Walking to transit (Study case: Pasar Senen Station, Jakarta, Indonesia)

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Abstract. Every country must have various ways in applying the concept of Transit Oriented Development (TOD). The benefit of applying this concept is to suppress the level of congestion caused by the dependence of private car uses by switching to public transportation and emphasizing healthy lifestyle through walking and cycling to transit or other destinations. The research location will be conducted at Pasar Senen station, which is the second largest station in Jakarta that serves for economy and business class passengers with destination within inner-city and inter Java province. Along with Indonesian Government plan to turn this station as MRT interchange station for East-West line which will be built in 2024, a further study is needed on how the characteristics of this station area and what can be prepared in advance if Jakarta Government want to adapt concept of TOD into this station. To know the successful implementation of TOD concept in other tropical countries, it is necessary to do further research on what factors that shaped it. Thereby through the result of the analysis, can be formulated some recommendations that can be applied by Indonesian Government related to the Implementation of TOD concept in Jakarta. To ensure the achievement of the research objectives, then several targets must be done, include: 1. Analyse or identify the key success factor of TOD concept in other tropical countries such as Hong Kong and Singapore; 2. Develop new guidelines related to TOD concept that can be implemented in Jakarta.

1. Introduction

With the increasing number of urban residents, resulting in increased demand for land, both for housings, offices, and other socio-economic facilities. Since each city has its own rules to regulate administrative boundaries, then to meet the demand for increased land required, an expansion the area outside the city area becomes one of the solutions to solve the problem. This phenomenon is known as urban sprawl, which characterized by uncontrolled expansion of land use outside the city area.

Initially the existence of this phenomenon is thought to have a good impact for the city and its territorial expansion, but in fact more negative impacts resulting from the expansion, such as long journey and longer travel time, social inequality, dependence on private vehicles.

This urban sprawl phenomena also occur in big cities of Indonesia, likewise Jakarta. As a metropolitan city, Jakarta and its satellite city (BODETABEK – Bogor, Depok, Tangerang, Bekasi) which currently begin to lead into a megapolitan city (JADBODETABEK), the urban sprawl issue become an unavoidable problem that need to be solved.
The rapid and uncontrolled expansion of Jakarta city is caused by most of the settlements in Jakarta are dominated by low rise residential, which lead to the end of Jakarta’s land stock for future development.

Car dependence is one of the impacts produced by urban sprawl, which causes the occurrence of transportation problems. Due to the lack of integrated transportation system between Jakarta and its surrounding satellite city, results people from outside Jakarta still rely on private cars as their daily commuters to do activities in Jakarta.

According to report from CNN Indonesia, throughout the year of 2014, the number of vehicles traveling in Jakarta was about 17.5 million, which from that amount were dominated by motorcycles (13 million), private cars (3.2 million), and the remaining amount was public transport [1]. With the population of Jakarta city reaching 10.08 million people and the growth of roads that only reach 0.01% per year, hence not surprising if congestion level in Jakarta getting worse [1].

Additional of road system is just one way to tackle traffic congestion, but that is not the right solution. Without any support from Government’s policy to reduce the increasing number of vehicle ownership each year, any efforts made to overcome congestion will not yield in significant changes.

Another strategy that can be done to reduce the level of congestion is to promote integration between land use and transportation system or known as Transit Oriented Development (TOD). This concept idea is based on the understanding that transit points (railway stations, bus stop, terminus) not only serve as a place to board or alight passengers, but it can also serve as a place for urban activities such as housing, offices, trade center, institution, and other uses.

The concept of TOD was introduced by an American Architect named Peter Calthrop in the 20th century, where the concept prioritizes mixed use building functions in transit areas, so that people can do their activities such as live, work, school, shop, and others activities on foot from and to public transportation (more effectively and efficiently) [2]. In addition, the presence of this concept, dependence on private vehicle can be reduced, people’s lifestyle become healthier and more active on foot, and environmental quality gets better as carbon emissions generated by vehicles are reduced.

