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# Travel behavior of commuter line passenger to station in Depok City

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**Abstract.** Depok City as one of the satellite cities has developed both in terms of population, social, economic and environment. The high mobility of commuter line passengers is influenced by the pattern of passenger travel using various modes of transportation such as: public transportation, private transportation online transportation, non-motorized vehicles or walking. The analysis used is the multinomial logistic regression method by observing the socio-economic characteristics of passengers and the travel characteristics of commuter line passengers. The results of the study suggest that the behavior of passengers to the station (access mode) is influenced by transport time and costs. And then, most of the commuter line passengers use online transportation as a means to get to the station. So the choice of the most used transportation modes will have an impact on the arrangement of facilities at Depok City stations.

## 1. Introduction

The rapid development of the region with all its activities will change the image of the city, which one is Depok, Depok has a high travel activities, especially on weekdays (Cahyadi & Surtiari, 2009). Depok City is a city with fast population growth and activities. In addition to the function of an independent city, one other important function is the buffer of DKI Jakarta in the southern part. Depok city residents are many workers in Jakarta. On weekdays the flow goes to Jakarta. The mobilization for urbanites in Depok, one the examples in the stations. Based on the Depok City Spatial Plan for 2012-2032, Depok City has five stations including Citayam Station, Depok Lama Station Depok Baru Station, Pondok Cina Station and Universitas Indonesia Station. Based on Railway Travel Chart in 2018, the number of commuter line trips on the central line train is 216 trips / day while for Loopline train as many as 180 trips / day with the headway of trains in Bogor crossing range from five until seven minutes. In January 2019, the number of commuter line passengers was 3,542,492 passengers. The high mobility of commuter line passengers in Depok City is influenced by the behavior of passengers in choosing modes of transportation to stations such as: public transportation, private transportation, online transportation and non-motorized vehicles or walking.

## 2. Literature Review

According to Sakar (2017) behavior an important to mode choice. Mode choice decisions may depend not only on travel time, travel costs, income, but also on individual preferences such as flexibility, comfort, reliability. In this study the passenger is commuter. According to Simpson (1994) in Indah



(2015) an important aspect in the station to improve service quality is the integration of supporting transportation modes, such as parking area and transfer facilities from buses. Based on Law Number 23 Year 2007, In station as one of the means of public transportation must be available in all other modes of transportation so that good integration between modes of transportation is created. Various modes of transportation at the station include access to pedestrians, parking lots for private vehicles, the places to park and ride public transportation and places to park and ride paratransit transportation in this case online transportation.

### 2.1 Pedestrian

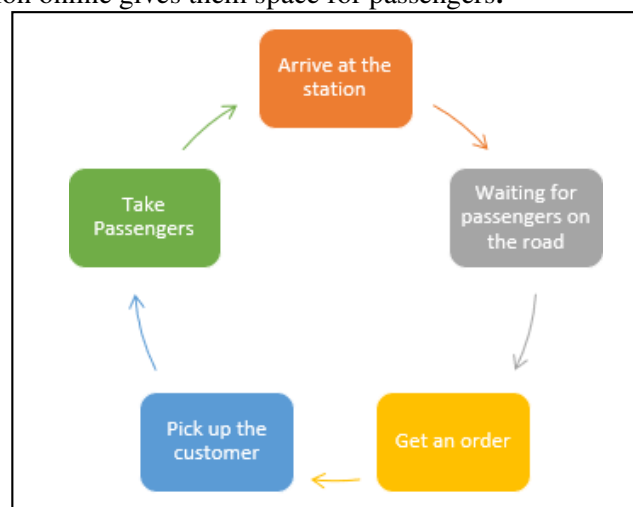
Pedestrians have the risk of being affected by accidents, especially in the elderly, children and people with disabilities. So it is necessary to provide pedestrian facilities such as sidewalks, pedestrian bridges, zebra cross. Accessibility to walk refers to an individual's ability to achieve services such as a train station (Zhao et al., 2003 in Chia, 2017). Ideally a station must be easily accessible by pedestrians to the origin and destination of the trip. In practice, the current 800 meter distance to the train station is used as one of the rules that supports a person's ability to walk to the station. (Horner & Murray, 2004 in Jason Chin Shin Chia, 2017). But based on observations, the condition of pedestrians in each of the Depok City stations is unfriendly for people with disabilities, switching functions as a place to trade and parking.

