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# Switching from motorcycle taxi to walking: A case study of transit station access in Bangkok, Thailand

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ABSTRACT

This study aims to find the factors affecting residents near transit stations within 1000 m, who are referred to as transit-oriented development (TOD) residents, to reduce motorcycle taxi use and encourage walking to stations. These two modes of commuting are the most popular among over 85% of residents. However, motorcycle taxis are the main pedestrian barriers that hinder easy access and walkability in TODs of Bangkok, because they ride, stop, and provide services on sidewalks. From 2013 to 2015, these problems substantially increased the number of motorcycle taxis that are not willing and able to follow the rules. The increasing number of pedestrian accidents on sidewalks is related to the increase in the number of motorcycle taxis. According to a survey on pedestrian safety with 249 respondents, over 25% of walkers feel unsafe to walk, while 40% of motorcycle-taxi users riding to stations do not walk because they are afraid of accidents. In modal split, the share of walking reduces from 76% for areas <00 m, to 25% for areas between 500 and 1000 m from transit stations, respectively. Hence, the number of motorcycle taxis in the 500–1000 m range is twice as high compared to that within the 500 m area. If motorcycle taxi users would accept a longer walking distance to station by 36 m or would be willing to walk to the station within 9.15 min, 54% of them may switch to walking to stations. Moreover, based on the estimation results of the logistic regression models, middle-adult aged residents, office employees, residents owning a car, and people living far from stations are less likely to walk. Average income households and commuters during non-peak hours tend to use motorcycle taxis more. On the other hand, residents living far from stations tend to use motorcycle taxis less, because most of the motorcycle taxi services are located near transit stations.



## 1. Introduction

Transit-oriented development (TOD) is an urban planning concept suitable for urban development and sustainability. It was introduced by Peter Calthorpe to encourage people near transit stops to use transit more and depend less on private vehicles. For TODs to be successful, a key factor in planning the concept is to have easy access to transit stations [1]. Generally, feasible areas that promote walking to transit services are in the range of acceptable walking distance for residents. To encourage walking and reduce motorized vehicle use to transit stations, creating a pedestrian-friendly environment and planning high density of mixed land use development and population near transit stations are necessary. In Bangkok, there is an increase in the number of high-rise residential buildings near transit stations, and the number of people moving to such locations is on the high as well. They are expected to walk to transit stations and use rail services for daily commuting, but, on the contrary, they hardly do so [2]. Moreover, the frequency of using motorcycle taxi services is much higher because the services are easily accessible. It is the second most used access mode by which TOD residents reach transit stations within 1 km area. The riders are able to ride swiftly even through narrow spaces during traffic jams. However, although motorcycle taxi services are popular for shorter trips, there are social and environmental problems: 1) urban air and noise pollution, 2) climate change, 3) accident and safety concerns. As for accidents and safety, motorcycle taxis are not only dangerous for passengers, but also for pedestrians and bicyclists on sidewalks because motorcycle taxis stop, ride, and provide services on sidewalk pavements. The number of pedestrian accidents in 2015 is higher than that in 2014 by approximately 20%. This is related to the increasing number of motorcycle taxis in Bangkok, which has increased almost two-folds from 2013. Clearly, these services can be seen at every corner of main streets and at every 400 m interval in narrow streets (soi). They have used half the width of sidewalks as their parking spot. At each stop, on an average, 20 motorcycle taxis are parked. The riders wait for their service-providing shifts on sidewalks. Hence, achieving a pedestrian-friendly environment is not successful. Moreover, an easy access to stations by walking and cycling in Bangkok is not well planned. Practically, if more TOD residents change their travel behavior from using

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motorcycle taxis to walking to stations instead, the number of motorcycle taxis would probably reduce. Hence, pedestrian facilities could be easily improved and walkability would be better.

## 2. Literature review

Previous studies show that the choice between walking and using motor vehicles to transit stations depends on the commuter's socioeconomic characteristics, travel characteristics, and residential location. Loutzenheiser [3] found that individual characteristics (gender, age, and car ownership) are more influential factors than land use variables in encouraging the residents to walk near the Bay Area Rapid Transit (BART) stations of San Francisco. Moreover, the density of land use development, the number of parking spaces at the station, and income and education of residents are the decisive factors that encourage walking. However, travel characteristics, distance from home to station, grid street patterns, and proximity to freeways can influence the decision of choosing motorized modes over walking. Hsiao, Lu et al. [4] found that higher vehicle availability relates negatively to walking likelihood, but positively to walking distance of the people near transit stations. A study in California found that high-income transit riders near rail stations tend to reach transit stations both on foot and by bicycle more than other groups [5]. Urban location factors, such as centrally located stations and residential locations in central business districts (CBDs), could be some factors that influence the commute to transit stations. In Washington D.C.'s business area, population density around transit stations and walking accessibility mode share were positively correlated [6].

