

# Transit Oriented Development Perspectives for Low-Carbon City in Bangkok, Thailand

Vasinee WASUNTARASOOK<sup>1</sup>, Kazuki NAKAMURA<sup>2</sup>, Hirokazu KATO<sup>3</sup> and Yoshitsugu HAYASHI<sup>4</sup>

<sup>1</sup>Dept. of Environmental Eng., Nagoya University  
(Furo-cho, Chikusa-ku, Nagoya 464-8603, Japan)  
E-mail: vachou@urban.env.nagoya-u.ac.jp

<sup>2</sup>Member of JSCE, Dept. of Environmental Eng., Nagoya University  
(Furo-cho, Chikusa-ku, Nagoya 464-8603, Japan)  
E-mail: k.naka@urban.env.nagoya-u.ac.jp

<sup>3</sup>Member of JSCE, Professor, Dept. of Environmental Eng., Nagoya University  
(Furo-cho, Chikusa-ku, Nagoya 464-8603, Japan)  
E-mail: kato@genv.nagoya-u.ac.jp

<sup>4</sup>Member of JSCE, Professor, Dept. of Environmental Eng., Nagoya University  
(Furo-cho, Chikusa-ku, Nagoya 464-8603, Japan)  
E-mail: yhayashi@genv.nagoya-u.ac.jp

According to economic growth and road-oriented development, Bangkok has rapidly grown to a greatly sprawling built-up area, which causes more CO<sub>2</sub> emissions from urban transport. Since the late 20<sup>th</sup> century, more investment has been made in urban railway development. Taking advantage of the influence, Transit Oriented Development (TOD) is a potential effective approach to calming urban sprawl for a lower-carbon urban form by promoting high-density development. The purpose of this study is to examine the possibility of TOD implementation in Bangkok by summarizing Strengths, Weaknesses, Opportunities and Threats (SWOT) of it. The SWOT analysis is made on a land-use transport system in terms of their advantages and disadvantages for the TOD implementation in Bangkok. This study shows that, while there are signs of growing demand for TOD, Bangkok has many problems with land-use transport systems to implement TOD.

**Key Words:** Bangkok, TOD, Urban Railway

## 1. INTRODUCTION

As the climate change becomes more serious due to increasing levels of greenhouse-gas emissions largely from fossil-fuel combustion, many countries, including developing countries, are required to mitigate their emissions. Especially for Thailand, it has been ranked among the top 25 emitters in the world with the gross emission level of 294.7 Mt-CO<sub>2</sub> per year in 2000, of which almost 70% are caused by fossil-fuel combustion (World Resources Institute, 2012). The transport sector is one of the key sectors responsible for the emissions, accounts for 28% of the fossil-fuel oriented emissions (ONEP Thailand, 2011), and their mitigation. Further growth in the emissions is expected according to rapid economic growth and accelerated motorization.

There are several strategies for reducing transport-oriented emissions by promoting low car-

bon transport system. They are classified into avoiding unnecessary travel demand (AVOID), shifting transport modes to the lower-carbon ones (SHIFT), and improving energy efficiency and emission intensity of transport (IMPROVE) (Hayashi et al., 2011). According to the 11<sup>th</sup> National Social and Economic Development Plan (2012-2016), Thailand's strategies for reducing transport-oriented emissions are mainly focused on the SHIFT and IMPROVE strategies by emphasizing railway development and promoting energy-efficient transport technologies (NESDB, 2012). However, the AVOID strategy is almost neglected in the plan and is not currently taken into account in any policy packages towards low-carbon system in Thailand (Winyuchakrit et al., 2011). AVOID can be realized by reducing distances between residential area, commercial area, and transportation stops, with high-density development to make an urban form

compact. As one of effective measures for AVOID, Transit Oriented Development (TOD) promotes high-density development within an easy walk from/to mass transit facilities supported by high-quality pedestrian facilities. The purpose of this study is to examine the possibility of TOD implementation in Bangkok by summarizing Strengths, Weaknesses, Opportunities and Threats (SWOT) in terms of a land-use transport system and organization capacity.

## **2. TRANSPORT SYSTEM**

### **(1) Mass Transit Development**

The development plan of mass rapid transit systems in Thailand was initiated in 1972 as the government proposed a development of the Mass Rapid Transit (MRT) for solving traffic congestion problem. In 1994, the first master plan for MRT named the Mass Rapid Transit Systems Master Plan (MTMP) was formulated by the Office of the Commission for the Management of Land Traffic (OCMLT) (currently the Office of Transport and Traffic Policy and Planning (OTP)). This master plan was regarded as the first attempt to provide an integrated framework to develop urban railway in the Bangkok metropolis. The master plan proposed construction of an urban rail network with a total length of 135 km during 1995–2011.

