The Relationship Between The Availability Of The Supporting Elements Of Pedestrian With Pedestrian Crossing Facility Usage Based On User Preferences (Case Study Corridor of Sumbersari Street, Gajayana Street, MT. Haryono Street, Malang City)

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Abstract. Pedestrian crossing facilities are effective enough to avoid pedestrians with vehicles, but its utilization is still quite low. It indicated that safety is not the only factor that influences a person to utilize the pedestrian crossing facilities. In addition, the availability of supporting elements of the pedestrian is still not quite attention, which is also became a factor that causes the pedestrians doesn’t utilize the pedestrian crossing facilities. Therefore, this research was structured to examine the relationship between the availability of the supporting elements of the pedestrian with pedestrian crossing facility usage based on user preferences. Data collection method used is primary survey consist of observation and the questionnaire. Sampling techniques used is purposive sampling with the number of respondents as many as 211 respondents by using questionnaire with ordinal scales to identify respondents’ consideration level of supporting elements pedestrian and crossing facility utilization factors. The survey is done on 15 crossing facilities area in 3 different locations with the same characteristics of land use in the form of higher education area (university area) and trades and services activities area. The analysis technique used is frequency distribution analysis in order to identify preference pedestrian on the availability of supporting elements of pedestrian and pedestrian crossing facility utilization factors, and chi square analysis is used to analyze the relationship between the availability of the supporting elements of the pedestrian with pedestrian crossing facility utilization. Based on the chi square analysis results with significance 5 % obtained the result that there are six supporting elements of pedestrian having correlation to the factors of pedestrian crossing facility utilization consist of the availability of sidewalk, pedestrian lights, Street Lighting Lamps, Pedestrian Crossing Markings Facilities, Sign Crossings Facilities, vegetation, and dustbin. So the result of this research can be considered for the government as main stakehoder especially the local government in preparing policy to provide supporting elements of pedestrian that should be on the area of pedestrian crossing facilities.

1. Introduction
A pedestrian is a person who performs activities on foot and is one of the elements of road users [1]. The term of pedestrian or a pedestrian comes from the Greek pedester/pedestris i.e. people who walk or promenade. Pedestrian also comes from the Greek meaning pedos. Pedestrian are also interpreted as
movement or circulation or as the destination on foot (Rubenstein, 1992) [2]. Where pedestrian is part of the transportation system are no less importance compared to other transportation modes. Although the Act of walking will look simple but it has an important role in the transportation system, because if the pedestrian crash then it will affect parts of the transportation system. Therefore, the needs of pedestrians is a part that is integrated with the transportation system. The results of a study from the Institute of Transportation Studies (INSTRAN) get that 65% of traffic accidents caused pedestrians fatalities. [3]. So it can be understood that the pedestrian facilities are often not included in the planning. If there are any often do not provide comfort for pedestrian who use the facility. With the condition and the facilities inadequate pedestrian often accused one of the causes of traffic congestion. So one of the elements that must be available in the process of engineering traffic is pedestrian facilities (available of pedestrian facility). The importance of the issue of the provision of pedestrian facilities is noteworthy based on the following factors: a). The road plays a role in responding to the problem of urban transportation. b). Pedestrian facilities is an important element in the planning of the city, the pedestrian facilities Set up from a matching vehicle lines would support the potential of the relic in the town center. c). Structuring strategic pedestrian facilities with a high standard of achievement will be able to support the overall circulation in the City Centre (Rhamdani: 1992) [4].

General conditions on the location of research, the existence of pedestrian crossing facilities are adequate is not followed by the availability of supporting elements of the pedestrian, it still is very minimal which forced the most crossing way to not utilize the facilities of the crossing as well as prefer to cross where it's not supposed to. With the high mobility of society requires the availability of pedestrian facilities that are equipped with supporting elements to suit preferred factor crossing the road. So the availability of supporting elements of the pedestrian needs to be examined to see the correlation of each element against the factors that more prioritized by pedestrians.

2. Literature Review

According to (John Fruin 1979), walk is a movement of internal city, the only instrument to meet the needs of interaction face-to-face that is in the commercial activity of and cultural in the city life [5]. The term pedestrian or pedestrians comes from the greek pedester / pedestris who on foot and pedestrians .Pedestrian also derived from a pedos greek which means feet .Pedestrian also interpreted as movement or circulation or as a destination on foot (Rubenstein, 1992) [6].

According to (John Fruin, 1971), planning facility for pedestrians, including crossing facilities must take into the seven main target : safety, security, convenience, comfort, continuity, integration system, attractiveness [7].

According to Anggraini (2009:33), explained that the aspect is included in pedestrian element consist of drainage, sidewalk, pedestrian lights, a seat, guardrail, dustbin, crossing markings facilities, sign crossings facilities, the information board, bus shelter, stalls wait, and the public telephone [8].

