



SUSTAINABLE URBAN TRANSPORT INDEX FOR BANGKOK

AND

IMPACTS OF COVID-19 ON MOBILITY

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Chapter 1 Introduction

1.1 General Information

Bangkok, the Capital of Thailand, is located on the Lower Central Plain over Chao Phraya delta at the top of the Gulf of Thailand. It is home to almost six million people. Its true extent may cover some other nearby provinces which now appear to be inseparable from Bangkok. The greater Bangkok may host more than 10 million inhabitants who live, work, shop, play and do many other activities in one day. The city itself covers an area of 1,568.73 square kilometers. This makes the population density of the city equals to 3,690 persons per square kilometers. However, the city has sprawled into many surrounding provinces namely Nonthaburi, Pathum Thani, Samut Prakan, Samut Sakhon, and Nakhon Pathom. These provinces form Greater Bangkok or Bangkok Metropolitan Region, population exceeding 15 million as projected by National Statistic Office, where economic and travel activities are interconnected and almost inseparable. Figure 1-1 shows the location of Bangkok and Figure 1-2 shows Bangkok and its neighboring provinces.



Figure 1-1 Location of Bangkok

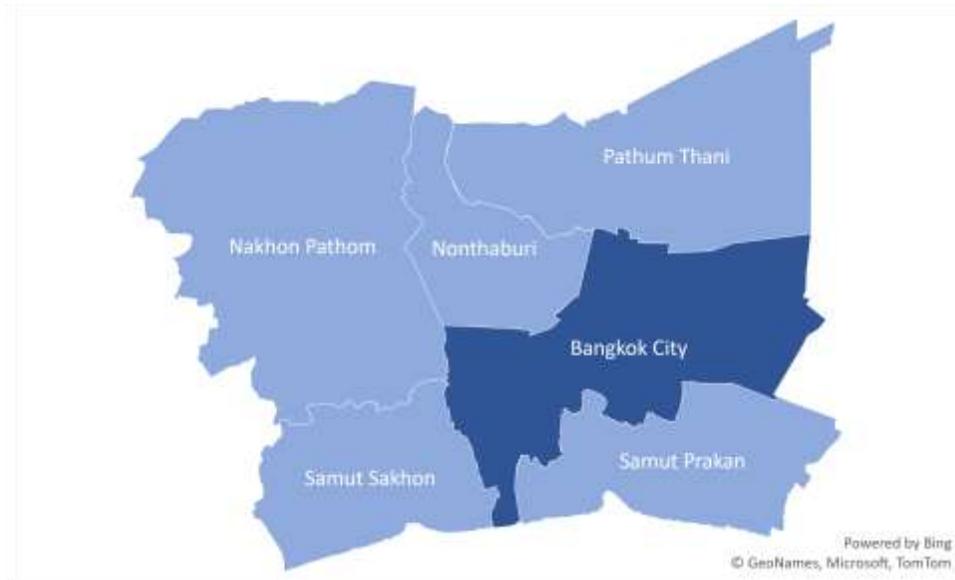


Figure 1-2 Bangkok Metropolitan Region

A recent survey in 2018 shows that 32 million trips are made daily, 70% of which are made by private vehicles. This makes Bangkok one of the most congested city in the world with 10.7 and 14.2 kilometers per hour average speed in the peak morning and evening periods respectively.

1.2 Bangkok Development Plan

Bangkok Metropolitan Authority has developed Bangkok Development Plan (2013-2032) to establish a framework in providing public services and to prioritize long-term project investment. The 20-year development plan is divided into four phases of 5 years so that the goals and measures can be reviewed and evaluated. Currently the second development plan (2018-2022) is in effect with a vision of “convenient metropolitan”. The plan consists of six strategies:

Strategy 1: Safe metropolitan

The first strategy addresses all types of risks including pollutions, drugs and crimes, diseases, disasters and accidents. The accident reduction plans are designed to generally attacks construction and road accidents.

Strategy 2: Green and convenient metropolitan

The second strategy aims to build public park and green area to the standard ratio compared to the population. It also addresses the clean and environmental-friendly forms of energy and its conservation. This include providing multimodal and convenient transportation with no barriers.

Strategy 3: Metropolitan for all

The third strategy focuses on creating equity and unity for all Bangkokians. All should receive the same opportunity to learn, develop and access to public services. Meanwhile each group or community should be able to maintain their own root, identity, tradition, and culture to make Bangkok multicultural city.

Strategy 4: Elevated metropolitan

The fourth strategy addresses immature development in some area. It aims to promote convenience and optimized expenses on utilities and transport. The city will be planned to be compact with multi-centers connecting with one another in network scheme.

Strategy 5: Democratic metropolitan

The fifth strategy aims to promote democracy and good governance for the city. The administration will have good management without corruption. Business and public participation is encouraged to strongly drive the city development.

Strategy 6: Metropolitan of economy and learning

The sixth strategy sets up 20-year goal for the city to be the capital of Asia with regional economic role. Bangkok will be the trade, investment, tourism, and cultural center, including regional learning hub.

1.3 Objectives of the study

The objectives of the study are:

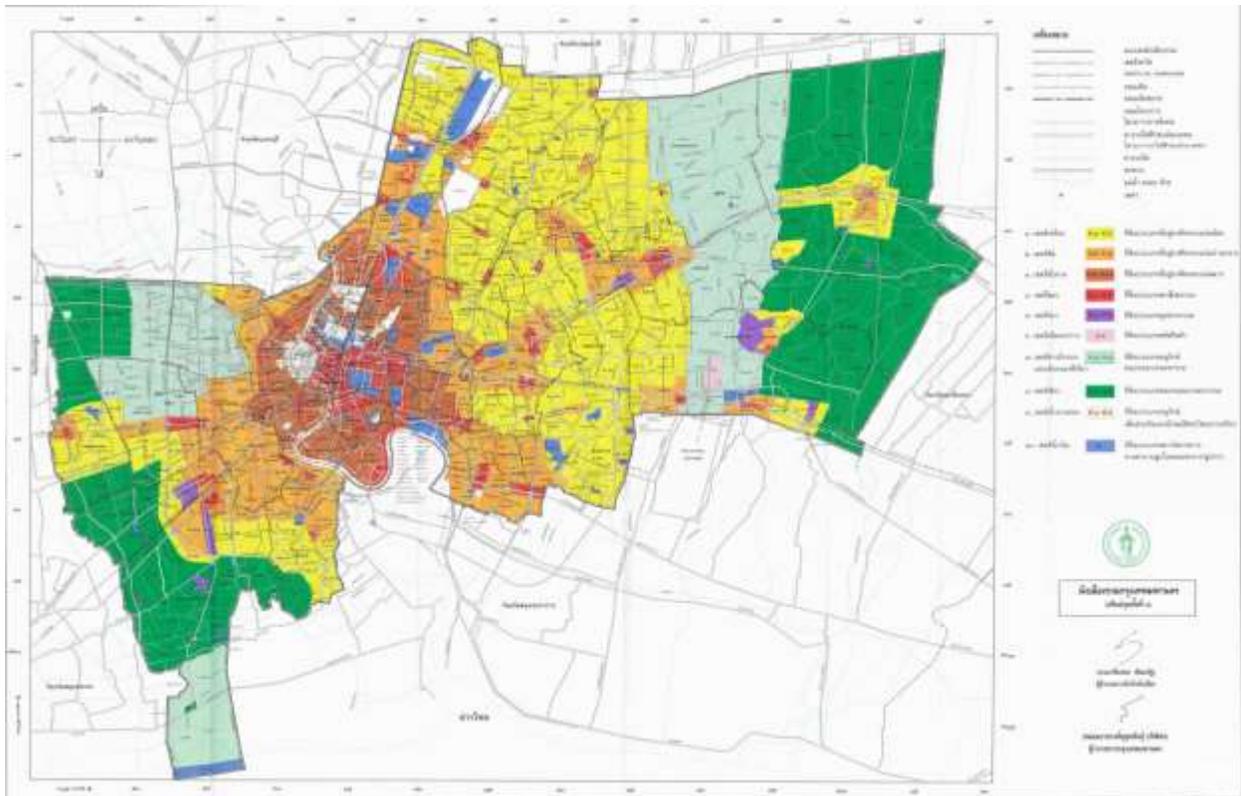
1. to review the urban transport situation in Bangkok in 2019.
2. to explore impact of COVID-19 to the ridership and financial viability of public transport services.
3. to evaluate the performance of sustainable urban transport and related sustainable development goals for Bangkok via Sustainable Urban Transportation Index (SUTI).

Chapter 2 Bangkok Urban Transport System

2.1 Land Use and Road Network

Bangkok is divided into two sides by Chao Phraya River. The center of the capital was moved from the west to the east sides of the river more than 230 years ago due to its strategic location which was enclosed by the river. The east side was safe from erosion and was easy to defend from the enemies. Canals were dug for city defense and transport purposes. In the early ages transport relied on boats and animals. Houses were built on or nearby the canals and waterways. Modern roads were paved when the westerners came into contact nearly 160 years ago. These roads increased access to inland regions where they had never been reached before. Inhabitants started to move from the canals to the land. Since then, the city has expanded rapidly, especially eastward, while the west side remained mostly agricultural area.

Figure 2-1 shows the most current version of Bangkok comprehensive plan which was prepared in 2014 and updated constantly after. The red and brown areas represent commercial and high-density residential areas respectively in the middle of the city, mostly on the east side of the river. The second and third strips in orange and yellow show medium- and low-density residential area. Finally, the conservation and agricultural areas in light and dark green are located on both farthest corners of the city.



Source: Department of Public Works and Town & Country Planning, 2020

Figure 2-1 Bangkok Comprehensive Plan 2014

The city is naturally polycentric. Although the core business area is apparently in the middle, the small red dots are also distributed everywhere around the city. The central business district itself is also a combination of many sub-centers sprawling into one another. The roads are mainly formed as ring and radial system with key main roads running from the city center to all directions. These roads are, for example, Phahonyothin and Vibhavadi Rangsit to the north, Lat Phrao and Sukhumvit to the east, and Petkasem and Boromratchonnani to the west. These main roads are connected by webs of collector street networks also known as “soi”. Business and commercial settlements and large condominiums are located on the main roads, while lower-density residential are dispersed around these soi networks. This makes clear road hierarchical system which requires comprehensive plan to provide transit coverage and access to some area deep into soi network.