Talking about TOD in Jakarta, before the current Government attempt to initiate the formation of this concept in transit area, this concept has unwittingly been formed by itself. This can be seen in the transit area of Pasar Senen Station where have been formed by various mixed functions building, such as offices, hotels, houses, shopping malls. But this concept does not work well because it has not been able to provide comfort and safety for pedestrians. Large block that impact on long distance to transit, narrow of sidewalk width, still dominated by low rise housing, and lack of parking space that result in the use of street as a vehicle parking lot.

As one of the oldest stations in Jakarta, serving destination within inner city of Jakarta and inter-Java provinces, Pasar Senen Station will serve as an interchange station of East-West MRT line, which the construction itself will begin in 2024 and operate in 2027. For now, there is no further study that have been done on how the characteristics of this station area and what can be prepared in advance if Jakarta Government want to adapt concept of TOD into this station.

Through this study, it is expected to provide input for Jakarta Government on what kind of TOD guidelines that might be suitable to be applied in Jakarta, where Pasar Senen Station is used for the object study. Based on that, the question for this study is: What is TOD in Jakarta? (study case: Pasar Senen Station).

In order to know the successful implementation of TOD concept in other countries, it is necessary to do further analysis on what factors that shaped it. Thereby through the result of the analysis, can be formulated a new design guideline or principle that suitable to be applied in Jakarta, with Pasar Senen Station as object study.

The first step that must be done is to collect the regulations related to current planning of Jakarta that associated with the principle of TOD; Analyse or identify the key success factor of TOD concept in other tropical countries such as Hong Kong and Singapore; and Develop new design guidelines related to TOD concept that can be implemented in Jakarta.
On the macro scale, the study area will be conducted at Pasar Senen station and Gambir Station, where the distance between these two stations is quite close, about 1.5 km, and area intersection between the two-station become potential area for future development.

On the micro scale, the study area will be more focus on the distance of 400 m range from the location of Pasar Senen Station. This is supported by the regulation of the Minister of Public Works of Indonesia number 3, years 2014, that stated the maximum distance from or to transit area shall not exceed 400 m or 10 minutes’ walk [3].

2. What is transit oriented development
The concept of TOD was introduced earlier by an American Architect named Peter Calthrop in the 20th century. According to Calthorpe [2]: A Transit Oriented Development (TOD) is a mixed-use community within an average 2,000-foot walking distance of a transit stop and core commercial area. TODs mix residential, retail, office, open space, and public uses in a walkable environment, making it convenient for residents and employees to travel by transit, bicycle, foot, or car [2].

As a strategy to achieve the objective of TOD concept that provides an alternative to the growth of urban development, suburban areas, and surrounding environment, there are several principles that can be applied, such as: relationship to transit and circulation: organizing the growth at regional level to be more compact and support transit function, such as: the frequency of service time either light rail, heavy rail, or buses should be no more than fifteen minutes; mix of uses: transit area should contain of mix uses such as commercial, residential, working place /employment, and public uses within walking distance; street and circulation system: to enhance comfort and safety in walking experience, street must be friendly to pedestrians, provision of sidewalks that connected to building entrance, and street trees along sidewalks as shading; residential mix: provision of various residential types for variety of users; general design criteria: active street frontage (with commercial function at ground level) will create a sense of safety for pedestrian; redevelop able and Infill sites: enables the development of low-intensity site areas to have a mixed-use function and pedestrian oriented.

According to Cervero, The characteristic of TOD area can be reviewed from 5Ds aspects, such as: Density (dwelling units); Diversity (land use mix); Design (site, street design, safety); Destination Accessibility; Distance to transit [4].

2.1. Indicators of transit oriented development
After several decades of minimal investment in transportation, it is not surprising that many central and local Governments in developing countries likewise Indonesia, India, Africa, etc., are now beginning to focus on improving the quality of transportation system in their countries [5].