### 2.2 Parking Facilities

Based on Law about parking is the condition of the vehicle stopping or not moving for a moment and left by the driver. Basically, the provision of parking facilities for public can be held in the Road's space in accordance with the permits granted. Parking facilities can be in the form of parking buildings or parking parks provided to support activities. Whereas in this study parking facilities are managed by individuals and do not have parking management permits, this will certainly harm local governments, especially regional revenues from parking.

### 2.3 Shelter For Online Transportation

In the digital era, online transportation is increasingly in demand, but its existence has taken up road space and is still polemic in policies regarding online transportation such as online motorbikes, for the examples : gojek and grab bike. If its existence is not restricted, the growth of two wheeled vehicles that are used as modes of online transportation will cause congestion and chaos in a city. In the near future, controlling transportation online gives them space for passengers.



**Figure 1.** The process of online transportation.

### 2.4 Shelter for public transportation

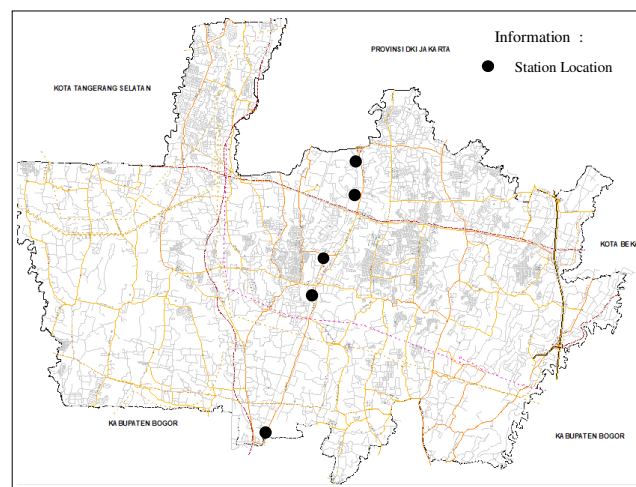
The stations must be able to be reached by public transportation, so as must integrated transportation system. Provision of infrastructure such as shelters for public transportation is very important, so that public transport does not increase the passenger down in places that can cause congestion. In five stations in Depok City only three stations are equipped with stops for public transportation, including the University of Indonesia Station, Depok Baru Station and Depok Lama Station.

### 3. Methodology

This research uses a mixed method, which is a combination of qualitative and quantitative methods based on facts supported by theory. According to Cresswell (2010), mixed methods are two forms of mutually integrated methods in combining, connecting and uniting data. To measure service quality from a variable aspect, quantitative data collection is done using the questionnaire method to station commuter line passengers. While qualitative is done through field observations or observations and interviews with related parties on the condition of the station and its facilities. And then data is processed by multinational regression such as univariate analysis and multivariate analysis of determine passenger behavior to the station in Depok City.

### 4. Findings

Based on the Depok city spatial map in 2012 - 2032, Depok City has five stations including Universitas Indonesia Station, Pondok Cina Station, Depok Baru Station, Depok Lama Station and Citayam Station, as shown below:



**Figure 2.** Station location in Depok City.

#### 4.1 Universitas Indonesia station

This station has an entrance in the education area (Universitas Indonesia). The lack of this station does not provide parking for passengers. At this station, it is integrated with public transport such as the yellow bus and Transjakarta. This station is equipped with pedestrian facilities such as pelican crossing which is friendly for the disabled. At this station is also equipped with facilities for the crossing people bridge, the bridge connects the University of Indonesia station with several apartments such as the Margonda Residence apartment, Taman Melati Margonda apartment, evencio apartment and others.



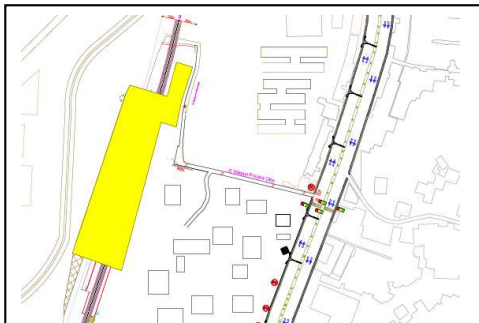
**Figure 3.** Access Universitas Indonesia station.