Later in 1996, the Conceptual Mass Rapid Transit implementation Plan (CMIP) revised the rail network from the previous master plan to cover the total distance of 178.9 km. 11 feeder mass-transit systems, such as light rail and monorail systems, with a total length of 206 km, were later recommended to improve access to the trunk lines.

However, during the economic crisis in 1997, the mass-transit development plan was changed, as the economic situation was not favorable for investment. As a result, the implementation of the development plan was suspended. OCMLT reviewed the plan and formulated the Urban Rail Transportation Master Plan (URMAP) in Bangkok and Surrounding Areas in 2000. URMAP proposed the development of mass transit networks with a total distance of 375 km for over 20 years. Despite the economic crisis, its length was longer than the previous plan because it was constructed based on an assumption of economic recovery and at least 5% economic growth per year after 2005 (OTP, 2010).

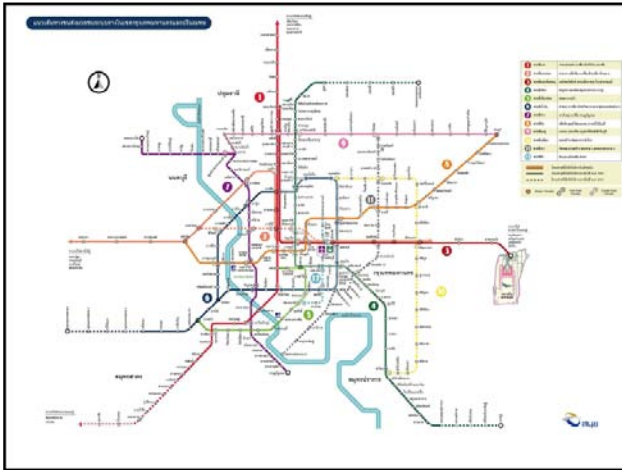
In 2004, when the economic situation showed signs of recovery, OTP conducted the Bangkok Mass Transit Implementation Plan (BMT). The first stage of development of the Bangkok mass-transit network was approved for the completion by 2009, which did

not include a plan for Bus Rapid Transit (BRT). The network incorporates 7 routes, totally 291 km in length. Although the mass-transit development have been implemented based on BMT, uncertain political policies periodically affected the development, resulting in changes in development concepts, investment, and route extension. The mass-transit network was proposed to be extended from 7 routes to 10 routes in 2006 to cover more BMR area.

However, due to the project implementation process, the feasibility in socioeconomic aspect, planning, and detailed design were reviewed to comply with the general standards of infrastructure development. Moreover, the bidding method was changed to allow foreign investment in mega projects under the so-called Thailand: Partnership for Development scheme. Yet, the implementation of the master plan was not achieved as expected as there were still short falls in funding and the construction was later than planned. During the General Surayud government, the mass-transit development plan was reviewed once again and, in 2006, the Cabinet approved 5 routes with a total distance of 135 km.

Up until now, there are 3 routes of urban railway operating in Bangkok Metropolitan Region (BMR); Bangkok Mass Transit System (BTS skytrain), Bangkok Mass Rapid Transit (MRT Subway) and Suvarnabhumi Airport Rail Link (ARL). BTS skytrain, the first mass transit, has started its service with two initial green lines: the 22-kilometer of Sukhumvit line and the 8.5-kilometer of Silom line, in December 1999. In July 2004, the 20-kilometer of MRT Subway was launched at underground level. These two lines are operating along the high-density areas in the inner core part of the city. Later on in August 2010, the 28.5-kilometer of ARL emerged as an intercity line between Bangkok and Samut Prakan. Currently, there are 2 more routes which have been under construction to extend the networks with 15-kilometer of the SRT Light Red line and 23-kilometer of the MRT Purple line since January 2009 and November 2009 respectively.

The latest plan involving with the mass transit system is called the Mass Rapid Transit Master Plan (M-MAP) which contains a 20-year development plan for urban railway during 2010 to 2029. The plan comprises 12 routes with a total distance of 509 km which extends the plan of 2008 to cover fast-growing suburban areas.