Based on the results of research that had been conducted so far, an organization of The Institute for Transport and Development Policy (ITDP) which founded in States, in the 20th century, shared their experience in how to improve the quality of public transportation system in order to tackle health issue, social, and economic impact that caused by traffic congestion problems.

Therefore, in 2016 ITDP issued new policies guideline that focus on the integration of transportation system with urban spatial planning, TOD Standard, consists of eight main principles including walk; cycling; connect; transit; mix; density; compact; shift [5]. It is hoped that through this new policy, it can be used as a benchmark and guidance by developing countries in developing their respective regions, so that mistakes that occur in developed countries will not happen again.

2.2. TOD in Jakarta
As the capital city of Indonesia, where the centre of Government and economic activity is located, it is not surprising if every year the level of urbanization that occurs in Jakarta city is very high.

The increasing development of Jakarta has caused several problems, especially in terms of housing needs and transportation system. Certainly, almost all the land in Jakarta has been built, both for residential buildings, trade and service areas, industry, offices, and other buildings, resulting in difficult
to find for land stock for future development in Jakarta (that cause urban sprawl to suburban area of Jakarta).

Due to the absence of an integrated masterplan from Indonesian Government to cope with the impact of the urban sprawl growth, and no integration of the transportation network as well from or to city centre, there is no doubt the level of congestion that is happening is likely to become worse (people still rely on private vehicle as daily commuter).

Therefore, to overcome the congestion problem, Indonesian Government through Minister of Transportation conducted a study on the integrity of Jakarta’s city transportation system network to surrounding Satellite city of Jakarta in 2013 (Figure 1).

The addition of new transportation system is needed by Jakarta (consider Indonesia still lack behind from other neighbouring countries likewise Singapore, Malaysia, and Hong Kong), but more than that how to integrate transportation system with efficient of land use and provision of quality development become challenges that need to be solved by Indonesian Government.

To reduce the level of population and activity density that just only focus on city centre, a controlled decentralization effort must be undertaken by the Indonesian Government through restructuring the urban spatial planning of each district, municipality, or even satellite city, so that each of them has different character and activity distribution (interact and depend on each other) such as Central Business District, Trade centre, Innovation and Technology centre, etc.

On the metropolitan scale, the commuter line in Jakarta has been operated since 1925, where first route was from North Jakarta (Tanjung Priok Station) to South Jakarta (Jatinegara Station). A new loop system was introduced in 2011, to integrate railway line in downtown Jakarta (where administrative, political, and business activities are located) to satellite city outside Jakarta (BODETABEK) (Figure 2).

TOD concept in Jakarta indirectly has been formed on the area around the commuter line station by itself. This can be proved by the presence of mixed-use functions such as offices, medium to high-intensity housings, retail, etc. But the concept of TOD is still cannot be realized properly because it is not supported by infrastructure or facilities that support comfort and safety in walking.

![Figure 1. Regional Transportation System (JABODETABEK) Source: [6].](image-url)
Figure 2. Loop System of Jakarta’s Commuter Line. (Source: By Author, 2018).

2.3. TOD in Singapore

The city-state of Singapore is internationally renowned for its successful integration of transit and regional development, placing the urbanized island of 2.8 million inhabitants on a sustainable pathway, both economically and environmentally [7].

With a masterplan concept (known as the Constellation Plan, 1991), the country with an area of 712 km$^2$ was considered a success in integrating the city centre (business district) with regional and sub-regional centre through the provision of the ring pattern and radial urban corridor transportation system and decentralization strategy to tackle urban growth issue [7] (Figure 3).

Decentralization is a process of retribution of business / economic activity, peoples, or power authority from city centre to out of the city area. As an effort to decentralize the density of urban growth in central area, Singapura’s Government began to set up regional centres in different suburban areas of Singapura. With the dispersing of various activity into the regional centre, it will reduce congestion and density in the CBD area (city centre) and workplace become closer to where people live [8].

On the micro scale, several attempts were made by Singapore Government to succeed TOD concept, such as provision of more dynamic and compact layout structure that give priority mixed use functions around transit area, more greener area to bring a comfortable environment within walking distance [7].