**Figure 4.** Facility Universitas Indonesia station.

#### 4.2 Pondok cina station

Pondok Cina Station is one of the stations that has a lot of passengers. Pondok Cina Station located is a very strategic area, because it is located in the area of trade and education, such as the Gunadharma University campus, the University of Indonesia campus, Depok Town Square shopping center, Margo city mall, there are also various hotels and apartments like as Margo hotel. In addition, near the station there is a plan to build an apartment that will be integrated with the station or Transit Oriented Development (TOD). The disadvantages of this station are that the pedestrian path is uncomfortable, there are many side obstacles such as street vendors (PKL), motorbike parking or many online transport pick-up passengers who use the pedestrian path. If you want to use public transportation, the passengers must walk five hundred meters from the station, because the road width of Pondok Cina station is only five meters, making public transportation unable to cross this road. Around the station entrance there is also an individually managed motorbike parking.



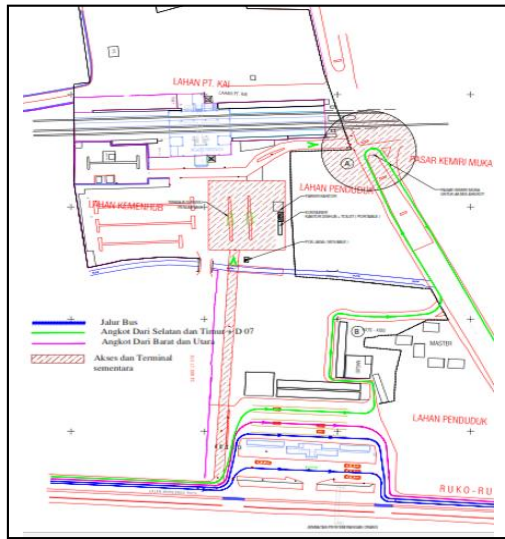
**Figure 5.** Access Pondok Cina stations.



**Figure 6.** Pedestrian at the Pondok Cina stations.

#### 4.3 Depok baru station

Based on the Depok City spatial plan, Depok Baru station is located on Jalan Margonda Raya. Around this station there are housing, offices, trade (ITC and Ramayana) and terminals. So that the station's location is very strategic. Depok Baru Station is one of the stations that has many access points. At this station there is also a parking area managed by individuals and groups. The weakness of the pedestrian street in Depok Baru Station is unfriendly for people with disabilities and the elderly. While the advantages of this station has an online shelter for online motorcycle taxis because there are 1700 ojek online operating in this station and integrated directly with the Margonda terminal.



**Figure 7.** Access Depok Baru stations.



**Figure 8.** Facility at the Depok Baru stations.

#### 4.4 Depok lama station

Depok Lama Station is located in a residential area. The width of the road to Depok Lama Station is 5 meters and the length of the road is 180 meters. On the road to Depok Lama station there is also an individual motorcycle parking lot that is managed by individuals. Not far from the entrance of the station, the existing online transit is needed to facilitate online transportation users. Around the station there are 800 online transportation drivers and 50 conventional motorcycle taxis. While the advantages of this station has an online shelter for online motorcycle taxis like as grab bike and gojek

The weakness of this station during the peak hours of the road leading to the station was opposed to street vendors and parking lots for motorbikes, such conditions made access to the station slum and traffic jam.



**Figure 9.** Access Depok Lama stations.

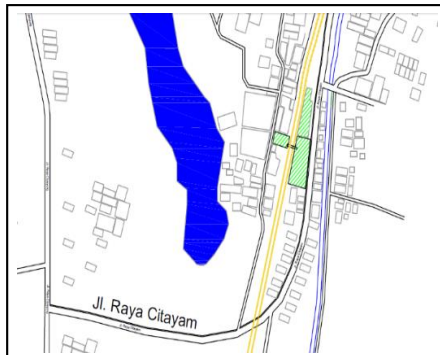


**Figure 10.** Pedestrian at the Depok Lama stations.

#### 4.5 Citayam station

Citayam Station is located in densely populated residential areas. Citayam Station has two access, but the most accessible access is on the north side of the station passing on Raya Citayam street. At this station, public transport has increased passengers, and has become a place of prosperity. At this station there is only motorized parking which is privately managed by the surrounding community by providing their own home. Based on field findings, weaknesses at Citayam Station are not provided by pedestrians and are not equipped with special access for persons with disabilities. While the ease of access for

pedestrians must apply to everyone including people who have different requirements such as small children. In addition, there is no shelter for public transportation and online transportation.