2.2 Bangkok Mass Transit Network

Bangkok mass transit network comprises two main modes: rail and bus. It is estimated that rail network accommodates more than five million trips per day and bus close to four million trips per day. Although water transport is widely use, the network is limited to the main river and two canals, and the ridership is incomparable to other two dominant modes.

Bangkok railway network has been developed through a series of rail transit master plans. The first Mass Rapid Transit Systems Master Plan was endorsed by the cabinet in 1994 and to be implemented from 1995 to 2011. In the meantime, Bangkok Metropolitan Administration has already commissioned BTS to develop the first elevated urban railway or “sky train” under build-operate-transfer (BOT) concession. In response to 1997 Asian Financial crisis, Urban Rail Transportation Master Plan in Bangkok and Surrounding Areas (URMAP) was proposed to begin in 2001 follows by an updated version called Bangkok Mass Transit Master Plan (BMT). The latest version of the master plan is the Mass Rapid Transit Master Plan in Bangkok Metropolitan Region (M-Map) which was proposed in 2008 and constantly updated in detail.

M-Map was developed with the concept of trunk and feeders, in which the main line or trunk enabled mobility from key origins to destinations and feeders facilitated accessibility to low-density area. The network was planned in a radial and circumference pattern as shown in Figure 2-2. The two Red lines function as backbone “commuters” conveying people from suburban to the city in the morning and doing the opposite in the evening. The key main metro lines that runs through the city main streets are Light and Dark Green Lines. The Orange Line is the main arterial for the east-west journeys, while Purple Line is for north-south. Blue Line is necessary the Ring Line for the network accommodating trips on the inner peripheral area of the city. Finally, Yellow and Pink Lines are light rail routes feeding travelers from the east and the north area to the main metro lines respectively.

The full version of M-Map plan consists of the aforementioned lines. Brown, Grey, Light Blue, Gold Lines were later added to fill in the coverage gap throughout the city. The current network as of December 2020 consists of 6 Lines which are Light and Dark Green Lines, Blue Line, Purple Line, Airport Rail Link, and newly opened LRT Gold Line. There are 123 Metro Stations for a total of 169 km as shown in Figure 2-3. The complete network is shown in Figure 2-4. The latest version of M-Map consists of 504 kilometers of rail network as detailed in Table 2-1.

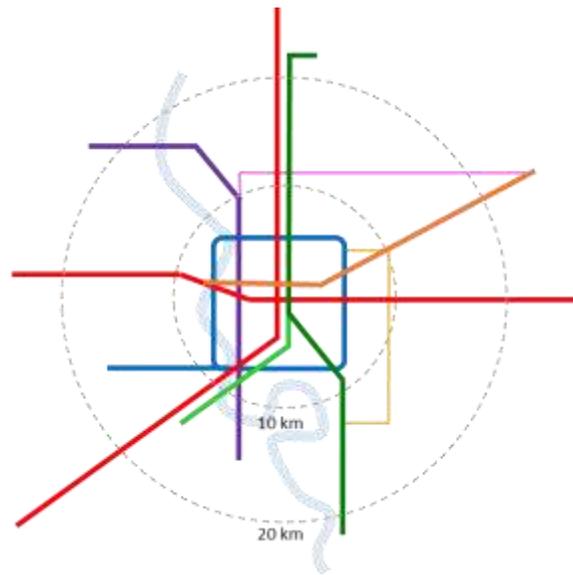
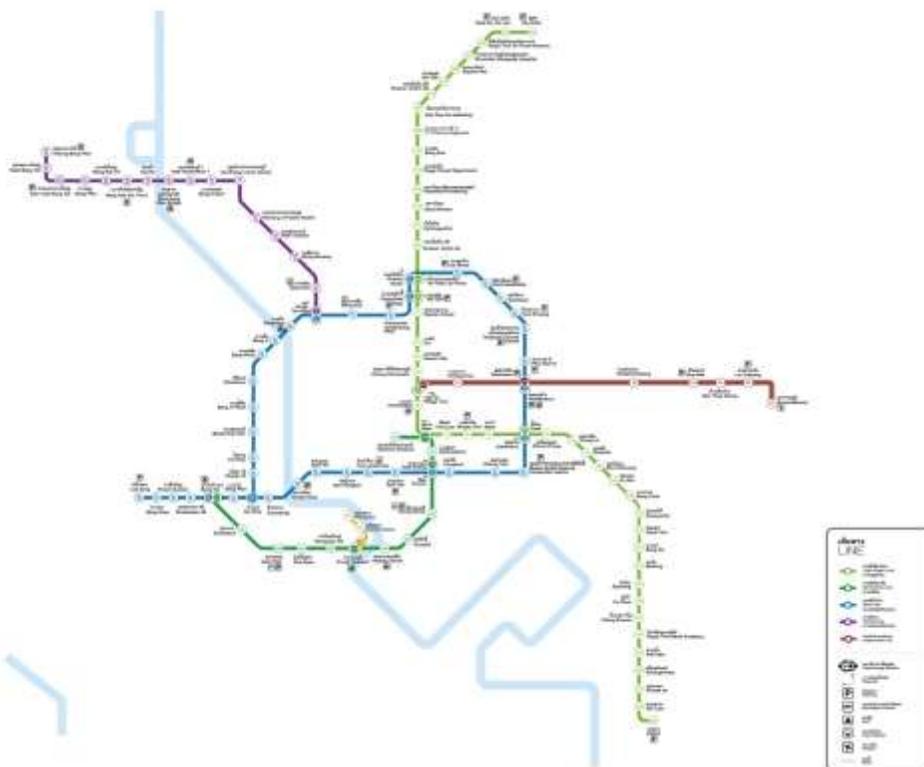


Figure 2-2 M-Map Network Planning Concept



Source: Mahidol University, 2020

Figure 2-3 Current M-Map Network



Source: Mass Rapid Transit Authority of Thailand, 2020

Figure 2-4 Complete M-Map Network

Table 2-1 List of Rail Transit Lines in M-Map Network

Line	Stations	Length (km)
Light Green	55	66.5
Dark Green	20	22.5
Blue	42	55.0
Purple	32	42.8
Orange	30	35.4
Pink	30	36.0
Yellow	23	30.4
Brown	23	21.0
Gold	4	2.7
Grey	39	26.0
Light Blue	19	30.0
Light Red	55	58.5
Dark Red	20	80.8
Airport Rail Link	14	49.5
Total		504.0

The rail transport business in the city belongs to three main owners who hires separate operators to run the services. Bangkok Metropolitan Administration (BMA) commissioned Bangkok Transit System (BTS) to build and operate the first metro line, the Green line in 1999. The Mass Rapid Transit Authority of Thailand (MRTA) was founded a year later to oversee the metro network development. MRTA built the Blue line and hired Bangkok Metro Company Limited (BMCL, later merged with BECL to form Bangkok Expressway and Metro: BEM) to operate the Blue line in 2004. BMA and MRTA has initiated and implemented a few other metro line projects since then while BEM and BTS are alternatively granted service contracts. The third player in the metro business is the State Railway of Thailand who built the Airport Rail Link (ARL) to Suvarnabhumi Airport and established a subsidiary company SETET to operate the line in 2010. This ARL line is slightly different from the normal metro operation as it takes a

commuter train characteristic serving travelers from the airport and inhabitant from the east suburban to the city with infrequent stops.

At the onset of the industry, bus transport had been run by private operators. The government granted licenses to private companies and ensure that the bus routes will not overlap with then in-operation streetcars. Due to high competition and sharp rise of fuel price, most operators could not sustain their business. Most of the remainders were operating with low quality services. In 1976, Bangkok Mass Transit Authority (BMTA) was formed to combine all bus operation under one umbrella.

Now, BMTA is the sole bus owner for the city. It operates part of the bus itself and also gives licenses out to private companies. The 2019 statistics reported that BMTA owns 3,005 buses and the private joint companies own 9,927 buses bringing the total to 12,932 buses. A total of 456 bus routes are in operation in Bangkok and its vicinity. A majority of buses use natural gas as their fuel. Table 2-2 and 2-3 show the 2019 bus statistics.

Table 2-2 Bangkok Bus Fleet and Routes

Type of Service	Buses	Percentage	Routes	Percentage
BMTA buses	3,005	23.24	117	25.66
Private joint buses	3,302	25.53	94	20.61
Minibuses	881	6.81	41 ^a	-
Shuttle in sois	2,039	15.77	98	21.49
Air-conditioned minibuses	3,619	27.98	139	30.48
Suvarnabhumi airport connection minibuses	86	0.67	8	1.75
Total	12,392	100	456	100

^a route shared with regular and air-conditioned vehicles in normal traffic.

Source: Bangkok Mass Transit Authority, 2019

Table 2-3 Buses Categorized by Fuel Type

Type of Service	Diesel	Natural gas	Total
BMTA buses	2,076	929	3,005
Private joint buses	-	3,302	3,302
Minibuses	-	881	881
Shuttle in sois	1,551	488	2,039
Air-conditioned minibuses	-	3,619	3,619
Suvarnabhumi airport connection minibuses	-	86	86
Total	3,627	9,305	12,392

Source: Bangkok Mass Transit Authority, 2019

2.3 Hired Transportation and Paratransit

As Bangkok network consist of clear hierarchy of roads, providing access to all area by feeders is extremely difficult. Hire transportation plays an important role in connecting people to transit stations and stops. Hired transportation in Bangkok are dominated by two forms: taxi and motorcycle taxi.

Motorcycle taxis are stationed together in places known as “*wyn*”. These stations are normally located at the intersection of collectors and arterials, mass transit stations, major bus stops, activity center or community where there are a lot of pedestrian and transit traffic. These motorcycle taxi do not cruise around for their customers, but users must walk to their *wyn* to use the service. Each *wyn* is organized by queuing system. The fares to nearby places are displayed so passengers have prior knowledge of travel costs. Helmets may be provided for the passengers, but most of the time they are not. This is a fast, convenient and efficient connection transit-connection mode, although their safety is still a big concern. Also, as parking space is not usually planned for these motorcycle taxis at the first place, traffic congestion may be observed around their *wyns*.