Figure 3. Singapore’s Masterplan in 1991. Source: [7]
2.4. TOD in Hong Kong (R+P Model)

The development of TOD concept in Hong Kong should be considered a successful model among other Asian countries, therefore there is no doubt it is often used as a case study by other countries. In developing TOD concept, HK Government also collaborated with local developers around the MRT line location. Not only shopping centre, but also housing for both middle class and upper class is also built and integrated directly with MRT station.

Despite HK’s geographical condition which only has about 60% of land built (the rest is countryside), this limitation is not become an obstacle for HK government to meet the demands of housing or other mixed use building as well. As a solution is by allowing MTR Cooperation (MTRC) corporate with other developers to build various building functions above station (podium), where this concept is known as R+P model. The benefit of this concept can provide facilities for people to live, work, school, and shopping directly adjacent to the transit station (reduce transportation costs and can overcome traffic congestion). For example: The Maritime Square in Tsing Yi that integrates high rise residential building with shopping malls and stations in one area development (Figure 4).

![Figure 4. The Maritime Square. Source: Edited by Author and Adapted from Suzuki [9].](image)

3. Study area

According to Jakarta’s Spatial Planning Maps, Senen district is located at Central Jakarta Administrative. Central Jakarta is one of the five administrative cities in Jakarta, where Government Center (Presidential Palace, Minister Office Buildings, Foreign Ambassadors’ office); business and financial center (CBD area), trades and service center located. Despite the area is the smallest when compared with other administrative cities, but here we can find: The National Monument (landmark of Jakarta), Museums, Education center, and about 21 shopping centers (from a total of 130 shopping center in Jakarta) are in Central Jakarta (Figure 5).
In addition to its strategic location, in the future development of Jakarta Transportation Map, Senen district will be traversed by MRT Line that connecting East-West corridor, where Pasar Senen station will be as interchange station. This will certainly have a major impact on the development of the area around the station (Figure 6).

Senen district is one of the sub-districts that located in Central Jakarta. With an area of 4.22 km², this district is served by three railway stations: Pasar Senen Station (study area), Sention Station, and Keramat Station. Among these three stations, Pasar Senen Station is the largest one, which serves for destination within inner-city and inter province of Java.

With the location is directly adjacent to central government of Jakarta (presidential palace, Jakarta Governor office, foreign embassy, etc.; it is not surprising the district that mostly surrounding by office
buildings, trading center, and residents, become an ideal place for both locals and migrants to live and work there [12].

As an interchange station which is connecting the MRT line from east to west, the development of new station will be underground with a depth of 17.5 to 28 meter. In the presence of future station development, there will be an increase in the number of passengers from MRT, therefore an expansion of existing station exit area must be done. The boundaries of Pasar Senen station area can be seen in Figure 7.

![Pasar Senen Station Boundaries](image)

**Figure 7.** Pasar Senen Station Boundaries. Sources: By Author, 2018.

4. **Finding and analysis**

In order to understand what TOD in Jakarta is and create a new TOD guideline that suitable for implementation in Jakarta, further analysis will be conducted on nine stations area in different geographic around tropical countries like Hong Kong, Singapore, and Indonesia (Jakarta) as well. Area of analysis include **(Figure 8):**

- **Jakarta, Indonesia:** Sudirman station (CBD area), South Jakarta
  - Pasar Senen station (1925) (urban area), Central Jakarta
  - Gambir station (urban area) (1884), Central Jakarta

- **Hong Kong**
  - Admiralty (1970) (CBD area)
  - Wan Chai (1842) (urban area)
  - Tsing Yi (1977) (urban area)

- **Singapore**
  - Raffles Place (1820) (CBD area)
  - Tampines (1978) (urban area)
  - Toa Payoh (1962) (urban area)
The analysis will be based on 5Ds aspects that effect on TOD area characteristics: Density, Diversity, Design, Distance to transit, Destination accessibility [4].

