urban design improvements in the vicinity of bus stops; and
- vehicles—i.e., ensuring that appropriate vehicle specifications are observed and examination of the means of procuring and operating such vehicles.

Figure 33: Possible Improvements in Bus Service



A bus driver in Mandalay and a trained customer-oriented driver in Jakarta.
Photos by Integrated Transport Planning.

Figure 34: Possible Improvements in Sidewalks



A typical street in Mandalay with no sidewalk compared with an improved sidewalk in Cebu, Philippines.
Photos by Integrated Transport Planning.

Pedestrian Facilities

Walking is currently a major form of transport and is also a major support mode to other transport trips, particularly public transport. Incomplete sidewalks and unsafe crossing points make walking difficult and dangerous. Pedestrians are thus forced to walk on the street, reducing road capacity and compounding the congestion problem. Much can be done at relatively low cost to improve walking facilities such as sidewalks and crossing points. Such improvements are complimentary to public transport development and would represent an upgrade to the overall appearance and operation of the corridor (Figure 34).

Bicycle Facilities

Mandalay has a reputation as a bicycle city, but bicycle usage in the city is reducing. While this might be for many reasons, the facilities that support bicycle use and the increasing motorization which is intensifying conflict is undoubtedly a major factor. A corridor study should seek to examine the following:

- potential for dedicated lanes;
- parking facilities at key destinations;
- development of wider (corridor-based) network;
- relationship with other transport modes, and whether the bicycle could be used as a feeder mode; and
- potential for hire schemes which might be particularly applicable to the tourist market.

Parking Management

Parking is very lightly managed. Inconsiderate parking by both motorcycles and cars block roads and sidewalks, causing delay and frustration. Clearly, parking has a significant role in the economic function of the corridor, and its planning would ensure that the positive effects of parking are maximized and its negative impacts minimized.

Parking management would seek to

- consider supply issues (such as how much parking is available and where), as well as demand issues (such as where it is most needed);
- determine optimum levels of supply, location, and pricing; and
- find the balance between on-street and off-road provision.

Traffic Management

The way the corridor is managed in terms of bus, car, motorcycle, freight, and pedestrian should be examined to maximize throughput. The use of road markings, signage, and traffic signals that facilitate optimized flow should also be examined.

Expected Outcomes

The initiative would deliver a corridor with improved infrastructure (lanes, sidewalks, parking, intersections) and public transport services. It would also establish a framework for institutional restructuring, which would later be applied to the rest of the city. Key benefits of the initiative would be the following:

- proving that buses are a viable alternative to motorcycles,
- testing the potential for institutional change within government and the bus industry,
- introducing transport management techniques;
- testing traffic and parking management options;
- establishing principles of putting people before vehicles; and
- demonstrating how road capacity can be maximized.

These are principles that are readily applicable across the city. They do not prejudice the development of a comprehensive mass transit network but make the establishment of such network more achievable at a lower risk.

Project Preparation Process

Corridor improvements must start with a thorough evidence-based definition of the components that make up the project. At present, little data exists and only scant knowledge of origins, destinations, and user needs is known. There needs to be a clear understanding of user needs on which improvements must be focused.

It is recommended that the terms of reference for a feasibility study be developed, which would include, as a minimum, the following:

- data collection, including origin and destination;
- demand forecasting;
- physical and ethnographic survey;
- consultation;
- institutional development;
- bus operational planning;
- outline design;
- institutional analysis;
- costing; and
- economic, social, environmental appraisal.

This study could be completed in 10–12 months. It would be followed by detailed design and implementation, which could be kept short. Significant change could be instigated within 2–3 years, depending on scheme and funding approvals.

4.4 Establishing a City Center Transport Strategy

It has been reported that the city center is intense, chaotic, and on the verge of breaking down. It is a complex area with multiple transport issues due to growth and neglect.

While trade and business thrive in the area, symptoms of vulnerability to change still show. As the city grows, and particularly if the city develops new centers of commerce and trade, its economic role will be diminished and the neglect evident thus far will further constrain its growth and even survival. The negative effects of developing satellite centers have been found in many cities including Johannesburg (where after decades of decline, significant investment was placed to revitalize the center) and Cebu (where mall development has led to a run-down cultural center with low-end shops often devoid of life). In transport terms, any intervention that inhibits access could potentially have a negative effect. Conversely, not actively considering the area will constrain its growth and full potential.

What is necessary is a multidisciplinary study of the city center that is driven by land use and economic function to understand the baseline performance of the area, its constraints, and opportunities. Through this assessment, transport might be considered either a constraint, in its current form, or an opportunity.

A consultative-based approach that seeks to fully understand the function of the area and establish a vision for its future must be used in replanning the city center. The potential to establish a town center group made up of local businesses could be explored, initially as part of a technical advisory group to the project.

The development of an optimized transport plan for the city center would examine the following.

Figure 35: Road Space Management and Intersections Issues in the City Center



Examples of conflicts between parking, motorized and nonmotorized transport, and pedestrian needs near the intersection between Shwebo Road and 26th Street.

Photos by Integrated Transport Planning.

Intersection and Road Capacity Management

Many intersections suffer delay during the peak periods and beyond. This is due to many features including inappropriate junction design, suboptimal junction form, parking at junctions, and road markings. Any improvements would need to balance the needs of accessibility with urban design and pedestrian circulation issues.