Taxis are normally not used for trip connection to the transit stations or stops, but to complete a whole journey. They used to be slightly more difficult to call as they did not often roam through small collector streets without passengers. They were also known to illegally refuse to pick up

some passengers who needed to go to destinations that were not profitable. Negative impression included favoring foreign over Thai passengers. During rush hours, it could be difficult to flag down a taxi as they were mostly occupied. However, with an arrival of on-demand taxi application, they are now become more easily available. Higher competition makes most taxi drivers decide to tie with one of these application providers, who in turn regulate the drivers to pick up passengers and maintain good quality of service. As a result, they provide complete door-to-door access to both ends of the trips. Now they are more reliable and become legitimate competitor to high-priced mass transit.

Motorized three-wheelers or so-called “tuk-tuk” functions as a connector mode between transit stations and stops to the final destinations. They usually gather near motorcycle *wyn* where parking space is available. Tuk-tuks normally form a group in similar way to motorcycle’s *wyn*, but with a smaller number. The fare rate is comparable to that of motorcycle taxi. They hold advantage over the motorcycle taxi for customers with luggage but lost the edge on the speed and availability.

Paratransit in Bangkok is rare. Some can still be found at the outskirts in a form of old small trucks. They operate close to a short-range taxi but a vehicle can be shared among customers with different destinations. This form of transportation is losing their popularity as other forms of hired transportation are improving themselves. However, there has been some proposals on developing more systematic paratransit service for some remoted area with help of modern information technology.



(a) Motorcycle taxi



(b) taxi



(c) tuk-tuk

Figure 2-5 Bangkok’s Hired Transportation

Chapter 3 Sustainable Urban Transport Index Calculation

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

Walking

Bangkok Development Plan (2013-2032) does not address any strategy or project specifically dedicated to pedestrian well-being. The second strategy “Green and Convenient Metropolitan” includes development and improvement of public transport, but with limited a vision of accessibility. Only type of pedestrian facility introduced to this strategy is the elevated walkway directly connected metro stations to buildings. The third strategy “Metropolitan for All” address disable and elder needs in all aspects but transportation. The fourth strategy “Elevated Metropolitan” concentrates on city planning in a big picture but not detailed enough to focus on pedestrian network. No project or budget was allocated on pedestrian facility improvement.

Pedestrian facilities including walkways, crosswalks and overpasses are periodically maintained. Some are improved with new materials and painting. Nonetheless, the city has no monitoring and evaluation system for these facilities. Repair, replacement or other improvement activities are induced by public appeal. However, the awareness of the needs of pedestrian facilities have recently been raised from the general public. A few Facebook fan pages have been dedicated to pedestrian facilities and surrounding including shading, bus stops and tree maintenance. They receive many good feedbacks and have actually stimulated some prompt action from BMA units on pedestrian facility improvement.

Cycling

The coverage of the cycling network and its safety problems have been realized. The second strategy of BMA Development Plan, “Green and Convenient Metropolitan” provide a general goal for cycling network development in the city. They aim to improve the coverage area and the width of the bike lane, as well as other aspects of safety. Measures are proposed including

develop new bike routes, establish and enforce specific cycling laws, developing a bike lane on all walkways with a width of 1.2 meters or more, and provide good protection to cyclists.

In reality, cycling networks have been implemented with limited success. The reason may be because of lack of proper planning and design. Cycling are still be viewed as recreational activity rather than a mode of commute. The cycling networks are not complete, do not connect housing and economic activity centers. Facilities such as bike rack, lockers and lighting have not been sufficiently provided or well maintained. In conclusion, there are still rooms to improve on cycling program development.

Intermodal Transfer Facilities

Bangkok is expecting a flagship intermodal facility at Bang Sue Grand Station to be in service next year. The grand station will be the terminals of intercity trains and future high-speed rail leading to every part of the country. It also offers mode transfer between intercity train and metro, namely Blue line. However, it does not provide a good connection with the main Chatuchak Bus Terminal, located 2 kilometers away. Therefore, travelers who arrive Bangkok by bus can hardly use Bang Sue Grand Station to connect with the metro line and vice versa. This is the crucial shortcoming for the intermodal facility as its main purpose should actually focus on intercity-urban transfer which happens more often than intercity-intercity transfer. However, the government is seeking solution to facilitate such transfer.

Although Bangkok Development Plan does not specifically include intermodal facility development plan, other central government agencies namely the Office of Traffic and Transport Policy and Planning (OTP) and Department of Rail (DRT) commission intermodal facility development studies. Meanwhile, importance of mode transfer has been increasing realized. Transit station or “transport hub” concepts are always introduced as a part of BMA’s area development and transit-oriented development projects. Recently focuses have shifted to connection between rail and water transport. A few feasibility rail-water intermodal facility projects are underway.

Public Transport

Bangkok Mass Transit Master Plan have been accelerated by the central government. As a result, significant progress has been witnessed. Projects recently completed include green line North Extension and Blue Line Extension. Pink, Yellow LRT Lines, Orange Line and Red Line Commuters are to follow in the near future.

Bus, on the other hand, is facing a sharp decline. Most routes have never been changed for 30 years or more. A large number of bus lines are running along the same route as metro and losing ridership to its main competitor. Newly improved bus lines have been licensed out to private companies under special high-quality service condition, but not with much success. The only exception is the airport bus servicing traveler from both key airports to various destinations in the city.

All things considered, the overall network is in need of new planning. Bus should take feeder roles supplemented to metro travel. Bangkok development plan have put this into a specific plan under the second strategy, stating that it needs to “develop secondary public transport system”.

Table 4-1 summarize the score and scoring rationale on the four aspects of SUTI 1

Table 4-1 Bangkok SUTI 1 Evaluation

Aspects	Explanation	Score
I) walking networks	Little attention has been paid to pedestrian network planning, although the awareness of maintenance of walkways and other pedestrian facilities have been raised from the general public.	2
II) cycling networks	Sparse Cycling networks have been implemented, most of which are with limited success due to lack of access to housing and economic activity centers. Facilities have not been sufficiently provided or well maintained	2
III) intermodal transfer facilities	Great ambition on planning and building new intermodal megaproject, Bang Sue Grand Station, connecting intercity public transport and urban transit, namely metro. Awareness on intermodal facilities in local level have been raised and a number of projects have been developed.	3
IV) public transport	Significant progress on M-Map (Bangkok Mass Transit Master plan) leads to promising sign of mode shift from private cars to rail. However, lack of bus feeder planning may deteriorate its role and jeopardize its business.	3
Total (sum)		10

3.2 SUTI 2: Modal share of active and public transport in commuting

A few feasibility studies have estimated Bangkok transportation mode share. Various survey methods have been executed and different mode classifications have been defined. Single trips made by two or more modes are also interpreted and record differently.

A Bangkok travel demand study was conducted by OTP in 2018. The survey was design to classified trips by purposes, and public transportation was broadly defined high, medium and low performance. It was reported that private car and motorcycle contributed for 30% and 20% of the mandatory trips (i.e., work and education) respectively. Meanwhile transit trips form all levels of service took 37% of mode share.

MRTA 2019 annual report offers more similar classifications of mode share to that defined in the SUTI form. Current available public transport modes in Bangkok include (a) bus and minibus, (b) bus rapid transit which is limited to one route on the edge of its CBD area, (c) train and metro, (d) water transport including Chaopraya River express and San Saeb Canal boats. The private modes include private car and motorcycle, while the hired transport modes comprise taxi and motorcycle taxi. Table 4-2 shows the adopted from MRTA report for mandatory trips.

Table 4-2 Bangkok SUTI 2 Evaluation

Purpose	Commuting	
	(Work and Education)	
MODE	#	subtotals
a. Scheduled bus and minibus (*)	3.933	
b. BRT	0.073	
c. Train, metro, tram	5.372	
d. Canal and River Express Boats	0.448	
d. Public transport	(a+b+c+d)	9.83
e. Walking	1.6300	
f. Bicycle	0.0000	
g. Active transport	(f+g)	1.63
h. Passenger car	14.2000	

Purpose	Commuting	
	(Work and Education)	
i. 3W - Private	0.0000	
j. Taxi	1.3600	
k. Motorcycle and Motorcycle Taxi	8.3200	
m. Other motorized (trucks,etc)	0.0000	
n. Individual motorized (**)	(i+j+k+l+m)	23.88
o. Total	(e+h+o)	35.34
p. Public and active	(e+h)	11.46
q. Modal share of active and public transport		32.4

The MRTA survey gives close results to the OTP study. It suggests that more than 35 million trips are made daily in Bangkok and 11.5 million of these trips are made by walk and public transport, while bicycle trips are so few that it can be negligible. Thus, the mode share of active and public are estimated at 32.4%.

It should be noted that the scoring system for SUTI 2 gives the mode share range between 10% to 90%. Original value becomes 28.03. However, the maximum value is considerably high and greatly affect the scoring result. This report thus narrows down the range and adopts 75% as the maximum. The SUTI 2 (mode share) for Bangkok is recalculated as 37.6 which normalized value would be 34.49.

3.3 SUTI 3: Convenient access to public transport service

Bangkok metro network contains 113 stations in 2019. BMTA also reported that 3531 bus stops are listed on its maintenance expenses. These stations and stops are distributed to cover most of Bangkok and effectively provide accessibility to communities with some small exceptions in the agricultural zone of the city in the northeast. The population living around the transit stops are estimated within the circular area of the station/stop locations as shown in Table 4-3.

Table 4-3 Bangkok SUTI 3 Evaluation

Stops and Stations	Coverage area within a radius of 500m (km²)	Pop. density (inh/km²)	Inhabitants
Rail			
113	84.31249284	3592	302,850
Bus			
3531	1109.296366	3592	3,984,593
Total Population			5,666,264
% within 500m buffers			75.67

3.4 SUTI 4: Public transport quality and reliability

The customer satisfactory survey is mandatory for transit operators including BTS, BEM and BMTA. The survey is carried out annually. The results are used to prepare the action plan or improvement plan so that the company can respond to the customer's needs. They are also used for self-evaluation and measured against the company's goals and vision.

The survey design focuses similar categories as designated by SUTI manual with some small exceptions. BTS, the Green Line operator classified 8 service categories, and so do BMTA with similar context. MRT defines further detailed categories but does not address ticketing and marketing issue. Thus, a few similar categories from MRT report are group together in line with BTS and BMTA, and the average scores are used as representative of the grouped category.