4.1. **Density**

The density of buildings can be calculated by dividing the number of dwelling units with the total area development (hectare). In this case, analysis on both the CBD and urban is carried out at a radius of 800m from the transit station (50.26 ha) (Figure 9, 10).

![Figure 8. Area of Analysis. Sources: By Author, 2018](image)

![Figure 9. Density in CBD Area.](image)
According to ITDP, to sustain urban growth in a compact and dense spatial pattern, the city must grow vertically (densification) [5].

Based on the analysis, the density of buildings in Hong Kong and Singapore are dominated by high rise buildings with homogeneous shape pattern (square or rectangular) with high concentration of activity near the transit station. While in Jakarta’s CBD area, the building shape pattern are more heterogeneous and dominated by low rise residential, with concentrations of activity disperse from the transit station.

Compared with urban areas in Hong Kong and Singapore, the buildings density in Pasar Senen, Jakarta is the most densely populated (almost three times from Wan Chai density), where dominated by single to triplex terraced houses and with limited open spaces.

On the other hand, there are more high-rise building with long slab shaped and courtyard oriented residential in Singapore, and in HK mostly residential building with provision of podium which can be used as commercial function (restaurants, retails, etc.). Although high activity is concentrated in the area around transit station, but it does not deplete the availability of open space surrounding the buildings.

4.2. Diversity
When there is a balanced mix of complementary uses and activities within a local area (i.e., a mix of residences, workplaces, and local retail commerce), many daily trips can remain short and walkable [5]. With provision of mixed use functions, will make local roads more lively, thus providing a sense of security, encouraging walking and cycling activities, and shaping a humane environment [5].
In this case, analysis of diversity will be conducted in a range of radius 400m from transit station. This is based on test have been done by author with QGIS, where it is a convenience distance for walking (Figure 11).

Compared to CBD area in Hong Kong and Singapore, in Jakarta’s CBD area, there is still a high percentage of residential allocation function, 15%. Given that the value of land in downtown area is high and expensive, this single function should be combined with the provision of a mixed-use building function, to improve the local economy, the area become more liveable and catchment to either workplace, school, residence, shopping centre, become closer and can be reached on foot.

Each country has different applications in the composition between percentages of residential, mixed use building, commercial, institution, and open spaces, because it must be adjusted with future projection of their district development and population. As for comparison of each district population can be seen in Table 1.

Table 1. Comparison of each district population.

| District   | Population | Total Area (Km²) |
|------------|------------|------------------|
| Jakarta: Senen | 96.783     | 4.23             |
| Hong Kong:  |
| Wang Chai   | 180.123    | 10.20            |
| Tsing Yi    | 191.500    | 10.69            |
| Singapore:  |
| Tampines    | 258.310    | 20.89            |
| Toa Payoh   | 121.770    | 8.17             |

Sources: Edited by Author, 2018 [13][14].

In addition, as a place for social interaction, open space also affects air quality, and improve the microclimate of an area.

Compared with other district area, the percentage of open space in Pasar Senen district is still limited (about 2% from total area of radius 400m from transit station). Given the density of buildings surrounding station area is high with dominant of low rise residential function, then gentrification need to be done to increase the vitality, maximize for future development, and at the same time improve the quality of existing environment through the provision of more open spaces.

Figure 11. Diversity in CBD Area.
4.3. Accessibility to destinations

In order to make the experience of walking and cycling become more varied and fun, a dense pedestrian network is required, which can also provide multiple route options to many destinations [5].

To know the ease of achieving a destination location, then the analysis will be done on the provision of buildings with various functions in the area within the station (radius of 200-400-600m) (Figure 13, 14).

Figure 12. Diversity in Urban Area. Sources: By Author, 2018.
Figure 13. Accessibility to Destinations in CBD Area.

Figure 14. Accessibility to Destinations in Urban Area. Source: By Author, 2018.
Based on the analysis, it’s found that in the area around Pasar Senen station, the provision of buildings with mixed use or commercial uses are spread and more dominantly located in the radius of 400m and 600m from the station, while in the radius of 200m is dominated by low rise residential buildings, some institutional buildings, and open spaces.