3. Methods

Research methods used in this research is quantitative research. Data collection technique used is primary survey consist of observation and the questionnaire. Sampling techniques used is purposive sampling with the number of respondents about 211 respondents using quesiner with ordinal scale (i.e., from 1 = Not Considered to 5 = Very Considered). The survey was carried out on 15 area crossing facilities in three different locations with the same characteristics of land use consist of higher education area (university), trading activities and services. Analysis techniques used frequency distribution analysis in order to identify pedestrian consideration on the availability of supporting elements pedestrian and factors of pedestrian crossing facility utilization and crosstab analysis and chi square analysis to measure association or correlation between availability supporting elements pedestrian with pedestrian crossing facility utilization with 5 percent significance level.
4. Research Results

4.1. The Distribution of Crossing Facility Based On The Kinds Of Pedestrian Crossing Facilities

There are two locations of the point of pedestrian crossing facilities on Sumbersari Street in the form of zebra cross. But seen from the existing condition is not maintained, whereas at that location is one of area with a significant amount of movement. In addition, the lack of adequate supporting elements of pedestrian crossing facilities so that most pedestrians tend to cross in places that are not supposed to.

In Gajayana Street, there are three locations of the point of pedestrian crossing facilities with the number of crosswalker are quite numerous and intense. The three crossing facilities in the form of two zebra cross and one pelican crossing. However, the condition can be said to be less maintained, it can be observed from marking condition of pedestrian crossing facility that has begun to fade. It is also not supported by supporting elements that can at least make it easier to cross the road in the region.

Pedestrian crossing facilities on Jalan MT. Haryono, there are 10 pedestrian crossing facilities consist of two pelican crossing and 8 zebra cross that existing conditions can be quite good. At 10 points facility, the people movement is very significant especially shopping activities, education, and work. However, the availability of a support element in the area of pedestrian crossing facilities are still very minimal.

![Figure 1. Crossing facility in: (a) Sumbersari Street (b) Gajayana Street (c) MT. Haryono Street](image)

| Street Corridor     | The Point Of Location | Jenis Fasilitas Penyeberangan |
|---------------------|------------------------|-------------------------------|
| Sumbersari Street   | Point I                | Zebra Cross                   |
|                     | Point II               | Zebra Cross                   |
| Gajayana Street     | Point III              | Zebra Cross                   |
|                     | Point IV               | Pelican Crossing              |
|                     | Point V                | Zebra Cross                   |
| MT. Haryono Street  | Point VI               | Zebra Cross                   |
|                     | Point VII              | Pelican Crossing              |
|                     | Point VIII             | Pelican Crossing              |
|                     | Point IX               | Zebra Cross                   |
|                     | Point X                | Zebra Cross                   |
|                     | Point XI               | Zebra Cross                   |
|                     | Point XII              | Zebra Cross                   |
|                     | Point XIII             | Zebra Cross                   |
|                     | Point XIV              | Zebra Cross                   |
|                     | Point XV               | Zebra Cross                   |
Figure 2. Map of distribution of crossing facilities based on the kinds of pedestrian crossing facilities.

4.2. Analysis of the Pedestrians Preference towards the Availability of Supporting Elements of the Pedestrian

Based on the distribution analysis results, the pedestrian preference describes that the supporting elements of the pedestrian that should be available on the area of pedestrian crossing facilities there are 7 elements, consist of the availability of sidewalks, pedestrian lights, street lighting lamps, pedestrian crossing markings facilities, guardrail, sign crossing facilities, and vegetation that belongs on the category as a whole is very considered and considered.

Table 2. Analysis of the Pedestrians Preference towards the Availability of Supporting Elements of the Pedestrian

| No | The Supporting Element Of The Pedestrian | Sumbersari Street | Gajayana Street | MT Haryono Street |
|----|----------------------------------------|------------------|----------------|------------------|
| 1  | Availability Of Sidewalks              | 1                | 1              | 1                |
| 2  | Availability Of Pedestrian Lights      | 2                | 2              | 2                |
| 3  | Availability Of Street Lighting Lamps  | 1                | 2              | 2                |
| 4  | Availability Of Stalls Wait            | 3                | 3              | 3                |
| 5  | Availability Of Pedestrian Crossing Markings Facilities | 2 | 1 | 1 |
| 6  | Availability Of Guardrail              | 2                | 2              | 2                |
| 7  | Availability Of Sign Crossings Facilities | 2 | 2 | 1 |
| 8  | Availability Of The Public Telephone   | 4                | 5              | 4                |
4.3. Analysis of the Pedestrians Preference towards the Crossing Facilities Utilization Factor

Based on the distribution analysis results, the pedestrian preference describes that overall belongs in two categories consist of very considered and considered. The most dominant factor included by very considered criteria consists of 5 main factors i.e. safety factor, security factor, ease factor, convenience factor, and smooth factor. But, the factor included by considered category consist of 2 factors i.e integration system factors, and atraction factor.