**Figure 11.** Access Citayam stations.



**Figure 12.** Condition at the Citayam stations.

## 5. Analysis

The author also conducted a quantitative survey of 400 commuter respondents at Citayam Station, Depok Lama Station Depok Baru Station, Pondok Cina Station and Universitas Indonesia Station.. The following are the results of the analysis.

### 5.1 Univariate Analysis

**Table 1.** Characteristics of respondents.

Characteristics	F	P
<b>Gender</b>		
Man	189	47,3
Women	211	52,8
Total	400	100,0
<b>Age</b>		
< 20 years old	33	8,3
21 – 30 years old	191	47,8
31 – 40 years old	139	34,8
41 – 50 years old	34	8,5
> 51 years old	3	0,8
Total	400	100,0
<b>Job Type</b>		
Housewife	14	3,5
Student	76	19,0
Private employee	184	46,5
Entrepreneur	39	9,8
PNS/TNI/Police	53	13,3
Other	34	8,5
Total	400	100,0
<b>Income/month</b>		
< Rp. 3.800.000	112	28,0
Rp. 3.800.000 – Rp. 4.800.000	57	14,2
Rp.4.800.000 – Rp.5.800.000	50	12,5
Rp.5.800.000 – Rp.6.800.000	61	15,3
> Rp. 6.800.000	120	30,0
Total	400	100,0

Based on gender, commuter line passengers in January 2019 were women as much as 52,8%. Based on age, it was found that in general, passengers aged 21-30 years were 47.8%. Based on the age group it was found that in general passengers were more likely to be of productive age. Characteristics of respondents based on work obtained in general are private employees as much as 46.7%, they live in the area around Depok and work in Jakarta using KRL. Based on the amount of income obtained in general, passengers have income more than Rp. 6,800,000 as much as 30.0%. Apart from the characteristics of the respondents, the authors also observed the characteristics of the trip:

**Table 2.** Characteristics of the trip.

<b>Characteristics</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Travel Destinations</b>		
Other	12	12,0
Office	42	10,5
Homes	341	85,3
School / Campus	5	1,3
Total	400	100,0
<b>Frequency of using a train in a week</b>		
1-2	11	2,8
2-3	78	19,5
3-4	2	0,5
4-5	157	39,3
> 5	152	38,0
Total	400	100,0
<b>Distance to Station</b>		
< 500 m	39	9,8
1,1 km – 3 km	78	19,5
3,1 km – 5 km	93	23,3
5,1 km - 10 km	69	17,3
501 m – 1 km	79	19,8
> 10 km	42	10,5
Total	400	100,0
<b>Travel Time</b>		
< 5 Minutes	25	6,3
6 - 10 Minutes	107	26,8
11 – 15 Minutes	95	23,8
16 – 20 Minutes	84	21,0
21 – 30 Minutes	50	12,5
> 31 Minutes	39	9,8
Total	400	100,0
<b>Cost</b>		
Free	41	10,3
< Rp. 5.000	23	5,8
Rp. 5.000 – Rp. 10.000	150	37,5
Rp. 11.000 – Rp. 20.000	103	25,8
Rp. 21.000 – Rp. 30.000	58	14,5
> Rp. 30.000	25	6,3
Total	400	100,0

The characteristics based on the origin of the trip were obtained by the majority of passengers coming from home as much as 85.3%. On frequency variables using a commuter line, generally passengers use the trains four until five times a week. The distance to the station is generally in the range of 3,1 km to 5 km. At the time of travel, generally the time spent on the commuter line is around six until ten minutes. Based on the costs obtained in general, the costs that must be paid by passengers to the station are IDR 5,000 - 10,000 as much as 37,5%.

### 5.2 Bivariat analysis

Bivariate analysis to discuss each independent variable on the dependent variable. The analysis used Spearman's Rho because the data analyzed are in the form of categories. The following are the results of experimental analysis on the research variables.