On the other hand, in Wan Chai district, the provision of buildings with mixed use and commercial functions are denser and concentrated in the radius of 200m and 400m, result in making the area livelier, activities are concentrated around station area, and many choices of destination that can be reach within walking catchment. The location of institutional building is more scattered at the radius of 400m and 600m from the station.

4.4. Distance to Transit

According to ITDP, Rapid public transit plays an important role not only in providing quick and efficient travel along its lines but also as a backbone for other transit options serving the entire spectrum of urban transport needs [5].

Analysis related to the provision of public transport (buses) will be carried out at radius range of 200-400-600m from the station (Figure 15, 16).

**Figure 15.** Distance to transit in CBD area.

**Figure 16.** Distance to Transit in Urban Area. Source: By Author, 2018.
The diversity of public transportation modes in Hong Kong makes it easy for people to move and choose types of transportation they want. Based on the analysis, it is found the availability of bus stops in Hong Kong lies at 100 - 150 m range, which makes people easy to reach the bus stop (especially for elderly people who can’t walk too far). In addition, taking bus in Hong Kong is very easy and convenient, with the application on smart phone, people can check the existence of buses, timeliness of bus services, and know which bus route that they must take.

On the other hand, although there are various modes of transportation around Pasar Senen Station, such as buses, ojek or motorcycle taxi, taxis, bajaj, BRT, metromini, etc., but not all types of transportation with affordable price (metromini and buses) reach all residential area (see Figure 29), thus causing residents prefer to use private vehicle (cars or motorcycles) for their daily commuting.

4.5. Design (connectivity)

4.5.1. Walking experience in Jakarta (Pasar Senen). A survey pioneered by Stanford University in 2017, reveals that the average Indonesian walk only 3.515 steps per day, which is a lot less when compared with people in the world who walk an average of 5.000 steps per day [15]. There are several factors that decrease the propensity for Indonesian to walk. Further analysis will be conducted on Pasar Senen Station area (Figure 17):

4.5.1.1. Provision of sidewalk. One of the factors that affect the comfort in walking is the availability of a good sidewalk and meet the standards that have been determined. In the area around Pasar Senen station, it can still be found that the quality of the sidewalk is not good and the width itself is still below the standard set by Indonesian Government, which is 1.60 m.

The transfer of sidewalk functions as a place for street vendors, car parking spaces (for motorcycles), and discontinue sidewalk in certain areas, causing pedestrian must share the street with other vehicles, which is certainly not safe.

Figure 17. Sidewalk condition in Pasar Senen Station area. Source: By Author and Adapted from Google Street View, 2018.
4.5.1.2. *Inadequate of public transportation.* The availability of integrated and adequate public transport also holds an important role in supporting the movement of people to destination place, because not all destinations can be reached by walking.

As in Pasar Senen station, where there are still limited of public transportation that can reach various of society. It is not surprising if people prefer to use their private vehicle for their daily commuting.

4.5.1.3. *Pollution and local climate.* Other considerations that affect are air pollution and hot weather. Based on the analysis, it is found in Pasar Senen station, most of the area is still not equipped with street tree and shade that can protect from sun heat.

Provision of street trees is very important, in addition can be functioned as a buffer for air and noise, also for sun shading as well.

4.5.2. *Walking experience in Hong Kong (Wan Chai).* As one of the busiest commercial centre in the western of Hong Kong Island, Wan Chai is one of the successful district in preventing conflict that occur between walking activity and vehicles, by providing elevated walkways which is integrated with office buildings, commercial and exhibition center, and parks. Provision of commercial activities along footbridge can make the bridge area livelier and create a sense of security (Figure 18).