**Fig.1** Schematic Diagram of the Rail Mass Transit Network  
(Source: Office of Transport and Traffic Policy and Planning (2010))

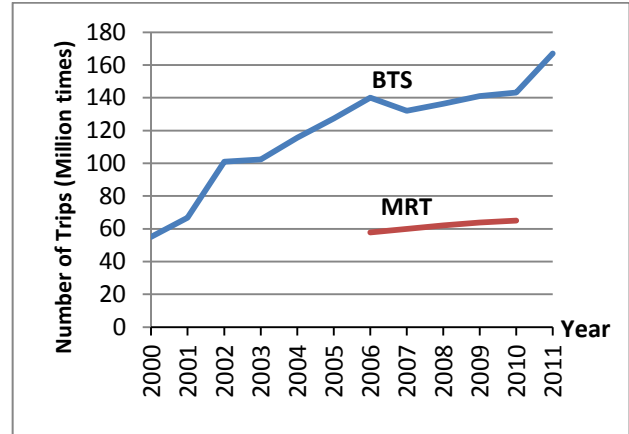
Besides the rail mass rapid plan, in 2004, Bangkok Metropolitan Administration (BMA) had conducted a study on the master plan for developing BRT services in BMR area which initially suggested 10 routes of BRT services. Later on, within the same year, BMA and OTP had collaboratively reviewed the plan for BRT services and proposed the new 12 routes plan. Last reviewing of the BRT plan had been solely conducted by BMA in 2005, which resulted in an extension to 14 BRT routes. The first and only BRT route which has been operating so far is Sathon–Ratchaphruek route opened in 2010.



**Fig.2** Bus Rapid Transit Network Plan  
(Source: Traffic and Transport Department, BMA)

According to the development of urban railway, there is an upward trend of demand for rail mass transit in BMR especially for the BTS. Since the

system started in operation, the numbers of passenger trips of BTS and MRT shows in Fig. 3 has increased annually by 11 % and 3 % respectively. Therefore, if the trend assumed continues, strong demand for TOD can be expected from the increasing level of the mass-transit users.



**Fig.3** Number of Passenger Trips of Rail Mass Transit

## (2) Public Transport Problems

Despite the recent growth in railway use, the modal share is small or only 4% (Fig. 4). The public transport systems in the BMR are still not well-established to be sufficiently convenient for users. The system comprises of many types of transportation, such as railway, bus, van, boat etc., with limited cooperation among the providers since there are different companies or authorities operating each mass transit system; for instance, Bangkok Mass Transit Public Company Limited and BTS, Bangkok Metro Public Company Limited and MRT, State Railway of Thailand and ARL, Bangkok Mass Transit Authority (BMTA) and bus system, and private entities and other modes of transport. Moreover, most public transportation systems provide neither timetables nor enough information on the routes, in which, motorcycle taxi and tuk tuk, do not even specify the fares. The service quality of the public transportation itself is also dissatisfactory since many of them such as paratransit, public buses, boat taxis, cannot assure safety of the passengers and cannot protect passengers from elements of weather and pollution. Particularly, there are many unqualified drivers of buses.

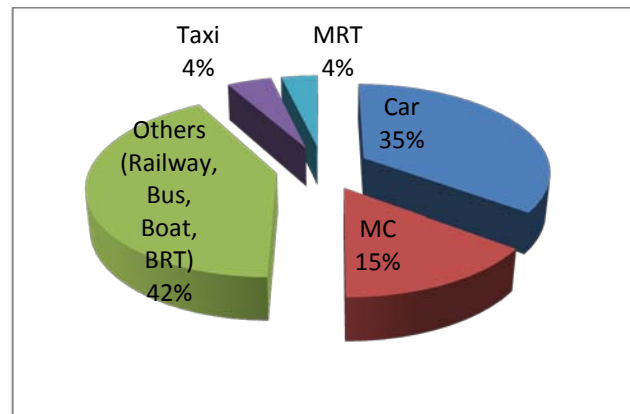
As for access to public transport services, bicycles are barely seen in Bangkok due to city's dangerous environments for cycling – too many cars and too little road surface. Even walking is difficult and dangerous because there are many obstructions on narrow sidewalks, such as street vendors, parts of houses, telephone booths and utility poles. Some-

times the obstructions are so many that pedestrians are forced to walk on road surfaces to avoid them. Nonetheless, there are many roads which do not have sidewalk at all.