However, the surveys do not ask the respondents whether they are satisfied or dissatisfied with the service categories, but provide the respondents with the Likert's scale rating. Only the aggregated statistics are available. Thus, the minimum score 1 is translated to 0%, the maximum score 5 is translated to 100%, and others in between are interpolated accordingly. Table 4-4 shows SUTI 4 evaluation.

Table 4-4 Bangkok SUTI 4 Evaluation

Category	BTS	MRT Blue	MRT Purple	BMTA
Safety	4.05	4.11	4.04	3.57
Service	3.81	4.03	4.06	3.03
Facilities	3.87	4.06	4.06	3.13
Reliability	3.89	4.06	4.03	2.91
Information	3.84	4.06	4.05	2.79
Value	3.74	4.06	4.03	4.05
Staff	3.78	4.07	4.05	3.56
Ticket and Marketing	3.49	N/A	N/A	3.16
Average	3.81	4.06	4.05	3.27
100 Scale	70.2	76.6	76.1	56.9
Ridership	241,200,000	124,573,770	12,781,205	160,021,110
% Ridership	44.8%	23.1%	2.4%	29.7%
Weighted Score (100)	67.9			

3.5 SUTI 5: Traffic fatalities per 100,000 inhabitants

Thailand has been among the top ranks for road accidents per 100,000 inhabitants for many years. The accidents are the consequence of the large number of vehicle-kilometers traveled each year combined with lack of driver disciplines and improper road and environment design.

Bangkok falls in the same case although it does with a lower rate. The nationwide road accident fatality rate in 2019 is 38.1 whereas Bangkok rate is 10.3. The lower-than-average may be contributed from the lower speed in the city and more law enforcement especially in DUI cases.

However, this rate is still considered exceptionally high by the rest of the world. Other Bangkok transport modes have minor accidents from time to time, but no fatalities are reported. Table 4-5 summarizes the transport accident statistics for the city.

Table 4-5 Bangkok SUTI 5 Evaluation

Fatalities	number
Road transport	586
Railway transport	0
Express Boats	0
Ferryboats	0
Others	0
Total	586
Inhabitants	5,666,264
Fatalities/100,000 inhabitants	10.34

It should be noted that the score 10.34 is out of range designated by the SUTI methodology. Thus, the high value of 9.90 is scored for this category in the aggregate SUTI in Section 5.

3.6 SUTI 6: Affordability – travel costs as share of income

The fare structure and levels of the four systems are investigated. In general metro system fare structure consists of initial and distance-based fare rate by distance or station which are rounded to the nearest baht. As of December 2019, BTS original lines charge 15 baht for the first station, 22 baht for the second, and add 3.45 baht per station thereafter, capped with a maximum of 42 baht. Both extended sections charge for additional 15-baht flat rate. MRT fare for Blue line starts at 16 baht for the first station, and 2.32 baht per station thereafter, capped with a maximum of 42 baht. MRT fare for Purple line starts at 14 baht and adopted the same graduate structure and maximum as that of Blue line. Once changing between the two MRT line, the capped fare starts increasing by station again, making the maximum travel fare between the two systems 70 bath.

BMTA's buses are simply divided into two types, air-conditioned and non-air-conditioned. Air-conditioned buses adopted the distance-based fare structure similarly to the metro system. Three subtypes of airconditioned buses apply slightly different fares. Cream-Blue buses charge 12 to 20 baht with 2-baht increment. Yellow-orange Euro-II buses charge 13 to 25 baht with 2-baht increment. NGV489 buses charge 15, 20, and 25 baht. All buses charge 2 baht extra for the expressway section. Non-air-conditioned buses charge 8-baht flat rate, and 2 baht extra for expressway as well. The night bus would add 1.50 baht on top from 23:00-05:00.

The average metro and bus fare are obtained from the respective agency's annual reports. Table 4-6 explains the ticket fares and market share for Bangkok's main public transport modes.

Table 4-6 Bangkok SUTI 6 Evaluation

Services	Monthly Ridership	Market shares	Single ticket price	Monthly cost (60 tickets)	Weighted monthly cost
BTS	19,810,650	44.7	29.0	1,740	778
MRT Blue	9,750,000	22.0	24.7	1,481	326
MRT Purple	1,602,480	3.6	20.0	1,202	43
BMTA	13,152,420	29.7	13.6	818	243
Total	44315550	100		0	1390
Mean household income, 2019					39,459
Expense to monthly income (%)					3.52

The statistics may have reasonably distorted the fact for Bangkok affordability. The reason was that commuters often rely on several modes to complete their journeys. One may have to pay for access mode to the station or stop and connect to the bus or metro line before making another transfer to the final destinations.

Bangkok public transport systems are operated by many private companies or state enterprises under different contracts and conditions. For several years attempts have been made to establish common fare structure for all systems to reduce expenses on trip makers. Due to complex conditions in revenue sharing and responsibility, the “common ticket” have not been materialized. The government still maintain high expectation on this project and set the target for it to be completed next year (2021). Meanwhile the commuters have to take this burden by paying duplicate initial fare for entering new public systems every time transfer occurs.

3.7 SUTI 7: Operational costs of the public transport system

Metro Operation

All metro transit service systems in Bangkok have been driven by public-private partnership (PPP) mechanism to achieve efficiency and readiness of the service. The projects have to be structured in a way that they attract interest of private investors with financial opportunities. Focusing on operation and maintenance cost and revenue sharing, two main PPP schemes have been exercised, although the contracts may be different in further details.

The original sections of Green and Blue Lines are operated under the “net cost” PPP contract under which the operators pay for their concession, operation and maintenance cost and enjoy the revenue over the contract period. The government has put focus on control over service safety and fare escalation rules to ensure essential welfare for the public.

The other scheme namely the “gross cost” PPP contracts are applied to Purple Line, Blue Line Extension, and Green Line 1st and 2nd phase Extensions. The government agencies pay a fixed amount of “availability payment” (AP) for the private operators to run the service. The operators take the risk of operation and maintenance costs but leave the business risk (i.e. farebox revenue) to the government. The metro lines or sections that are viewed unprofitable and normally have to opt for this contract option to secure the bank funding.

Two private operators namely Bangkok Transit System (BTS) and Bangkok Expressway and Metro (BEM) currently takes the majority of Bangkok metro contracts. Both are registered public company and listed in the stock market. Thus, they essentially aim for profit operation. Their business structures are rather complicatedly set up, which makes it difficult to determine clear cut operation burden. BTS holding company sets up a subsidiary company, BTS Rail Mass Transit Growth Infrastructure Fund (BTSGIF). BTS sell the future revenue to BTSGIF while takes some of the operation cost burden. Thus, the annual report shows the fuzzy boundary of expenses between the two companies. BEM has a more direct way to manage their operation and maintenance costs. However, the revenues are recorded from both farebox (Blue Line) and AP (Blue Line Extension and Purple Line). In the business point of view, both BEM gross cost concession contracts are running at a loss but the costs are compensated by the AP from the government, namely Mass Rapid Transit Authority (MRTA) and the farebox revenues do not appear on the private account.

Bus Operation

Majority of Bangkok buses are owned and operated by Bangkok Mass Transit Authority (BMTA). Many small private companies are granted the license to run a certain fleet of buses. Only BMTA bus operation expenses and farebox revenues are realized while the private operation's balance is reflected in BMTA annual report as an income from licensing.

Score

Subject to the unknowns described above, the best estimate for operation and revenue is shown in Table 4-7.

Table 4-7 Bangkok SUTI 7 Evaluation

Services	Fare Revenue	Expenses	Farebox ratio	Yearly Ridership	share (%)
BTS	6,814,244,379	2,015,852,432	338%	241,200,000	45%
BEM	5,022,000,000	4,214,000,000	119%	124,573,770	23%
BEM Blue Line Ext.	127,000,000	211,000,000	60%	12,781,205	2%
Bus	4,572,762,151	8,668,446,132	53%	160,021,110	30%
Total	16,536,006,530	15,109,298,564	196%	538576085	100%

Both metro companies are operating with good profits. This is due to rapid increase in ridership in the recent years and the PPP structure that allows private companies to enter the market and provide efficient service. BMTA's bus, on the other hand, continues to lose its ridership and struggle to keep up with the operation cost as well as providing competitive service. In the overall picture, Bangkok public transport generates almost twice farebox revenue compared to operation costs.

3.8 SUTI 8: Investment in public transportation systems

The total investment in transport sector is obtained from 2019 BMA action plan, assuming the actual spending between the public and private transport project remain at the same ratio as planned. It is found that a great amount of budget is spent on road improvement, pavement rehabilitation and traffic signal and control projects under the Civil Works Division and Traffic and Transport Division to respond to the first strategy “safe metropolitan”. Considerable amount of budget is also spent on improving pedestrian walkways under the same strategy, which is recorded as a part of public transport facility portion for the analysis. In fact, there are as many pedestrian projects as road projects but with much lesser budget due to their nature of investment. Some projects are ambiguously defined whether it would involve on the private or public transport facilities such as safety device installation and pavement and footpath improvement.

Not only is the responsibility of transportation investment in Bangkok limited to Bangkok Metropolitan Administration (BMA), but the Central Government also contributes to a large sum of investment for the city, especially such large infrastructures as metro systems. In a national scope, budget has been distributed to different modes of transportation. A report from National Economic and Social Development Board (NESDB) shows the 2017-2021 investment plan. The total investment for transportation sector in 2019 is 396,831 million baht and the investment for urban rail sector (i.e., M-Map network) is 160,448 million baht. The rest of the budget are assigned to intercity motorway, railway, aviation, and freight, but no other urban transport. Thus, the aforementioned urban rail budget is included into score calculation. Table 4-8 shows the 2019 budget allocation and SUTI 8 evaluation.

Table 4-8 Bangkok SUTI 8 Evaluation (million baht)

Investments	2019		Total
	BMA	Central Government	
Public Transport Facilities	1,332.00	160,448	161,780
Total Transport	5,096.00	160,448	165,544
Share			97.73%

3.9 SUTI 9: Air quality (pm10)

Air quality has been of great concerns for the city in the last few years. PM2.5 has become a focus in place of PM10. The available PM10 is selected as an indicator for SUTI 9 calculation over PM2.5 as its values are more in the max-min range (i.e. 10-150) of the SUTI scoring system. PM 10 values range from 17 to 94 with average 40.89 and median 38, while PM2.5 values range from 34 to 177 with average 83.40 and median 77. Table 4-9 shows daily statistics for PM10 in 2019.

