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Submission date: 18-Aug-2022 09:06AM (UTC+0700)

Submission ID: 1883762142

File name: Agustina_2021_IOP_Conf._Ser._Earth_Environ._Sci._878_012036.pdf (990.86K)

Word count: 2845

Character count: 15646

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To cite this article: T Agustina *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **878** 012036

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Connecting facilities of several modes of transportation with transit-oriented development approach

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Abstract. Jakarta is one of the cities in Indonesia that has a very high level of traffic jams. So it takes several alternative transportation so that congestion can be reduced. DKI Jakarta Provincial Government provides a solution by creating several mass transportation facilities including Mass Rapid Transit (MRT), Light Rail Transit (LRT), Soekarno-Hatta Airport trains, TransJakarta buses, and the Jabodetabek Commuterline. In order to make it easier for transportation users to use it, a connecting facility is needed so that it makes it easier for users to choose the mode of transportation. The research entitled Connecting Facilities of several modes of transportation with Transit Oriented Development Approach used qualitative descriptive method by collecting data from journal article, observation to research location, interviews with users. After the data has been collected, analysis is carried out in order to obtain a complete picture of characteristics and conditions that exist, so that a basic program for planning and architectural design of the Dukuh Atas Interchange Station building can be compiled. This research produces a design of connecting facility that integrates between modes to move users from one mode of transportation to another without leaving the station so that it is more effective and efficient.

1. Introduction

Population growth is expected to increase two-fold in some countries in Asia, including in Indonesia [1]. Population growth and also industrial and trade economies is a characteristic feature of urban development in countries [2]. Jakarta is a city that is the centre of government, economy, culture and transportation where it becomes a metropolitan city and has always experienced increased population growth [3]. The number of people in Jakarta causing burden on the city and intercity transport systems provided increased so that it takes the addition of adequate mass transportation [4]. Some of the modes of transportation currently available are Commuter Line, Busway, Monorail, MRT, Bus Shelter. Several researchers conducted studies related to how to design a mode of transportation with Transit Oriented Development approach. Susetyarto conducted research using an observational method that analyses the application of land use and zoning regulations, observing patterns the movement of people from the starting point to the destination point, analysing the conditions of urban facilities and infrastructure that produce a Transit Oriented Development design that implementing an intensive land use zone and a cultural heritage building zone, having green open space, and having pedestrian corridors that are safe and comfortable for persons with disabilities [5]. However, this study does not consider connecting facilities in its design. Chan and Nakamura use ten principles in designing Transit Oriented Development but can only be applied in developed countries such as the United States of America (USA), New York and Hong Kong due to different conditions and research locations [6]. So, it is necessary to think about a design of Connecting Facilities of several modes of transportation with Transit



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Oriented Development in the area around Dukuh Atas, Central Jakarta. Transit Oriented Development is a multi-purpose, compact, and walkable environmental design which encourages people to stay nearby and use public transportation [7]. Hope, Transit Oriented Development in the area around Dukuh Atas, Central Jakarta is one of the solutions and innovations provided by the Government to accommodate population mobility, solve problems such as traffic jam reduction, and become a meeting point for several modes of transportation in the area around Dukuh Atas, Central Jakarta so that there is increased mobility in the area. The construction of integrated stations between modes is an ideal solution because the integrated station will allow users to move from one mode of transportation to another, without having to exit the station.

2. Methods

The method used in the study titled Connecting Facilities of Several Modes of Transportation around Dukuh Atas Area, Central Jakarta with TOD Approach is to use descriptive, documentary and comparative methods. Descriptive method is carried out by collecting data from literature studies taken from national and international journal articles to be used as a reference in designing a Connecting Facilities of several modes of transportation with Transit Oriented Development in the area around Dukuh Atas, Central Jakarta, collecting data from related agencies, interviews with users of mass transportation, observations of research locations by analysing the conditions of the research location, existing and future transportation modes, circulation, and analysing the activities of mass transportation users. Documentative method which is to document the pictures from research location that being used in preparation of this research. Comparative method is conducting a comparative study of the building of an existing integrated station or integrated station from browsing internet. The first, TOD Shinjuku Station in Japan which is one of the main transit nodes in Japan. The convergence of several transit networks divides the area around the station into several districts. In Shinjuku, there is a commercial area on the east side and a business and government administration area on the west side. The two areas are divided by railways, but at the same time the front-station area connects the two areas [8].



Figure 1. Planning conditions.



Figure 2. Planning conditions.