While TOD promotes accessibility and safety to the mass transit system, there is still a drawback with complementary parts of the system. The current mass transit systems in BMR cover only its urban areas; therefore, people living outside the coverage areas has to rely on public transports as feeder for the mass transit system. Even though public transports are a cheap mode of travel, their above mentioned problems force people to use private transport which hinder TOD achievement.

**Table 1** Attitude on transport modes

Mode	Attitudes
Private Vehicle	<ul style="list-style-type: none"> <li>• Accessibility: door to door</li> <li>• Convenience: no transfer, carry more stuffs</li> <li>• Travel cost: fuel cost, maintenance, expressway fee</li> </ul>
Mass Transit (BTS/MRT/BRT)	<ul style="list-style-type: none"> <li>• Limited coverage: only in urban area</li> <li>• Punctuality: can predict time to destination</li> <li>• Safety: safety than other public transport mode</li> </ul>
Public Transport (Bus)	<ul style="list-style-type: none"> <li>• Cannot protect passenger from weather and pollution</li> <li>• No timetable available</li> <li>• Route information is not clear</li> <li>• Lacking of maintenance</li> <li>• Cheapest mode: some are free</li> <li>• Not safety: pick pocket, fighting, road accident and etc.</li> <li>• Unqualified driver</li> </ul>
Paratransit (Motorcycle-taxi and Songtaew)	<ul style="list-style-type: none"> <li>• Can access to narrow street or traffic congestion</li> <li>• Not specify the fare</li> </ul>
Non-motorized	<ul style="list-style-type: none"> <li>• Obstacles on sidewalk: telephone booth, utility poles, street vendors and etc.</li> <li>• No bicycle lane</li> </ul>



**Fig.4** Modal Share in 2008

(Source: Office of Transport and Traffic Policy and Planning (2010))

### (3) Growth in Car Use

Compared to the small share of urban railway, the mode share is overwhelmed by private transport, such as cars, 35% and motorcycles, 15%. Car ownership has grown according to a rise in income level and road-oriented development, and is expected to grow further in economic growth.

Moreover, the government policies promote car use. One of the policies is to refund excise tax for the first time car buyer, making private transportation choice even more rational. The policy includes first time car buyer who bought a car before 31 December 2012.

## 3.LAND-USE SYSTEM

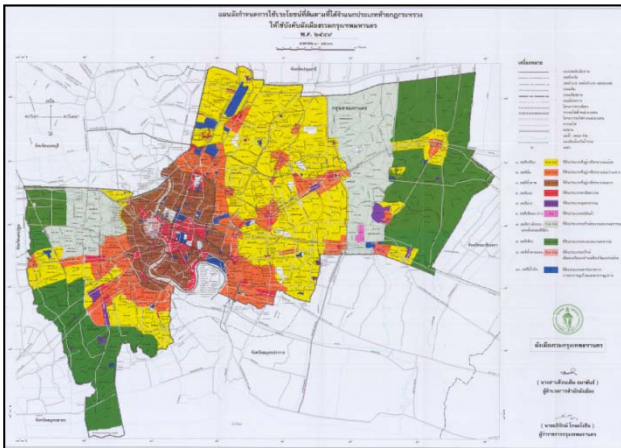
### (1) Land-use plans

The Comprehensive City Planning of Bangkok was first started in 1960 by the Thai government who hired Litchfield Whiting Bowne & Associates from the United States to carry out the Greater Bangkok Plan 1990 or commonly known as Litchfield plan. This plan included a map of land use, a map of transportation and a map of infrastructure projects, covering the areas of the border cities of Bangkok, like Thonburi, Nonthaburi and Samut Prakan. The duration of the plan was 30 years. In 1971, the Department of Public Works and Urban Planning improved the layout to accommodate for the increased population from the original 1990 City Map plan.

In 1975, there was an enactment which gives authority to force designations. Therefore the Department of Town and Country Planning developed a comprehensive city planning for Bangkok. This comprehensive Plan included land use map set by the classification of usage and communication and transportation map. This comprehensive Plan will cover only specific area of Bangkok.

Before the period of enforcement of the city planning of Bangkok would expire, Bangkok as a local authority has made the 1<sup>st</sup> improvement to the comprehensive city planning of Bangkok. This updated comprehensive plan besides including land use map set by the classification of usage and communication and transportation map also included unused land.

