Optimal location for online motorcycle taxi shelter at Bekasi Train Station

R R Pangestu, H M Taki*, R Situmorang and Y Supriyatna

Department of Urban and Regional Planning, Faculty of Landscape Architecture and Environmental Technology, Universitas Trisakti, Jakarta, Indonesia

*herika@trisakti.ac.id

Abstract. In some locations such as in this study are stations, online motorcycle taxi requires a shelter or a special location to conduct their activities, such as drop off and also pick up to maintain regular traffic so as not to cause congestion and create orderliness in transportation activities. In this study, the optimal shelter location at Bekasi Train Station will be searched using the weighting method, that is using rank sum weight, where respondents will be given preference questions with a scale of 1 to 5 on each particular indicator where the number of ratings will get preference ranking of each indicator which can be calculated its weight by a formula and gives a score to each indicator with a value of 1 to 3 which is assessed from the physical condition of each indicator in this study. Where in this study in finding the optimal location five indicators will be used namely Distance, Landmark, Comfort, Safety, and Orderliness. In searching for the weighting of the correspondents on the preference questionnaire are users and drivers of online motorcycle taxi. From the assessment, it can be seen that the most optimal location to pass the drop off is to be in Indomart Juanda with the highest weighting preference at the drop off is the landmark and then the distance from the station, and the most optimal location for ordering an online motorcycle taxi is located Indomart Juanda with the most weight preference in motorcycle taxi booking online is the landmark and the safety.

1. Introduction

Bekasi City is a dormitory city for DKI Jakarta and is also the second largest contributor of commuter volume after Bogor. The existence of a train service as a massive public transportation mode has been utilized by the majority of commuters than any other public transportation modes [1]. The number of train users who used online motorcycle taxi services to and from Bekasi Station that fills the surrounding areas should be controlled by providing a special area to as shelter to pickup and deliver passengers to improve effectiveness and efficiency [2]. However, with the closing of laybay area in 2019 for renovations and with the addition of rail lines, online motorcycle taxi activity in this area has become uncontrolled and irregular, which caused numbers of traffic jams. Therefore, this research is intended to look for alternative locations. Because there is no more available land that can be used as a shelter in the area, we will consider users and drivers preferences inside Bekasi Station area.

2. Optimal online motorcycle taxi shelter location

Several theories have been utilized to determine optimum location for shelter. One of them is a theory elaborated by ITDP which mentions that shelter location must be safe, located in an open space,
visible, and walking distance away or relatively close with the facility where the shelter is intended for (mall, train stations, offices, etc.), with at least 500 meters of range [3-7]. However, the location for conventional taxi (with similar nature as online motorcycle taxi), is established based on comfort value, which then decided to be located in an independent area where it does not disrupt the traffic or pedestrians, the shelter is also can easily be found by its name or visible by both the drivers and the passengers, and the taxi shelter is also reachable. These reasons are the attractiveness of taxi shelter location [8]. Based on several researches above, the indicators utilized in this research are comfort, safety, orderly, distance, and area with easily remembered name both by the drivers and the passengers.

3. Methodology
In this research, the first thing to do is to look for references both from the drivers and the passengers of online motorcycle taxi service, as the users of the shelter. Because the population of shelter users is unknown, the number of sample utilized in this research will be determined by using Wibisono formula as follows.

\[
 n = \left( \frac{Z_{\alpha/2} \sigma}{e} \right)^2 
\]

(1)

Where \( n \) is the number of sample, \( Z_{\alpha} \) is 0.05, \( \sigma \) is population standard deviation, and \( e \) is mistakes rate. The calculation results a value of 96.04, which is rounded up to 97. Questions given to users and drivers are using likert scale of 1 to 5 with an explanation that these indicators are representing their opinion starting from highly important to unimportant. This questionnaire is also used to locate existing popular location that regularly used by both the users and the drivers. After the preference score is generated, the next step is to calculate the value based on rankings of each indicator [9] by utilizing the following formula.

\[
w_j = \frac{n-r_j+1}{\sum (n-r_j+1)}
\]

(2)