Shinjuku Station's underground area connects the east and west by creating underground passageways and underground shopping malls that take advantage of the area on Tokyo's Marunouchi Metro Line and provide underground access to the surrounding area as well as an above-ground network created by pedestrians and artificial lands on trains at Shinjuku Takashimaya. Department Stores and Commercial Zones to the south connecting areas that being cut off by stations. Construction of the bus and taxi terminal that is connected with Shinjuku Station is also underway.



Figure 3. Shinjuku station underground network.

To eliminate the separation of areas on various levels (underground, at ground level and above ground), the planning also secures the visual connection of the underground and above-ground areas through a sunken garden in the front rotary station at Shinjuku Station. West Entrance, a pavilion staircase at Shinjuku station's South Entrance and beyond. Planning underground and above ground centred on large spaces, a public space called Mosaic Hill has also been built between the city and high-volume blocks to provide a comfortable environment for pedestrians.



Figure 4. Shinjuku Station-front area above the Ground Walkway.

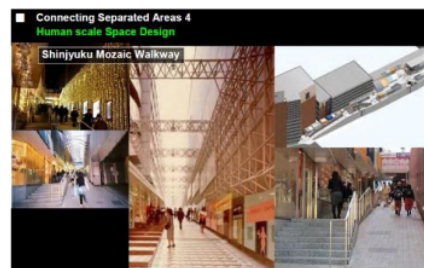


Figure 5. Plaza in front of Shinjuku station.

The second, TOD in Rotterdam, the Netherlands [9] can be seen from the function of an area in the city of Rotterdam, namely the Blaak area which is a mixed area function, both commercial, residential and office functions. In this area there is also a train station that connects Rotterdam with other cities and has a train line that functions as a metro or subway line that forms a network between areas within the city of Rotterdam. The Blaak area has public spaces in the form of plazas and parks which are used by the community to spend time outdoors. Every Tuesday and Saturday, the plaza is used to sell daily necessities at a relatively affordable price. There is a bicycle parking area for bicycle users who are in transit and want to continue their trip to another place. The Blaak area has pedestrian and bicycle paths that make it easy to move without using a motorized vehicle. The third, TOD in the City of Sacramento, United States, which has a concept that includes a long-term plan by considering transit movements using the light rail mode but still limiting development around the transit area by implementing the directed TOD concept. The application of TOD will reduce the greenhouse effect and create a comfortable and healthy atmosphere by supporting movement without motorized modes [10]. From the data that has been collected, identification and analysis is carried out to obtain a complete enough picture of the characteristics and conditions that exist, so that it can be arranged a Foundation of the Planning

and Architectural Design Program of Dukuh Atas Interchange Station building which will result in a design of Connecting Facilities of several modes of transportation with Transit Oriented Development in the area around Dukuh Atas, Central Jakarta.

3. Results and discussion

Before conducting the research, the researchers gathered literature studies of similar projects in several countries where it applied the concept of Transit Oriented Development. The research site is in Dukuh Atas which is located at the central point of Jakarta. This area is an area left behind by development along Thamrin/Sudirman road due to its location in areas crossed by rivers and railways and the dense housing and areas with complex land use rights. On the other hand, even in the current state, transit nodes with roads and trains and the like that connect in all directions are important. Moreover, it is expected to increase in line with the commencing of MRT and Airport Railway services, and Elevated BRT and in the next few years there is LRT, can increase the development potential of Dukuh Atas as Transit Oriented Development. Currently, the Dukuh Atas area is separated into 4 regions by canals and railways that move east-west and Jalan raya Thamrin/Sudirman which moves north-south and the bridge that crosses the Canal causes a difference in elevation, the shape of the bottle-neck structure in the entire area, also in the north consists of low density houses with complex land ownership, making development in Dukuh Atas, difficult to occur.

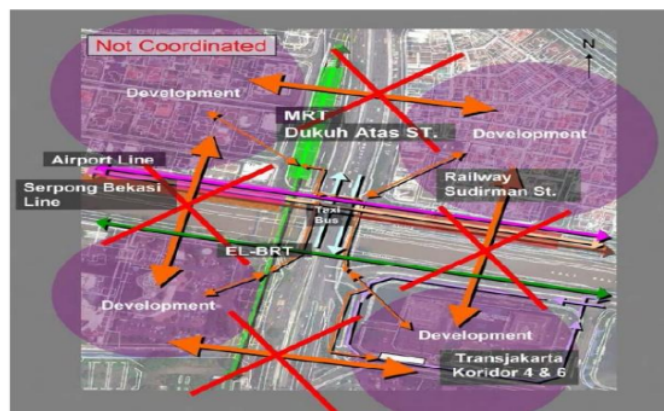


Figure 6. Uncoordinated Dukuh Atas area.