Table 4-9 Bangkok SUTI 9 Evaluation

Date	PM10											
	Dec	Nov	Oct	Sep	Aug	Jul	Jun	May	Apr	Mar	Feb	Jan
1	39	30	48	18	25	32	28	28	38	50	61	38
2	36	36	37	25	24	43	26	25	39	52	57	40
3	44	39	36	23	23	43	33	28	36	47	44	48
4	51	41	45	26	18	63	30	25	37	40	50	55
5	51	58	45	27	22	33	45	31	27	46	48	62
6	60	59	33	28	24	43	36	47	35	46	38	76
7	58	61	29	31	25	37	36	60	28	29	41	74
8	68	61	34	26	23	35	37	61	35	33	43	47
9	64	60	26	29	25	35	28	61	27	31	36	49
10	68	61	34	26	18	43	25	55	31	31	40	59
11	74	69	41	30	18	59	25	54	32	39	41	85
12	67	62	37	29	18	39	23	55	32	51	50	73
13	68	54	23	20	24	34	23	39	28	42	72	76
14	63	41	19	24	33	26	24	43	24	34	50	78
15	67	46	31	31	32	24	27	55	20	31	50	67
16	61	54	42	28	32	22	30	51	21	47	43	63
17	59	56	46	35	22	24	31	49	29	47	36	67
18	60	55	44	31	20	22	21	58	32	51	31	58
19	59	51	46	33	27	24	20	53	33	45	26	70
20	57	40	46	33	26	27	34	42	48	41	26	62

Date	PM10											
	Dec	Nov	Oct	Sep	Aug	Jul	Jun	May	Apr	Mar	Feb	Jan
21	57	41	50	26	23	17	37	43	55	36	34	74
22	50	44	69	33	25	27	32	38	34	47	31	65
23	50	51	46	25	25	28	29	34	39	53	37	64
24	52	49	36	41	24	39	25	35	37	44	38	60
25	54	55	42	59	20	27	26	40	39	34	38	79
26	51	46	44	59	18	34	24	32	46	38	38	73
27	57	47	32	49	24	28	27	38	49	36	50	62
28	57	38	34	62	22	33	31	41	26	41	52	73
29	59	35	37	66	21	20	25	23	24	40		82
30		36	40	77	25	25	21	24	27	38		94
31			48		21	27		30		39		79
2019 Annual Average PM10											40.89	
2019 Annual Median PM10											38.00	

3.10 SUTI 10: Greenhouse gas emissions from transport

The greenhouse gas emissions are estimated from fuel sales. The diesel and gasoline sales statistics is available through the Office of Policy and Plan, Ministry of Energy. The data have been collected from the gas stations throughout the country, but the data specific to Bangkok are not available. Bangkok share of gasoline consumptions is then estimated from the number of registered vehicles in Bangkok versus the total registration nationwide.

The gasoline is categorized into several types of gasoline used in Thailand, namely Benzine 95, gasohol 91, gasohol 95, gasohol E20 and gasohol E85. Although they may contribute to CO₂ differently, the referenced factors are not available. Therefore, calculation of the CO₂ emissions still relies on the factors suggested by the SUTI manual. Table 4-10 shows SUTI 10 calculation.

Table 4-10 Bangkok SUTI 10 Evaluation

	Litres of fuel sold	CO₂-factor (kg/l)	Emission (tons/year)	Population	Emission/capita
Gasoline/ Petrol	3,230,655,231	2.272	7,338,433		
Diesel	1,542,034,281	2.676	4,126,484		
Total			11,464,917	5,666,264	2.02

Chapter 4 Sustainable Urban Transport Index

4.1 SUTI Score

SUTI for the city is determined by the geometric mean of the 10 indicators in Chapter 3. The SUTI score comes out at 42.22. Table 4-1 summarizes SUTI for Bangkok.

Table 4-1 Bangkok SUTI

C1 RESULT SPIDER DIAGRAM		Input value	Normalized Score
1	Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes	10	62.50
2	Modal share of active and public transport in commuting (adjusted)	37.6	34.49
3	Convenient access to public transport service	75.67	69.58
4	Public transport quality and reliability	67.9	58.26
5	Traffic fatalities per 100.000 inhabitants	9.9	1.00
6	Affordability – travel costs as part of income	3.52	99.93
7	Operational costs of the public transport system	100	100.00
8	Investment in public transportation systems	50	100.00
9	Air quality (pm10)	38	77.93
10	Greenhouse gas emissions from transport	2.02	26.42
SUTI Geometric mean			42.22

Its low value is primarily the result of the low public transport mode share (SUTI 2) and, more dominating, the high rate of accidents per 100,000 inhabitant (SUTI 5) which exceeds SUTI scale. The high rate of private car usage also reflects on the high petrol sales and resulting in

high greenhouse gas emission (SUTI 10). The travel cost is likely to be underestimated in the affordability category (SUTI 6) which may indicate a lower value than it should be due to lack of fare integration and need to pay multiple access fees in case of using more than one mode. The same case applies to operational cost of the public transport system (SUTI 7) where the structure of concession contract would ensure operators to operate with profits under normal circumstances.

The greatest strength of the city public transportation is the fact that metro operators are operating under PPP contracts which allows great profit opportunity and in turn good quality services. Public transport plan (SUTI 1) and convenient access to public transport service (SUTI 3) are among the brightest points, as a result of comprehensive metro development plan and implementation.

4.2 Spider Web

The spider web chart in Figure 4-1 shows the overall picture of strengths and weaknesses for public transport systems and services in Bangkok.

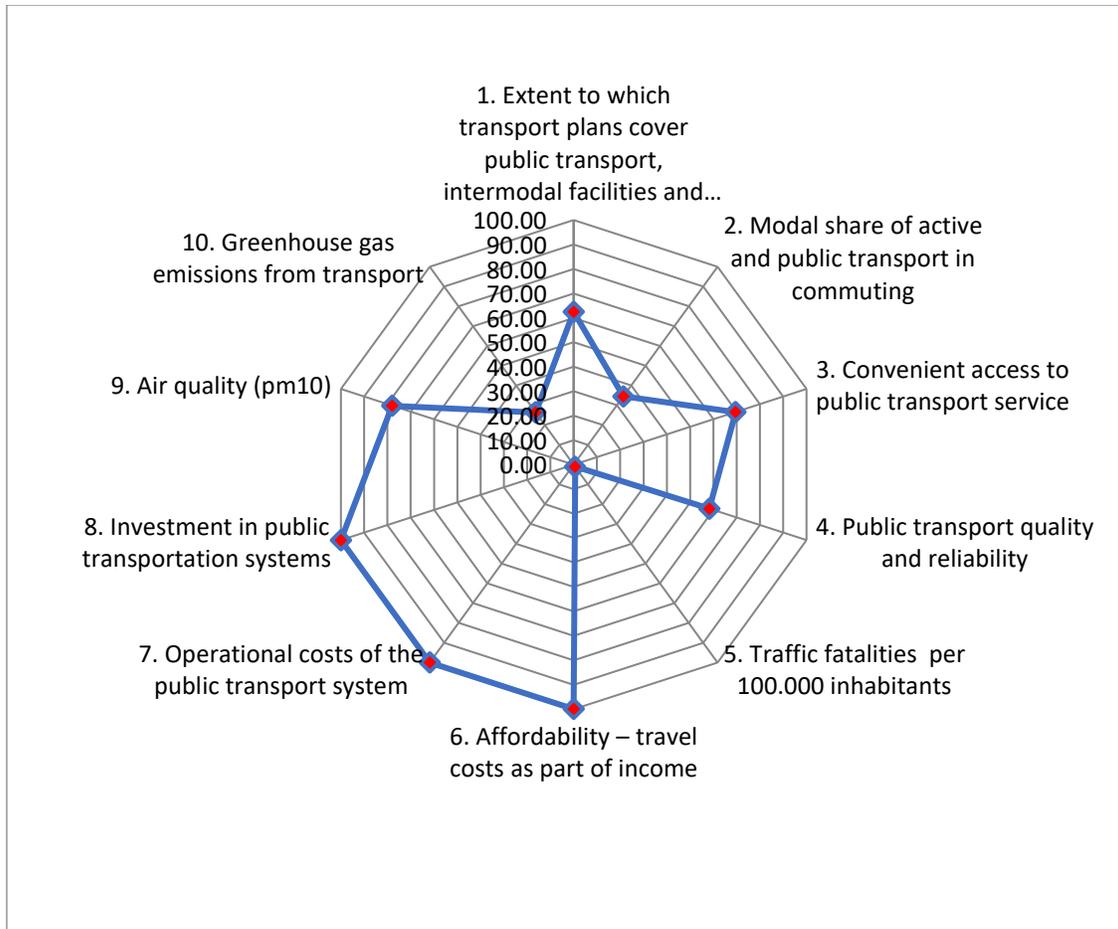


Figure 4-1 Bangkok SUTI Scores for Ten Indicators

Chapter 5 Public Transport for All

5.1 Walkability

One of the basic but important elements to promote use of public transport is walkability. Being able to walk safely and conveniently means higher accessibility which encourages public transport usage. While Bangkok enjoys its lively activities that encourage walking in many parts of the city, the walkway physical conditions are still questionable. Most walkways have not been well constructed, maintained and regulated. Motorcycles and vendors are illegally using walkways as shortcuts and detour from mainline street traffic which even accelerating deterioration.

Walkscore, a famous pedestrian rating company which as recently extended their service to Bangkok as well as many major cities around the world, gives the walk score in a range of 70-90 around most Bangkok metro stations. Goodwalk, another local pedestrian rating company also rates high score to most metro station locations. Both rating systems are based only on the utility of walking, i.e., how many useful things can be carried out while walking in the area. The more shops, services and other settlements in the walkable distance, the higher the rating. However, neither rating takes into account the physical conditions or the connectivity of the walkways.