![Figure 18. Integrated Walkways in Wan Chai. Sources: Edited By Author and Adapted from HKCEC, 2018.](image)

4.5.3. *Walking experience in Singapore (Tampines).* As one of the third largest cities in Eastern Singapore, The Tampines that used to be swamp area, now has become a self-sufficient town. In promoting comfort in walking experience, one of the efforts made by local government is the availability of street trees along the sidewalk. For some area that do not allow for the street trees, will be replaced with shelter (canopy) (Figure 19).
5. Research conclusion and recommendation

5.1. An Integrated TOD concept in Jakarta

Every country must have various ways in applying the concept of Transit Oriented Development (TOD) in their country. As in Hong Kong, the application of TOD concept, better known as R+P model due to its geographical condition, which consist about 60% of land built (the rest is country side), attempts to meet the demands of housing or other mixed-use buildings, various building functions are built on top of the stations (podium). Supported also by concentrated activity centres in station, results the area become more lively, daily trips become shorter, and destinations within easy walking distance. Through this effort, it is not surprising Hong Kong should be regarded as a successful model among other Asian countries and often used as case studies by other countries.

Different from other countries, TOD concept in Jakarta cannot be seen only as a dot and circle area around station only (usually radius between 400-800 m from station), but also how to distribute the density of urban growth in the central area to surrounding areas. With this distribution of activities, it can indirectly reduce the level of congestion that occurs in the city centre. Residents form outside Jakarta do not have to travel to Jakarta every day to do their activities such as school, working, or shopping.

From Metropolitan scale, to support the success of TOD concept, it is necessary to have integration of transportation system, accuracy in service time, availability of adequate public transportation, and comfort level and security in using public transport are maintained. So, the effort to encourage people to rely on public transport as their daily commuting will be achieved.

From District scale, the efforts of Indonesian Government to build new affordable housing (high rise building) above the station at certain stations in Jakarta (one of them is Pasar Senen station) by carrying the concept of R+P model as done by Hong Kong, is not an appropriate solution to reduce the level of congestion and encourage people to walk.

Geographically, Jakarta is growing based on vehicle transportation model that caused urban sprawl at suburban area. With the distribution of different activities between one district and another such as provision of new CBD area, education centre, recreation area, retail and trade centre, etc., then the density of activities in the downtown can be spread evenly to other areas as well.

If the implementation of TOD in Jakarta done with the approach of R+P model like Hong Kong, it will only benefit some parties, people who live above the station.
Based on above description and analysis that have been done by the author, here are some recommendations that can be applied by Indonesian Government related to the implementation of TOD concept in Jakarta:

5.2. Recommendation
After analysing nine different stations in different geographies in tropical countries such as Hong Kong, Singapore, and Indonesia (Jakarta) as well, here are some recommendations that can be used as guidance for the application of TOD concept in Jakarta (study case: Pasar Senen station):

5.2.1. Density. A good city structure will certainly be able to spread the movement pattern evenly throughout the surrounding area. Although Pasar Senen station can be said has a good permeability (most of the station area is surrounding by low rise with high density residential, but there are still can be found large block size development which causes the distance from station to certain destinations become far away, vice versa. Therefore, it must be redeveloped into small block. The benefit of small blocks is the road network become denser, many options that provide easy movement to destinations.

5.2.2. Diversity. Based on the analysis that conducted on the radius of 400 m from station area, it is found the area has various functions of activities, such as: residential, mixed use function, institutional, commercial function, and open space. But when compared with other station in Hong Kong and Singapore, the percentage of open space in Pasar Senen station is very low (2%), where the CBD area in Hong Kong (Admiralty) and Singapore (Raffles Place) still have a high percentage of open space, up to 20% within range 200 – 400 m from station.

The effort of gentrification need to be done to increase the vitality around station area through the provision of high percentage for mixed use building, and at the same time improve the quality of existing environment through provision of open space within radius 200 and 400 m from station.

To promote sustainable development in Indonesia (especially in Jakarta), a new policy according to open space requirement need to be set by Indonesia’s Government. Compared with Hong Kong 2 m² per person, and Singapore 8 m², Indonesia is only about 0.5 m² per person for the open space requirement [16] [17] [18].