3.1. Analysis of existing and future transportation modes

In 2018 after completion of the North-South MRT Line at Stage 1, BRT Corridor 1 running along the same line will be discontinued, the North-South MRT line will take over completely for this part of the route. The current issue not being considered in the MRT plan is maintaining an important connection between Dukuh Atas MRT station and BRT corridor 4 and 6. In the current situation, transit passengers of BRT corridor 1 and BRT corridors 4 and 6 use a connecting bridge for 260m, and this line allows passengers to transit safely without any interference with road vehicles. For north-south MRT lines do not provide connection lines, and transit passengers must walk through under Thamrin road, then walk across Sudirman bridge, the line is 430m away and cannot reach a safe place for pedestrians, leading to a decrease in the current level of service. BRT Stations Corridor 4 and 6 Dukuh Atas currently do not provide enough space for passengers, such as during rush hour with operating delays occurring, the connection line between BRT Corridor 1 and BRT Corridor 4 and 6 is crowded with passengers. As with the North-South MRT line, which carries more passenger volume than the BRT Corridor 1 station, BRT Corridors 4 and 6 in Dukuh Atas must have the capacity and space to accommodate large volumes

of time. By 2020 it is hoped that The Airport Railway, MRT and LRT planned in the area will be able to operate perfectly. But if this facility is built in a scattered way, with no coordination at all, then there are no integrated transit lines or safe and smooth access from various areas of Dukuh Atas.



Figure 7. MRT-BRT Passenger Transit Line corridor 1 and Corridor 4 and 6.



Figure 8. Coordinated future transit lines.

3.2. Circulation analysis

Circulation analysis is divided into several parts, namely vehicle circulation analysis and pedestrian analysis. Road conditions in the area around the land have a high density, Kendal road width is 8 meters. This road is a one-way street. The pedestrian walkway is located on Sudirman street corridor and along the outskirts of Banjir Kanal. Pedestrian intensity increases during office hours (7am-9am) and office hours (4.30pm-6pm). Majority pedestrians are workers in Sudirman and Thamrin areas.



Figure 9. Pedestrian circulation.

3.3. Activity analysis

The analysis of the activities that take place in this station is divided based on its main activities as stated in the table below. The facilities are divided into main facilities, supporting facilities, and complementary facilities.

Table 1. Activity analysis.

Facilities	Stakeholders	Main activity
MAIN FACILITIES	- visitors	- transfer between modes of transportation
- Transit Facility		
SUPPORTING FACILITIES	- Leaders	- manage
- Administration and Management	- Employees	- receive guests
- Operational	- Employees	- hold a meeting
	- Security Guard	- Control platforms and the stations
		- Control the ticket machine
		- Secure the area
- Train Passenger Service Section	- Passengers	- Information locket
	- Employees	- Booking hall/ticket counter
	- Security Guard	- Concourse
		- Ticket door area
COMPLEMENTARY FACILITIES:	- Visitors	- Eat/drink
- Restaurant	- Manager	- Preparing orders
- Cafe		- visitors
- Retail	- Visitors	- shopping
	- Manager	- sight seeing

4. Conclusion

Dukuh Atas TOD area is recommended to be developed with a large concept Provision of Connecting Facilities of Several Modes of Transportation around Dukuh Area, Central Jakarta with TOD Approach. This planning concept is expected to be a solution to various problems and the results of a comprehensive analysis that has been done by the author. By prioritizing the Provision of Public Areas, the creation of access between modes of transportation, and the provision of pedestrian/cyclist facilities as well as strengthening the activities and various functions of regional land use, this plan is suitable to be realized immediately. This plan will of course create a good Tod Dukuh Atas Area that supports the realization of sustainable transportation system and can support urban activities that are also sustainable in Jakarta.

Acknowledgement

The author would like to thanks to:

- God for his blessing
- Mr. Dr. Dhaniswara K. Harjono, SH., MH., MBA, as Rector of Universitas Kristen Indonesia.
- Mrs. Ir. Galuh Widati, M.Sc, as Dean of the Faculty of Engineering, Universitas Kristen Indonesia
- Mrs.Prof.Dr.Ing.Ir.Sri Pane Eni and Mr.Ir Riyadi Ismanto, M.Arch who have teach and guided the author.

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