Bangkok streets has been continually widened to accommodate rapidly growing motorized traffic. In the process, walkways have been trimmed down to give way to extra vehicular lane or curb parking space. The limited width become a major barrier to proper design and necessary street furniture placement. Trees, electric poles, utility boxes, benches and street lightings are often aligned on the same line yet leaving small space for walking. Construction sites and roadworks involving walkways almost always neglect provide proper measures for pedestrian, leaving them to walk on the street surface with motorized vehicles. Space conflicts between pedestrian walkway and metro station stairways are common as the land acquisition plan does not necessarily provide enough room for both to coexist. Figure 5-1 and 5-2 show the space conflicts between walkway by utility furniture and stairway.

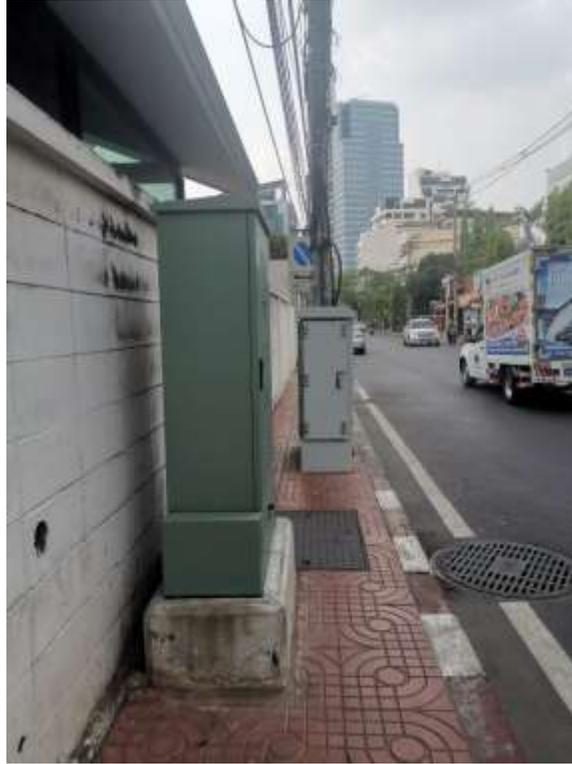


Figure 5-1 Street Furniture Taking Pedestrian Walkway Space



Figure 5-2 Metro Station Stairways Taking more than Half of Walkway Width

As deteriorated conditions of walkway pavement cause inconvenience and is sometimes harmful, public becomes more aware of the basic pedestrian rights to use safe and convenient walkways. Lately, there have been several discussion topics on social media platforms involving walking experience in various spots of Bangkok. Problems have been reported, and most of which have been promptly fixed with short term solutions by the responsible agencies. Long-term action plans for pedestrian network have been discussed and initiated in a few locations around the city. Some plans have also been developed together with walking street and transit-oriented development (TOD) concepts in an attempt to promote the economic activities of the selected vicinity. One of the most famous projects that has already been successfully implemented is Khlong Ong Ang, which can be accessed via MRT Sam Yot Station. It becomes one of the city's top destinations and welcomes a large number of tourists every weekend.

5.2 Inclusiveness in Public Transport

Recently there has been increasing public awareness on the rights for women, disables and elderly. Universal design and design for all concepts have been considered and mandated for almost all sectors ranging from building and facility design, manufacturing, tourism and transport. For transport facility design, attention is specifically paid to elderly and disables. Disabled Life Quality Promotion and Improvement Act B.E. 2556 by the Ministry of Social Development and Human Security and Building Control Act B.E. 2543 by the Ministry of Interior Affairs issues two ministerial laws specifying facilities for disables in transit station to ensure that disables and elderly are able to use public transport by themselves without unreasonable difficulties. Recently, the Ministry of Transport commissions a series of study to investigate whether transport facility design matches the requirements of these laws, and whether there are any room for improvement based on real user experiences.

Metro systems in Bangkok have provided facilities for disables and elderly including elevators, ramps, Braille block, passenger announcement, and security guard assistance. In 2015, the court ordered the operators/the project owner to provide complete facilities for disables as listed in the ministerial laws for all metro stations. All newly constructed stations have been equipped with full list of facilities while the existing ones have also been improved to fulfil the requirements.

The rolling stock itself are also designed for people with special needs. Platforms are leveled with the train floor making it easy for wheelchairs and elderly to board the train. Priority seats are available on metro trains for monks, children, pregnant women, elderly and differently abled (Figure 5-3). It is, however, normal practice for Bangkokian to give up seats for those in needs, no matter they are priority seats or not. Monks are included in the priority list as Buddhism prohibit them from touching women. Seats are normally given to children, pregnant women, and elderly. Differently able in wheelchair also have a designated space in the coach equipped with the locks to secure the wheel from rolling. Meanwhile, women are treated equally and do not receive any privilege. However, they are safe to travel on public transport system alone.



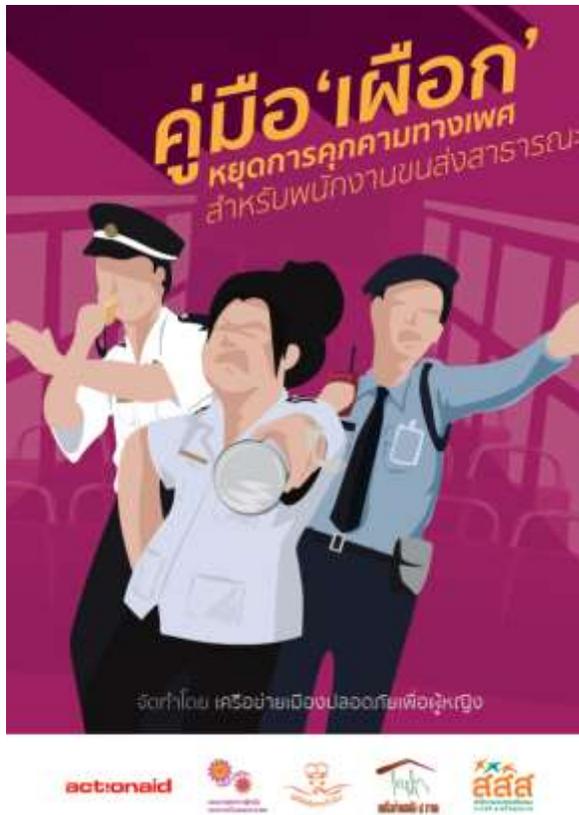
Figure 5-3 Priority Seats for Monks, Children, Pregnant Women, Elderly and Disables

The bus system, on the other hand, still lacks comparable facilities. The walkway and ramp leading to bus stops are not normally well maintained. Bus stairs are high and do not accommodate wheelchairs. Priority seat are not normally designated. Only special discounted fares are offered for senior citizen and differently able. Most part of their travel is made possible through the bus ticket staff and fellow passengers.

5.3 Gender Issue

In general, men and women are valued quite equally in Thailand, except for very few old traditional interests. Although women take more crucial role and are more accepted in professional jobs, they customarily take extra domestic responsibilities at the same time. However, men are more likely to own access to family's private mode of transport, if any, and leaving women with public transport option whether through self-access or being dropped off. On public transport women are not normally viewed as physically vulnerable. While seats and other forms of helps would be given up for the group of special needs as mentioned in section 5.2, they are hardly offered to normal adult women. However, there is still possibility for sexual misdemeanor on board or within public transport premises. In the past, undesirable discrete events occurred including stalking, photo shooting, voyeurism, jostling, and other forms of obscenity. A 2017 survey revealed that 35% of the respondents experienced sexual harassment. 50% of the misconducts occurred on the bus, 10% on vans, 9% on metro, and the rest were on hired transportation.

Operators have realized the sexual harassment issues and establish measure and protocol to cope with the problem (Figure 5-4). BTS and BEM, two main metro operators provide security guards in all the station areas. Female security guards are also appointed to selected locations to offer helps to women in close-contact situations. These security measures have also been collaborated with local and tourist police forces. Meanwhile, BMTA, the main Bangkok bus operator provides training for their 13,000 staff in all 8 service districts and publishes a manual to prevent sexual harassment on their buses.



ตัวอย่างเหตุการณ์การคุกคามทางเพศที่พบบ่อย

ตัวอย่างที่ 1 เมียดชิด ถูกเนื้อต้องตัว

ผู้โดยสารหญิงบังเอิญ ผู้โดยสารชายที่ไม่ได้มาด้วยยืนก้ำกึ่งนั่งหลังเธอตบเข่าเป็นจังหวะเป็นจังหวะ เมียดชิด หรือเอนศีรษะลงบนไหล่ฝ่ายหญิง ผู้โดยสารหญิงมีท่าทีอึดอัดและพยายามเลี่ยงตัวหลบ ผู้หญิงบางคนอาจละทิ้งและบอกให้ฝ่ายชายขยับออกห่าง แต่อีกไม่นานผู้โดยสารชายก็ทำพฤติกรรมเดิมซ้ำอีก



ตัวอย่างที่ 2 ลับหลัง ดูถือ

ผู้โดยสารหญิงนั่งเก้าอี้ริมทางเดิน ผู้โดยสารชายยืนหลังพนักเก้าอี้ตัวนั้น เมียดตัวกับตัวฝ่ายหญิง และเอนตัวเมียดชิดจนคิดสังเกตุ ผู้โดยสารหญิงมีท่าทีอึดอัด และพยายามเลี่ยงตัวหลบ



ตัวอย่างที่ 3 พุดแซว เทียบพาราดี

หญิงสาววัยรุ่นเดินทางมาคนเดียว และนั่งอยู่ตรงที่ว่างท้ายรถ ต่อมาตัววัยรุ่นชาย 2 คนเข้าไปนั่งประกบ และพยายามชวนฝ่ายหญิงพูดคุยและหัวเราะสนุกสนานเองฝ่ายเดียวกัน ผู้โดยสารหญิงไม่ได้พูดโต้ตอบ หรือพูดตอบแบบขอไปทีและมีท่าทีอึดอัดอย่างเห็นได้ชัด แต่ก็ไม่สามารถลุกจากที่นั่งตรงนั้น