**Table 3.** Bivariat results.

Independen Variable	Correlation coefficient	Sig	Information
<b>Time</b>	0,269	0,000	Significant
<b>Cost</b>	0,605	0,000	Significant
<b>Distance</b>	0,369	0,000	Significant
<b>Income</b>	0,036	0,474	No significant
<b>Job</b>	-0,101	0,044	Significant
<b>Gender</b>	-0,907	0,052	No significant
<b>Age</b>	-0,127	0,011	Significant
<b>Origin</b>	-0,023	0,648	No significant

In the time, cost, distance, occupation, gender and age variables, a significance value of 0,000 is obtained so that the significance value is less than 0.05 and can be interpreted as having a significant correlation to the choice of transportation mode used to the station.

### 5.3 Multivariate analysis

Multivariate analysis aims to analyze the independent variables to dependent variable. Multivariate analysis used in this study is multinomial logistic regression analysis. This analysis is used because the dependent variable consists of more than two categorical data, namely transportation modes on walking (1), private vehicles (2), public transportation (3), and online transportation (4). The following are the multinomial logistic regression results that have been carried out.

*5.3.1 Partial test.* Partial test is used to effect of independent variables on the choice of transportation mode. This is indicated if the variable has a smaller than 0.05.

**Table 4.** Partial test results.

Variabel Independen	Model Fitting	Chi-Square	Sig	Information
<b>Time</b>	446,889	31,066	0,009	Significant
<b>Cost</b>	588,329	172,507	0,000	Significant
<b>Distance</b>	433,919	18,096	0,258	No significant
<b>Income</b>	452,186	36,363	0,000	Significant
<b>Job</b>	457,929	42,106	0,000	Significant
<b>Gender</b>	415,912	0,089	0,993	No significant
<b>Age</b>	422,984	7,161	0,847	No Significant
<b>Origin of travel</b>	419,368	3,545	0,939	No Significant

Based on the table above, the variable time, costs, income and jobs have a significant influence on the choice of transportation modes used to the station while the other variables have no effect because the value is smaller than 0.05.

*5.3.2 Coefficient of Determination.* The coefficient of determination aims to determine the influence of independent variables to the choice of transportation modes. This coefficient value is 0 to 1 where the value close to 1 shows a strong influence. The following are the results of the coefficient determination from multivariate calculations.

**Table 5.** Determination coefficient test results.

<b>Cox and Snell</b>	<b>Nagelkerke</b>	<b>McFadden</b>
0,771	0,835	0,576

The results of the coefficient of determination with Nagelkerke R Square show a value of 0.835. This value can be interpreted that the variable time, cost, distance, income, occupation, gender, age, and origin can influence or determine the choice of transportation modes used to the station by 83,5% and the remaining 7.7% is influenced by other variables that are not became the focus of this research.

### *5.3.1 Goodness Of Fit Test*

The goodness fit test is used to determine the feasibility of the multinomial regression model used. A decent regression model is indicated by a significance value of goodness of fit that is greater than 0.05. The following are the results of a simultaneous test on the regression model that has been obtained.

**Table 6.** Goodness of fit test.

<b>Chi Square</b>	<b>Significant</b>	<b>Information</b>
546,968	0,999	Significant

Overall test results, which can be seen in the Pearson value Sig variable is 0.999 which means the model is fit (feasible to use). This means that the regression model obtained is fit or feasible.

## **6. Conclusions**

The results of the study about travel behavior of commuter line passengers to the station in Depok City, conclusions can be given as follows:

### *6.1 Relationship between socio-economic characteristics of commuter line passengers when choosing transportation modes to stations in Depok City*

The relationship of socio-economic characteristics of commuter line passengers in choosing transportation modes to stations is obtained by time, cost, distance, job and age showed a significant influence in the choice of transportation mode. In the study, the correlation coefficient is negative, therefore it can be said that the work of housewives, or students shows a tendency to use online transportation. Housewives find it easier to station using vehicles or online transportation because it will be more difficult if using other transportation such as private vehicles or public transportation.

### *6.2 Relationship between the characteristics of travel when choice modes of transportation to stations in Depok City*

The relationship between commuter line passenger travel characteristics in choosing transportation modes to the station obtained variable costs, time, income and job obtained showed a significant

influence while the distance variable did not show any influence in the selection of transportation modes indicating the tendency to use online transportation.

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