Where \( w_j \) is value of \( j \), \( n \) is the number of indicator and \( r \) is the criteria ranking position. After identifying the value, alternative location will be assessed by using scoring method with a scale of 1 to 3 with the following criterias.

| Indicator | Criteria                                                                 | Score |
|-----------|--------------------------------------------------------------------------|-------|
| Landmark  | the location has a name that everyone knows                              | 3     |
|           | the location near a place that has a name                                 | 2     |
|           | the location doesn't have a name                                         | 1     |
|           | \( \leq 250 \) meters                                                   | 3     |
| Distance  | 251 - 500 meters                                                        | 2     |
|           | \( \geq 501 \) meters                                                   | 1     |
| Comfort   | the location does not obstruct the flow of traffic and pedestrians       | 3     |
|           | the location is blocking a pedestrian way or the flow of traffic         | 2     |
|           | the location has it's own space                                         | 1     |
|           | the location does not have a traditional motorcycle taxi or other        |       |
|           | conventional transportation that can trigger conflict                    | 3     |
| Safety    | the location is next or near to a traditional motorcycle taxi or other   |       |
|           | conventional transportation that can lead to conflict                    | 2     |
|           | the location is at a base of traditional motorcycle taxi or other        |       |
|           | conventional transportation that can trigger conflict                    | 1     |
|           | the location does not violate traffic signs at all                       | 3     |
| Orderliness| the location violates one of the lights or signs                          | 2     |
|           | The location violates signs and traffic lights                           | 1     |

Table 1. Score of each criteria.
4. Results and discussions

4.1. Demand analysis
Based on questionnaire result, several known locations are obtained which are Indomart Juanda, Indomaret Perjuangan, CAD Shop House, and Pempek GABY with the map and following percentages.

Figure 1. Map of each alternative location.

Figure 2. Pick up demand of each alternative location.

Figure 3. Drop off demand of each alternative location.

Based on the graphic above, we can see that as long as there is no shelter area provided in Bekasi Station, the users and drivers often use Indomaret Juanda as pickup and drop off location with 38% of probability. The second choice would be Indomaret Perjuangan with 30% probability. This decision is driven by the fact that Bekasi Station has two entrances, one that head towards Perjuangan Street, and the other one facing Juanda Street. Also, based on demand perspective, although the most favorite location is at Perjuangan Street with probability of 30%, the inexistence of favorite location in this street has made it a non-prioritized location. Based on the graphic above as well, we can see that with
the inexisting shelter in Bekasi Station, online taxi service users and drivers tend to choose Indomaret Juanda as preferable location with 32% probability and Indomaret Perjuangan with 27% probability. This decision is driven by the fact that Bekasi Station has two entrances, one that head towards Perjuangan Street, and the other one facing Juanda Street. Also, based on demand perspective, although the most favorite location is at Perjuangan Street with probability of 30%, the inexistence of favorite location in this street has made it a non-prioritized location.

4.2. Scoring analysis

As explained on previous sections, the first thing to do in this research is to rank respondents preferences. The ranking result is as follows.

Table 2. Pick up preference by shelter user for each alternative location.

| Location          | Landmark | Orderliness | Comfort | Safety | Distance |
|-------------------|----------|-------------|---------|--------|----------|
| Indomart Juanda   | 170      | 154         | 160     | 156    | 157      |
| Ruko CAD          | 78       | 69          | 65      | 73     | 64       |
| Pempek GABY       | 28       | 23          | 22      | 26     | 27       |
| Indomart Perjuangan | 141     | 131         | 129     | 137    | 119      |
| Other             | 28       | 26          | 26      | 28     | 27       |
| Total             | 445      | 403         | 402     | 420    | 394      |

From the table above, the first factor that influence both users and drivers decision to choose pickup and drop off location is landmark, followed by safety, orderliness, comfort, and the last one is distance. The reason is that Bekasi Station is located in a satellite city where the majority of train passengers are commuters that usually use the service at night time to come home. Landmark becomes the most important factor because users and drivers tend to look for the most recognizable place as meeting point, and the second reason is safety which is driven by the need to feel safe from possible conflict that might happen between transportation service providers. Preference regarding drop off area can be seen on the following table.