Figure 5-4 Manual of Sexual Harassment Prevention by MRTA

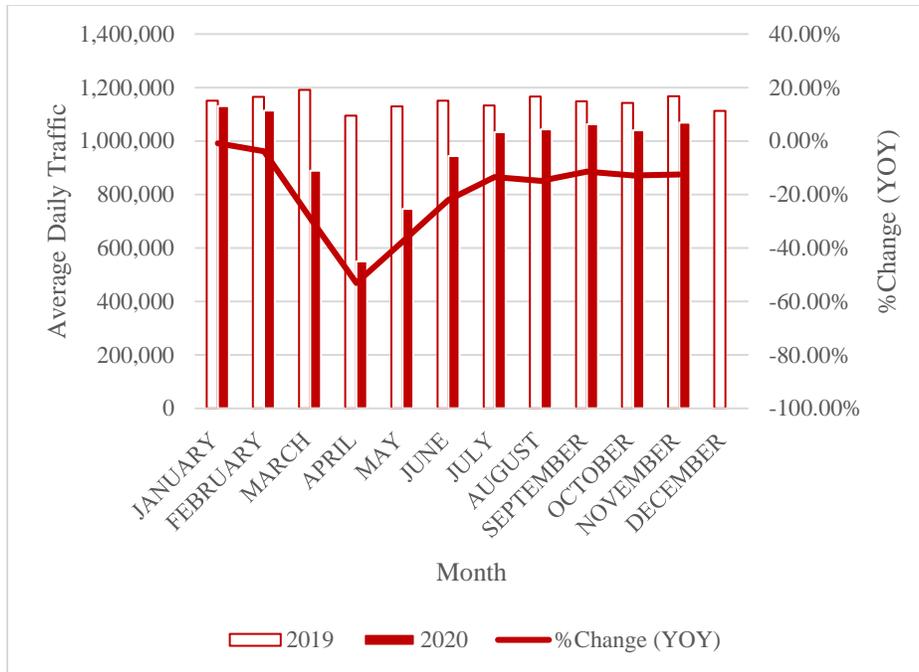
Chapter 6 Impacts from COVID-19

6.1 COVID-19 Situation

Thailand is the second country in the world and first outside China to have detected a Covid-19 case in January 2020. The country's first three cases were all Chinese tourists, while some of the later cases involved Thais who visited China or were in contact with Chinese tourists. The detection statistics was gradually rising until it sets an alarm to the public. The government encouraged everyone to avoid large group meeting and to work from home if possible. Restaurants, nightclubs, malls, stadiums, and public parks were ordered to close, whereas supermarkets, schools and other public venues with lower risks were restricted with some specific regulations.

In April, at the peak of epidemic spread, almost all social activities were cancelled and people are requested to stay home. After weeks of rigid restrictions, the number of domestic infections reduced and finally reached zero for a long period of time.

Overall, the travel demand started to fall in February, took a sharp decline in March and reached the lowest point in April due to work-from-home-policy. Even road traffic was apparently much less congested. Traffic gradually picked up in the months after and kept stable trend until present, which was still considerably lower than last year average. Figure 6-1 shows comparison in expressway traffic between year 2019 and 2020, with percentage change showing in red line using the right secondary axis.

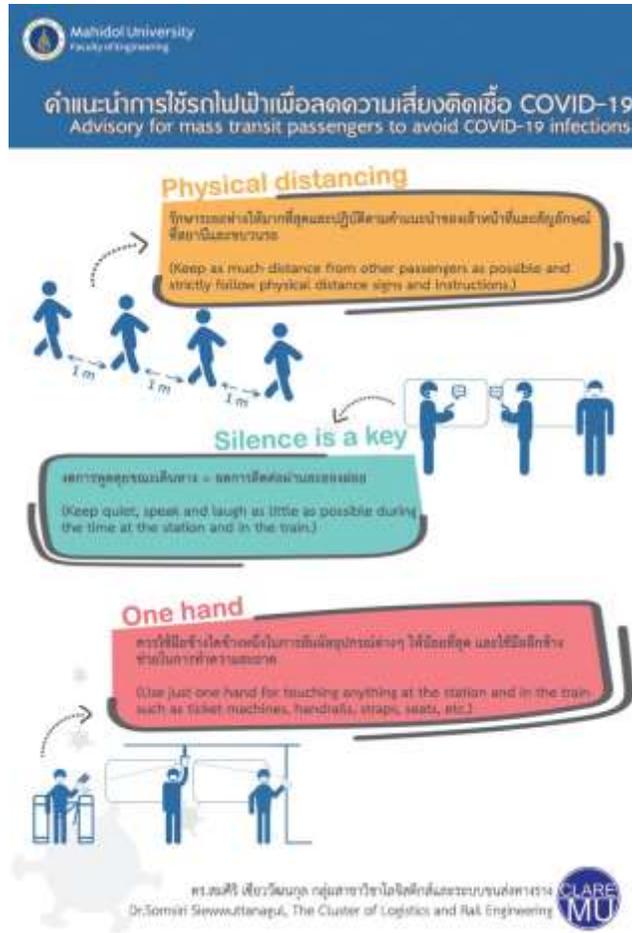


Source: Annual Expressway Traffic and Revenue Report, BEM, December 2020.

Figure 6-1: COVID-19 Impact on Bangkok Expressway Traffic (Excluding Don Muang Tollway)

6.2 COVID-19 Impacts to Public Transport

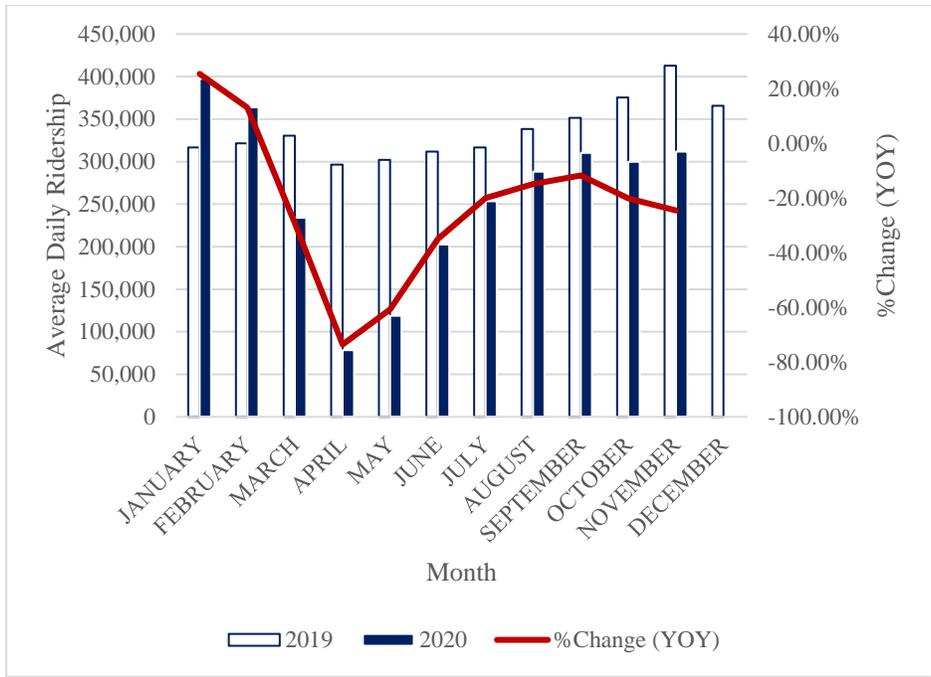
Several measures have also been applied to public transport. Passengers had temperature checked at the gate of the metro station and had to wear masks at all time in the metro systems. Markings were put on the platform and all queuing area to remind passengers to keep proper distance. Alcohol gel was provided at the entrance and exit. Measures for bus riding was slightly more relaxed as it did not have more defined system boundary than the bus vehicle itself. However, passengers were also required to wear masks on board and social distancing policy was encouraged. Figure 6-2 displays an example of public transport measures against COVID-19



Source: Mahidol University, 2020

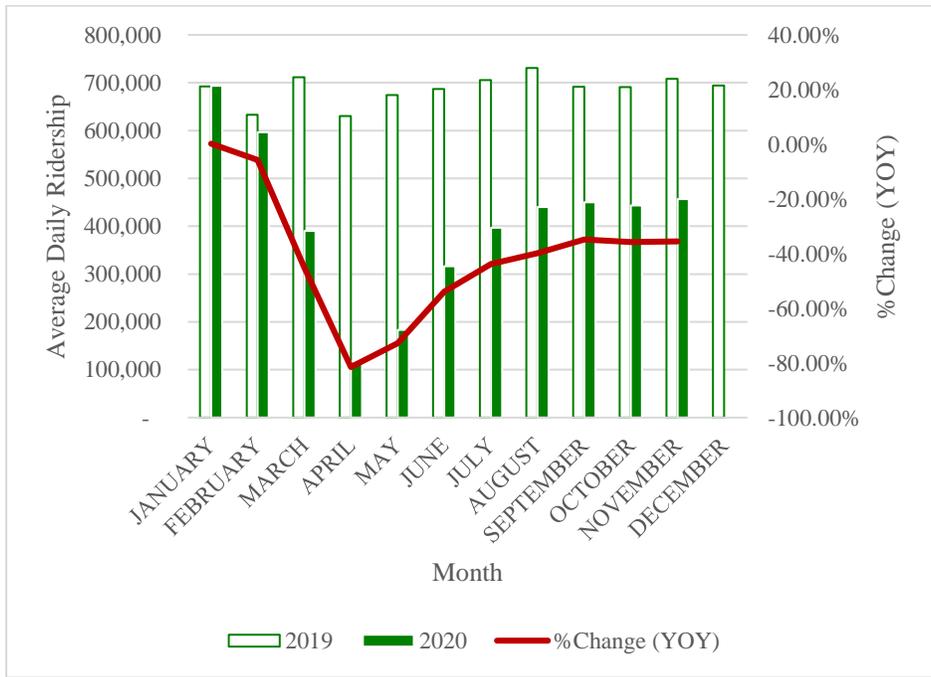
Figure 6-2 Example of Public Transport Measures against COVID-19

It was estimated that the social distancing measures reduced public transport capacity by 30-40% for all trips. In fact, public transport suffers further loss of ridership. Two key possible reasons possibly contributed to this decline. As the pandemic news became more intense, people naturally did not feel secured enough to use public transport system. Moreover, the work from home policy coupled with cancellations of social events greatly reduced daily travel demand. Introduction of new remoted conference technology kept business and other economic activities running. Figure 6-3 compares ridership on BEM’s Blue Line during April 2019 and 2020. Lastly Figure 6-4 offers the same comparison for BTS’s Light and Dark Green Lines.