Parking Management

Parking is currently lightly controlled with government officials managing key sites and charging fees. This should be reviewed, its capacity determined and compared with its needs and demands. The potential for off-street parking should be examined, where on-street parking has a detrimental effect on road capacity or free movement of pedestrians. Signage and pricing mechanisms should also be investigated.

Penetration, Access, and Circulation of Public Transport

Many bus services have terminals in the city center. However, bus routes have not been systematically reviewed and optimized. Issues of what routes operate and where should be examined. The point at which they penetrate the city center, their circulation, and where they might stop should also be examined. Many buses have extended layovers within the city center. Dedicating prime real estate for parking is not a good use of space and should be reviewed.

Pedestrian Facilities

The city center is relatively compact and, theoretically, walkable for those without goods to carry. As with the rest of the city, walking in the city center is frustrated by the conflict at road crossing points and by the lack of effective and continuous sidewalks. The development of a walking infrastructure improvement plan would assist and consolidate walking as a primary transport mode.

The development of a walking strategy that includes signage and information could form part of a tourist strategy that exploits the interest of the city center, which is currently largely overlooked by tourists who, seeking a cultural experience, are more likely to head to accessible and promoted sights.

Bicycle Facilities

As with walking, cycling is an undersupported transport mode in Mandalay; and its use in the city center is frustrated by conflict and the lack of space. A rational transport plan that seeks to optimize the use of available space will identify the potential to incorporate cycle facilities such as dedicated lanes and parking.

Traffic Management

Traffic management would seek to address specific problems such as conflicts, accidents, and congestion. It could primarily be developed to support (i) the rationalized use of the city center road network, (ii) better public transport penetration and circulation, and (iii) cycle and walking improvements.

Expected Outcomes

The purpose of a strategy study would be a comprehensive transport plan for the city center that is rooted in an understanding of land use and the economic function and future of the center. It should further seek to develop understanding of urban management issues among government entities and establish a consultative approach to its future development, perhaps centered on a city center management group.

A strategy study would aim to achieve the following:

- an understanding of the function and importance of the city center to the growth of the city;
- definition of the city center's future role in an expanded city and its protection from potential negative effects of competition as growth occurs;
- development of a transport strategy that is inclusive and integrated between modes and with land use and economic development;
- an understanding of the economic dynamics of the area, its vulnerabilities, and its opportunities;
- a framework for social cohesion that recognizes the function of city center activities on promoting social integration and well-being;
- protection of the local environment in terms of air quality, aesthetics, and ecology;
- an understanding of land use planning issues that would enable sustainable growth of the city center area; and
- an institutional framework for future development of the city center.

Preparation Requirements and Schedule

This report has sought to define, in outline terms, potential initiatives within the city center; but it has been clear in stating the need for an in-depth study that precisely defines, with full appreciation of, project benefits and outputs across all sectors, specifically the local economy. Thus it is recommended that terms of reference for a strategy study be developed. Such a study would include the following as a minimum:

- microeconomic assessment,
- social analysis,
- relation to city land use development plan,
- infrastructure audit,
- data collection,
- demand and impact modelling,
- strategy development,
- multimodal scheme design, and
- consultation.

Such a study could be conducted within 12 months. The study and parallel activities should seek to emphasize engagement and capacity building to ensure subscription as the study evolves and to ensure a swift path to implementation.

Implementation of planned improvements could be achieved within 2–3 years.

Conclusion – Part II

Mandalay is a city of character and charm that is going through significant change. Population is increasing; the city is set to double in size by 2040. Increasing affluence with a low-level and declining public transport sector is leading to increasing dependence on private transport, primarily the motorcycle. While the city's infrastructure can accommodate current levels of motorization, the city will soon start to break down.

While significant investment might be required to accommodate a city that is set to double in size, that investment is best planned and applied on a solid foundation, which is currently missing. The public transport sector is low-skilled, lightly managed, and not aligned with a growth strategy; and the means by which it is regulated is convoluted. Improving public transport is as much about the way it is planned, operated, and maintained as it is about infrastructure and vehicles.

Other forms of transport are not adequately supported. This includes walking, which is still a significant transport mode, and the use of bicycles. Mandalay's reputation as a city of bicycles is being eroded by the lack of infrastructure, which causes conflicts with increasing private transport use.

The biggest concern in creating a basis for sustainable growth is challenging the growing motorcycle culture. The challenge is similar to that in Viet Nam and Taipei, China, and parallels are made in this report. The challenge is twofold: (i) providing an attractive alternative to stem the growth in motorcycle usage, and (ii) persuading those using the motorcycle to switch modes.

The scale of change required is significant, as well as the risk of failure. Two concepts for initiatives have been developed that enable principles to be tested and established both in terms of physical improvements and means of delivery backed by institutional development and capacity building. These two recommended initiatives are based on a single corridor and the city center.

Myanmar Transport Sector Policy Note

Urban Transport

Better transport is essential to Myanmar's development. After decades of underinvestment, Myanmar's transport infrastructure lags behind other regional countries. Sixty percent of trunk highways and most of the railways need maintenance or rehabilitation. River infrastructure does not exist, while 20 million people lack basic road access. Can the transport sector deliver upon the master plan's objectives? What is needed to improve the quality of the infrastructure and services for the industry? How can basic transport services be provided to all? How can Myanmar reduce the economic and social cost of transport? This report is an attempt to answer these questions.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to the majority of the world's poor. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.



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