For the catchment area and walking distance, previous studies have mentioned several definitions for the catchment area of rail stations. It is generally defined as the maximum walking distance or acceptable walking distance. Mostly, it is a type of stated distance for which rail passengers are willing to walk between home and station, rather than drive. The acceptable walking distance is associated with features of built or social environment including proximity to destinations as well as social features such as safety or the presence of other walkers. Several studies define the pedestrian radius as a one-way walking distance of 500–1000 m to rail station. Vuchic [7] and Rood [8] define the catchment area as a circular surface with a radius of maximum walking distance that is possible in 5 min from the center of activities or a 10 min walk from rail station. A 5 min walk is equivalent to a distance of 400 m; therefore, a 10 min walk is equivalent to 800 m. There are other definitions of maximum walking distance, e.g., in Great Britain, over 70% of all one-way walks are shorter than 1600 m [9]. Stringham [10] found that the average maximum walking distance of rail passengers in Toronto, Canada, is approximately 1200 m. Rastogi and Rao [11] studied the maximum walking distance of rail passengers in Mumbai, India. They reported that 85% of people are comfortable with a maximum walking distance of 1250 m. Lee et al. [12] studied the subway accessibility of people in new towns of six metropolitan areas of Korea, and found that 93.7% accept a maximum walking distance of 732–762 m, which is equivalent to a 10 min walk with an average walking speed of 1.22–1.27 m/s. However, the acceptable walking distance was different, depending on geographical condition, climate, land use characteristics, and walking preferences [13]. Moreover, developing public spaces and pedestrian network connectivity can encourage people to walk longer [14]. Based on these studies, the catchment area in this study is within a radius of 1000 m of rail stations.

## 3. Contextual background

### 3.1. Mass transit systems in Bangkok

Fig. 1 shows the maps of three rail transit systems in Bangkok metropolitan region. The first map shows the Bangkok mass transit system (BTS), referred to as the "green line sky train." It is an elevated heavy rail system consisting of two lines, 34 operational stations, and running for a length of 36.45 km. It began operations in 1999. The second map shows the mass rapid transit authority (MRT), referred to as the "blue line subway," which is an underground heavy rail system, with 18 operational stations along 20 km; the operations began in 2004. The third map shows the airport rail link (ARL), referred to as the "red line," which is a partly elevated, partly underground rail system, having eight operational stations along 28.6 km; it began operation in 2010. BTS and MRT aim to serve travels of relatively short intervals, between 800–1200 m [15]. However, ARL is mainly for commuters travelling to the airport with a distance of 2–5 km between stations. In 2015, the number of daily commuters of the BTS, MRT, and ARL were approximately 630,000, 255,000, and 47,000 respectively [16]; however, currently, it is much lower than the targeted ridership of 680,000, 570,000 and 95,900 passengers, respectively.

### 3.2. Growth of high-rise residential buildings along transit corridors

Currently, a moderate to high density of land use development near transit stations (one of the key concepts of TODs) [1] has been implemented in Bangkok. Locations along the transit corridors are ideal to develop land use, especially for residential development in Bangkok. Since the operation of the first line of urban rail services in 1999, residential projects have significantly increased near transit corridors, particularly in CBD areas, as shown in Fig. 1. There are seven transit stations located in CBD areas, as mentioned by Knight Frank [17]. In 2004, there were approximately 3000 condominium units (or "rooms" in the high-rise residential buildings, which are higher than 23 m or with a total area of > 10,000 $m^2$ [18]) within a radius of 1 km from stations. However, the number of condominium units was almost 48,000, which increased by 12 times in 5 years [15] (Fig. 2). The rapid growth of condominium projects results not only from the expansion of transit routes, but also from the zoning regulations launched in 2006. In the Bangkok comprehensive plan of 2006, the zoning regulations have granted a bonus of additional floor area ratios (FARs) for new development projects within a distance of 500 m around transit stations to increase density [19]. Rail transit systems are a good choice for residents near rail transit routes when they go to work and help avoid traffic jams during rush hours. According to the Bangkok metropolitan administration (BMA), BTS serves over 600,000 passengers on an average each day [16]. Consequently, proximity to rail transit systems could attract people to live near rail stations and use them regularly.

### 3.3. Pedestrian barriers from motorcycle taxi services

Motorcycle taxis are common public transport vehicles, which are generally used for short distances, e.g., picking up and dropping off passengers from inaccessible areas to bus stops, piers, and rail stations. They can enter even narrow streets (soi). However, they often provide services on the sidewalks especially in rush hours, and become main obstacles to walkability of pedestrians in TODs. According to the data from 2014, during the morning rush hours (6.30–9.30), there were >100 motorcycles riding on the sidewalks of Phahonyothin road, Sukhumvit road, and Sathorn road, where many transit stations are located. Among them, 52% were motorcycle taxis [20]. According to the data from 2015, in the area between Ladprao soi 132–134 (near MRT system rail stations), there were >60–70 motorcycle taxis riding each day on sidewalks (60% of illegal motorcycles in total) [21]. Although these data were collected in different areas, they show that barriers to pedestrians from riding motorcycle taxis have remained the same in Bangkok especially around transit stations. Generally, the motor vehicles riding on the sidewalks are both motorcycle taxis, and personal motorcycles. However, the motorcycle taxis are the largest group of motor vehicles usually riding on the sidewalks. According to the data in 2014–2015, they do not mention how many trips or contacts with pedestrians. They show only the number of motorcycle taxis riding on sidewalks.

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