Table 3. Drop off preference by shelter user for each alternative location.

| Location          | Landmark | Orderliness | Comfort | Safety | Distance |
|-------------------|----------|-------------|---------|--------|----------|
| Indomart Juanda   | 165      | 151         | 150     | 152    | 162      |
| Ruko CAD          | 71       | 69          | 69      | 70     | 70       |
| Pempek GABY       | 26       | 26          | 25      | 30     | 29       |
| Indomart Perjuangan | 130     | 134         | 131     | 129    | 127      |
| Other             | 28       | 25          | 27      | 28     | 26       |
| Total             | 420      | 405         | 402     | 409    | 414      |

Based on the table above, we can see that the reasons drive users and drivers to determine drop off location are landmark, the second is distance, the third is safety, the fourth is orderliness and the last one is comfort. This reason is generated because the passengers usually use online motorcycle taxi service in the morning when they are going for work. Landmark still become the strongest reason to determine location with the same reason as pick up. However, the second reason changed into distance where the passengers prefer to be lifted closer to the station to improve efficiency. By using sum weight rank, we can produce valuation weight as follows.
Table 4. Weight for each indicator.

| Indicator | Weight Pick Up | Drop Off |
|-----------|----------------|----------|
| Distance  | 0.266          | 0.066    |
| Comfort   | 0.666          | 0.133    |
| Orderliness | 0.133      | 0.2      |
| Safety    | 0.2            | 0.266    |
| Landmark  | 0.333          | 0.333    |
| Total     | 1              | 1        |

The next step is to calculate the scoring by considering the existed provisions of every existing alternative location as follows.

Table 5. Scoring analysis on each alternative location.

| Location         | Indicators | Distance | Comfort | Orderliness | Safety | Landmark |
|------------------|------------|----------|---------|-------------|--------|----------|
| Indomart Juanda  | 3          | 3        | 2       | 3           | 3      |          |
| Indomart Perjuangan | 3        | 3        | 2       | 2           | 3      |          |
| Ruko CAD         | 3          | 1        | 2       | 3           | 2      |          |
| Pempek GABY      | 3          | 1        | 2       | 3           | 2      |          |

The scoring above is multiplied with the valuation weight to produce the analysis result as follows.

Table 6. Scoring analysis on each alternative location.

| Indicator | Weight | A | B | C | D |
|-----------|--------|---|---|---|---|
|           |        | BxS (DO) | BxS (PU) | BxS (DO) | BxS (PU) | BxS (DO) | BxS (PU) | BxS (DO) | BxS (PU) |
| Distance  | 0.266  | 0.798  | 0.198  | 0.798  | 0.198  | 0.798  | 0.198  | 0.798  | 0.198  |
| Comfort   | 0.666  | 1.998  | 0.399  | 1.998  | 0.399  | 1.998  | 0.399  | 1.998  | 0.399  |
| Orderliness | 0.133 | 0.399  | 0.6    | 0.399  | 0.6    | 0.266  | 0.4    | 0.399  | 0.6    |
| Safety    | 0.2    | 0.4    | 0.532  | 0.4    | 0.532  | 0.6    | 0.798  | 0.6    | 0.798  |
| Landmark  | 0.333  | 0.999  | 0.999  | 0.666  | 0.666  | 0.666  | 0.666  | 0.666  | 0.666  |
| Total     | 1      | 4.594  | 2.822  | 4.261  | 2.395  | 2.996  | 2.195  | 4.461  | 2.661  |

From the valuation above, we can see that Indomaret Juanda is seen as the most optimum location for both pick up and drop off as this location is highly preferred by both taxi online service users and drivers.

5. Conclusion

The conclusion of this research is that Indomaret Juanda is the most preferable location for both pick up or drop off activities around train station in this satellite city. For pick up activity, the preferences order are landmark, safety, orderliness, comfort, and the last one is distance (from the station). Meanwhile in drop off activity, the preferences order are landmark, distance, safety, orderliness, and the last one is comfort. Based on scoring analysis, Indomaret Juanda is seen as an optimum location for online motorcycle taxi service shelter location for Bekasi Train Station.

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