Before the period of enforcement of the city planning of Bangkok (Modifier 1) would expire, Bangkok has made a comprehensive plan Bangkok (Update No. 2) and announced that this comprehensive plan would apply as a ministerial regulation called Bangkok Comprehensive Plan 2006, show in Fig. 5. This new version has added a floor area ratio requirement (Floor Area Ratio or FAR) and the open space ratio (OSR) as well as the condition that the total floor area ratio could be increased (FAR Bonus) in case of more open space for public use or if there is more space for car parking in the area around public transport stations.

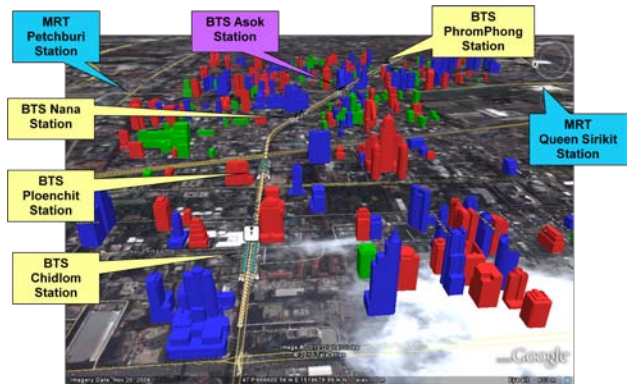


**Fig.5** Land-use plan (2006)  
(Source: Department of City Planning, BMA)

**(2) High-Density Development**

Demand for development along mass-transit station has become stronger in the BMR. Fig 6 shows a map of buildings along mass-transit in Bangkok. The buildings are classified into three groups by their development year. The first group, as colored in green, is developed before BTS started its construction in 1992. The second group, as colored in red, had developed during the construction of BTS from 1992 to 1998. The development of the third, as colored in blue, are took place after BTS opened in 1998. Fig 6, there are many buildings which have been developed after the mass-transit development. Therefore, that even in Bangkok, where a mass-transit system is not well-established, mass-transit development has stimulate a land development which suggests the

potential development of TOD.

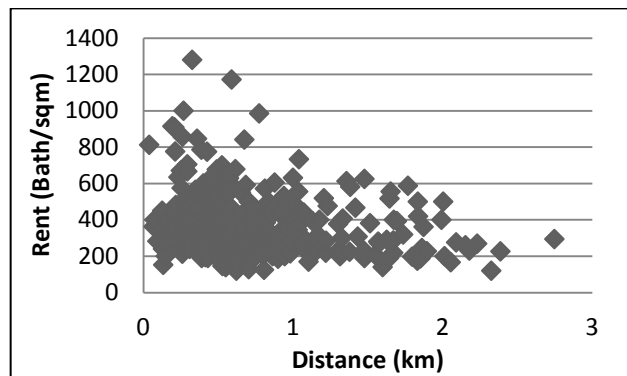


**Fig.6** New Buildings Attracted by Rail Mass Transit  
(Source: Sathita (2010))

**(3) Affordable Housing**

However, the development demand for TOD may not lead to the demand for mass-transit use due to a housing affordability issue for the users. As mass-transit development raises land values around; lower-income people tend to be unable to afford houses near the station and have to move far away. As a result, the location of high-income residents in the TOD area who are likely to prefer car use, may not contribute to mass-transit use.

Chalermpong (2007) reveals that the premium of transit accessibility adding to the property is approximately \$10 in property sale price for every meter closer to the station which propels people with lesser affordability to reside further from the station.



**Fig.7** Scatter plots for relationship between price and distance from mass transit station

Fig. 7 shows scatter plots for relationship between price and distance from mass transit station. Several high rent samples exclusively reside within 1 km from the station, where an average price of the sample within 1 km is 400 baht/month/m<sup>2</sup>. If the minimum size of a house is 30m<sup>2</sup>, the rent will be 12,000



<b>Threat</b>	Car Ownership growth and tax exemption	Cost of land value
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Even if mass rapid transit systems in BMR have been successfully developed, people have to shift their mode of travel to the systems. In order to achieve TOD, mass rapid transits have to attract as many users as possible by designing the system with consideration of transporters' preferences. Those data are important for policy makers for implementing proper mass rapid transit plan. Therefore, this study would like to suggest the further studies on the TOD in BMR to examine opinion of people living in BMR on the Quality of Transport.

### ACKNOWLEDGEMENT

This research was supported by the Environment Research and Technology Development Fund (S6-5) of the Ministry of the Environment, Japan.

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