Source: Annual Ridership and Farebox Report, BEM, December 2020.

Figure 6-3: COVID-19 Impact on Bangkok Blue Line Ridership



Source: Annual Ridership and Farebox Report, BTS/GIF, December 2020.

Figure 6-4 COVID-19 Impact on Bangkok Green Line Ridership

A quick comparison shows that public transport lost more patronage than the expressway in term of percentage. In April 2020, the expressway traffic fell to 550,000 vehicles per day from 1,095,000 vehicles per day in the same month of 2019, accounting for 50% year-over-year (YoY) drop. Three months after the traffic climbed back to a steady state at 1,050,000 vehicles per day, yet around 8% drop from the year before. The April-to-April statistics elsewhere saw Blue Line ridership dropped from 297,000 to 78,000 trips per day or 73.5% drop. Meanwhile Green Line which served as the backbone of the city suffered the largest drop from 631,000 to 117,000 trips per day which was equivalent to 81.5% decline. Both lines picked up more passengers after that critical period, but not as well as expressway traffic. It is likely that some public transport users may have shifted to private car and have not switched back. Now Blue and Green Lines are receiving 20% and 30% lower passengers than they did in the same period last year respectively.

Low ridership continues to affect the business performance. Not only does the revenue goes down, several measures against the disease also incur costs. More security guards are required. Shield and blockage have been installed. Alcohol gel and temperature check must be provided at the gates. These measures increase operating costs to the operators, while the farebox revenues are still not recovered.

6.3 COVID-19 Impact to Hired Transportation Service

Taxi is expected to take the greatest negative impact as tourists are the key income of the industry. Taxi passengers are from the high-income group. These passengers are ready to shift as they can afford to buy and use private cars to avoid the risk of infection. Lastly, upon announcement of Emergency Decree on Public Administration in Emergency Situations, people are prohibited to leave their home after 10 pm. This even reduced opportunity of taxi drivers to earn their income.

Kasikorn Research Center forecasted COVID-19 impacts to transport businesses as shown in Table 6-1

Table 6-1 Covid-19 Impacts to Transport Businesses

Transport Business	2019 Market Value (million baht)	2019 Market Value (million baht)	% change
Public/Hired Transport	120,355	66,185 – 72,202	-40% to -45%
Taxi	58,912	26,511 – 29,456	-50% to -55%
Motorcycle Taxi	49,593	32,236 – 34,715	-30% to -35%
Bus (BMTA and joints)	9,213	5,988 – 6,449	-30% to -35%
Van	2,637	1,450 – 1,582	-40% to -45%
Rail Mass Transit	10,935	7,114 – 7,691	-30% to -35%
BTS	6,963	4,526 – 4,874	-30% to -35%
MRT	3,162	2,213 – 2,372	-25% to -30%
ARL	810	405 – 446	-45% to -50%
Total	131,290	73,239 – 79,893	-39% to -44%

Source: Kasikorn Research Center

Chapter 7 Conclusion and Suggestions

7.1 Bangkok Urban Transport

Bangkok mass transit main modes are rail and bus which accommodate around nine million trips per day between them. Bangkok railway network has been developed through a series of rail transit master plans. As of December 2020, six metro lines are in operation including Light and Dark Green Lines, Blue Line, Purple Line, Airport Rail Link, and newly opened LRT Gold Line, for a total of 169 km providing coverage throughout the city. The city bus service was exclusively run by BMTA which also grant licenses out to private counterparts to operate some selected routes. The 2019 statistics reported that BMTA owns 3,005 buses and the private joint companies own 9,927 buses bringing the total to 12,932 buses and 456 routes. The city water transport is fairly popular, albeit limited to the river and canal small network.

The city transport has supports from ample tuk-tuk, taxi and motorcycle taxi services. All of these hired transport forms are available everywhere in the city. However, lack of regulations and law enforcement sometimes lead to reliability and security problems. The arrival of on-demand taxi service has partially alleviated these difficulties by offering competitive service. The on-demand service also gradually expands to paratransit mode covering some selected area of the city.

7.2 Urban Transport Performance Analysis based on SUTI Scoring

The SUTI scoring system has been employed to evaluate ten aspects of urban transport. The overall score from the city is 42.22. Remarkable strengths of the city urban transport, as suggested by the SUTI score, include public transport plan (SUTI 1) and convenient access to public transport (SUTI 3). Bangkok has a great bus network which provide coverage to most part of the city. Yet the routes have not been evaluated or improved for years. Some routes may not be operating with proper frequency during different times of the day and different days of the week. On the other hand, metro network does not provide as good coverage but many lines are under construction and will be in operation in the near future. A large sum of money and effort

have been spent on establishing and reviewing metro master plan as well as feeder and supporting elements for public transportation.

Affordability (SUTI 6), and operational cost of the public transport system (SUTI7) also receive high scores. However, there could be some misleading information and interpretation on the last two categories. Affordability is estimated from ticket price, but the number of transfers is neglected. The common ticket program which is expected to combine all the fare systems (i.e. bus, rail and water) together is still in progress. Now travelers have to pay multiple initial fare when transfer from one system to another, and that normally translates to unnecessarily high travel expenses. Furthermore, they might need to pay for access cost including taxi and motorcycle taxi to reach the station/stop. Operation cost of the service providers appeared low in the book. This is because the government tends to form PPP concessions in which it absorbs the costs and offers attractive deal to attract quality private operators. Moreover, the operators often create complex organizational structure due to business reason. This makes operating expenses very difficult to track.

Notable weaknesses include the low public transport mode share (SUTI 2) and the rate of accidents per 100,000 inhabitants (SUTI 5). Despite the extensive mass transit master plan and high import tax of motor vehicles, costs of driving in Bangkok are still considered low. Parking fees in downtown are relatively low compared to mass transit fare and are often waived when the customers spend to a specified amount. Gasoline prices are also low compared to other non-oil producer countries. Mass transit still lacks pricing strategies to compete with private mode, for example group ticket or off-peak fare. The high usage rate of private cars and motorcycles naturally lead to high rate of accidents. Laws have not been sufficiently and effectively enforced. Law violations such as speeding and red-light running are common cause of accidents. Consequently, these accidents lead to great economic loss from property damage, injuries and fatalities, as well as incurring traffic congestions.

7.3 Suggestions

After reviewing data and information of Bangkok urban transport against the SUTI scoring system and evaluation methodology, it was found that some categories may be overrated, underrated or misinterpreted in some manners. Thus, the following suggestions are summarized

in an attempt to improve the SUTI scoring system to truly reflect condition and reveal the problems that may exist.

1. SUTI 2 score for public transport mode share sets the minimum and maximum values at 10% and 90% which are quite ambitious. Singapore which runs one of the best public transport systems in the world currently has 67% public transport mode share, and aim to achieve 75% in 2030 (source: <https://www.mot.gov.sg/about-mot/land-transport/public-transport>). Therefore, the min-max range for this score should be considered lower.
2. SUTI 5 score for traffic fatalities allows the maximum of 10 fatalities per 100,000 inhabitants which is surpassed by Bangkok numbers in most years. This year statistics, for example, shows 10.34 but the analysis for this report uses 9.90 so that the index is calculable. In the future the cap should be revised to accommodate larger fatality rates.
3. SUTI 6 score for affordability only compares the average monthly cost for a single ticket fare to the average monthly income. It fails to reflect the true travel expenses for the whole trip chain. Although Bangkok urban transport consists of good metro and bus network, a great portion of transit trips require either transfers between transit lines or connection with other modes. Nonetheless, the city does not have a common fare system. Travelers must pay access fee every time they change the mode. So, the true public transport expenses may be much higher than the figure has estimated. Alternative calculation of SUTI 6 may be offered if the travel expenses statistics are available.
4. The calculation of the overall SUTI index should be reconsidered. Compared to the arithmetic means, the geometric mean is known to be more suitable for data that are drawn from small sample size and highly fluctuated. However, the SUTI index is not really the “mean” or “average”, but rather the combined interpretation of ten scores. A sharp drop in one or two scores would severely affect the overall SUTI index. In Bangkok case, consider SUTI 5 which scores only 1. When include it in the product to find geometric mean, the SUTI 5 becomes a great “punishment to the overall geometric mean, resulting in SUTI index of 42.22. Should the arithmetic mean be

used, the drop-in index would have not been this low. Figure 7-1 shows the effect of SUTI 5 to the overall SUTI index.

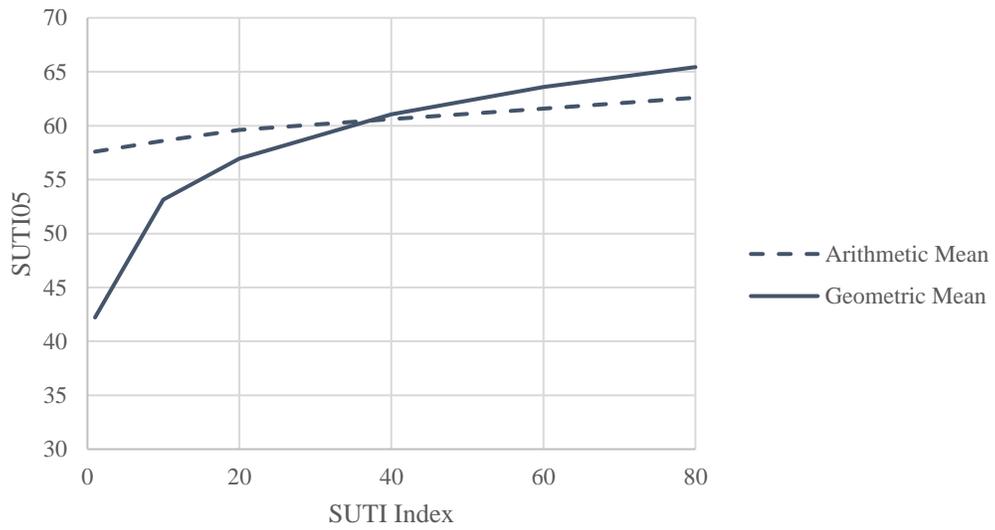


Figure 7-1 Effect of SUTI 5 to the overall SUTI

References:

(to be added)