5.2.3. Design (connectivity – walking). Walking habit in Jakarta still has not got a strategic place in everyday life, both from young and elderly. Based on the analysis, there is some reluctance and difficulty in the formation of walking habit in Jakarta, cause by factors:

5.2.3.1. Provision of sidewalk. It requires a standard increase of pedestrian width from min. 1.60 m to 2.40 m (accessible to wheelchair users from different directions), tactile surface and street tree along sidewalk to provide a comfortable walking experience. To support active street frontage, then it needs building set back min. 1.00 m, so that trading activity will not interfere the walking activity on sidewalk area. For certain areas such as commercial buildings (office, retails, or shopping malls), removal of perimeter walls should be made to give the impression of comfortable walking experience through wider sidewalk.

5.2.3.2. Inadequate of public transportation. Required for additional bus stops in certain areas previously unreachable by public transport. This will provide an easy movement for people to walk to the transit area and reduce the dependence of private vehicle uses.

5.2.3.3. Pollution and local climate. Street tree along sidewalk as a barrier of pollution that caused by vehicles and shading from sun heat. In addition, elevated walkways that connected multiple destinations to and from station (study case: Wan Chai, Hong Kong), can provide comfort, easy of people movement, and prevent conflict between walking activities and vehicles.
5.2.4. Accessibility to destinations. Based on the analysis, it is found that the provision of mixed-use function or commercial uses are spread and more dominantly located in the radius of 400 – 600 m from the station. To make the area around station area livelier, and many activities can be reached on food, then the addition of mixed use building needs to be done within a radius of 200 m. Institutional buildings can be reached within radius of 400 m, and beyond 400 m from the station area should be for residential uses.

References
[1] Yuliawati 2016 Kisah Mereka yang Beranjak Tua di Jalanan Jakarta CNN Indones.
[2] Calthorpe P 1993 The Next American Metropolis: Ecology, Community, and the American Dream
[3] Umum M P 2014 PERATURAN MENTERI PEKERJAAN UMUM NOMOR : 03/PRT/M/2014 vol 2013
[4] Cervero, R. et al. 2009 2009 Influences of Built Environments on Walking and Cycling: Lessons from Bogotá Int. J. Sustain. Transp. 3 203–26
[5] Abe E 2013 endorsed by : Institute for Transportation and Development Policy TOD Standard , 3rd ed . New York : ITDP , 2017 . TOD Stand. 3rd
[6] Hi B 2018 Peta Jaringan Transportasi Rel Massal Jabodetabek Jakarta Metropolitan 8
[7] Curtis, C., Renne, J.L. & Bertolini L 2009 Transit oriented development : making it happen (Farnham, England ; Burlington, VT: Ashgate)
[8] Connectx P 2016 Regional Centers in Singapore
[9] Suzuki H, Cervero R and Iuchi K 2013 Transforming Cities with Transit : Transit and Land-Use Integration for Sustainable Urban Development (Washington, DC: World Bank)
[10] Ardiiansyah Y 2011 Kritik Arsitektur “Rencana Pola Ruang Daratan Propinsi DKI Jakarta 2030” Blogspot
[11] Jakarta By Train 2018 Jakarta MRT Route Map
[12] Statistik B P 2016 STATISTIK (Central Jakarta)
[13] Census and Statistics Department 2017 2016 population by-census: Summary results Gov. Hong Kong Spec. Adm. Reg. 166
[14] Wong W K 2017 Population Trends 2017 Dep. Stat. Singapore 142
[15] Valentina J 2017 Stanford study reveals Indonesians laziest walkers in the world Jakarta Post
[16] Resources M of the E and W 2014 Upadate on the green plan 2012 1–2
[17] Conference P 2017 Unopened Space: Mapping Equitable Availability of Open Space in Hong Kong 1
[18] Wilayah D I and Kawasan K 2009 RUANG TERBUKA NON HIJAU