Table 3. Analysis of the Pedestrians Preference towards the Crossing Facilities Utilization Factor

| No. | The Supporting Element Of The Pedestrian | Street Corridor |
|-----|------------------------------------------|-----------------|
|     |                                          | Sumbersari Street | Gajayana Street | MT Haryono Street |
| 9   | Availability Of Vegetation               | 1               | 1               | 2               |
| 10  | Availability Of Dustbin                  | 4               | 4               | 2               |

Description:

| 1   | = Very considered                        |
| 2   | = Considered                             |
| 3   | = Considered enough                      |
| 4   | = Less considered                        |
| 5   | = Not considered                         |

4.4. Analysis of the Relationship between the Availability of Supporting Elements of Pedestrians with Pedestrian Crossing Facilities Utilization

Based on the results of the analysis of the relationship between the availability of supporting elements with pedestrian crossing facilities utilization by using the chi square analysis. Chi square analysis mathematically can be calculated with the following formula:

\[ x^2 = \frac{\sum (fo - fe)^2}{fe} \]  

Information:

\[ x^2 \] = The value of the Chi Squared
\[ Fe \] = Frequency expected
\[ fo \] = Frequency obtained/observed
The chi square test hypotheses with IE:
H₀ = no relationship between availability of the supporting elements of the pedestrian towards the utilization of pedestrian crossing facilities.
H₁= There is relationship between availability of the supporting elements of the pedestrian towards the pedestrian crossing facility factors.

Chi square correlation test with significance level of 0.05 as follows:
- If Asymp. Sig > 0.05 H₀ is received
- If Asymp. Sig < 0.05 H₀ is rejected

Table 4. The Chi Square Test results Correlation between Availability of The Supporting Elements of the Pedestrian Facility Usage Factor towards the Pedestrian Crossing

| The Supporting Element OfThe Pedestrian | Safety Factor | Security Factor | Ease Factor | Convenience Factor | Smooth Factor | Integration System Factor | Attraction Factor |
|----------------------------------------|--------------|----------------|------------|--------------------|--------------|--------------------------|------------------|
| Availability Of Sidewalks              | 0.373        | 0.563          | 0.020      | 0.095              | 0.000        | 0.775                    | 0.062            |
| Availability Of Pedestrian Lights      | 0.916        | 0.902          | 0.020      | 0.490              | 0.199        | 0.010                    | 0.546            |
| Availability Of Street Lighting Lamps  | 0.712        | 0037           | 0.205      | 0.081              | 0.673        | 0.927                    | 0.004            |
| Availability Of Stalls Wait            | 0.522        | 0.072          | 0.467      | 0.997              | 0.736        | 0.185                    | 0.786            |
| Availability Of Pedestrian Crossing Markings Facilities | 0.206 | 0.225 | 0.017 | 0.824 | 0.054 | 0.989 | 0.791 |
| Availability Of Guardrail              | 0.096        | 0.424          | 0.675      | 0.230              | 0.860        | 0.247                    | 0.872            |
| Availability Of Sign Crossings Facilities | 0.001        | 0.082          | 0.567      | 0.927              | 0.571        | 0.840                    | 0.635            |
| Availability Of The Public Telephone   | 0.195        | 0.205          | 0.987      | 0.607              | 0.533        | 0.968                    | 0.835            |
| Availability Of Vegetation             | 0.537        | 0.581          | 0.327      | 0.033              | 0.156        | 0.707                    | 0.379            |
| Availability Of The Trash              | 0.896        | 0.892          | 0.946      | 0.404              | 0.633        | 0.721                    | 0.038            |

Description:
- Red = Have a correlation (significance level <5% /< 0.05)
- Yellow = Do not have a correlation (significance level of >5% >/ 0.05)

Based on Chi square analysis the results it can be concluded that there is some element of the pedestrian have a correlation towards utilization of pedestrian crossing facilities.
Availability of sign crossings facilities have a correlation with safety factor by significance of 0.001.

Availability of street lighting lamps have a correlation with security factor by significance of 0.037.

Availability of sidewalks, pedestrian light availability, and the availability of pedestrian crossing markings facilities have the correlation with ease factor by significance of 0.020, 0.020, and 0.017.

Availability of vegetation have a correlation with convenience factor by significance of 0.033.

Availability of sidewalks have correlation with smooth factor by significance of 0.000.

Availability of pedestrian lights have a correlation with integration system factor by significance of 0.010.

Availability of street lighting lamps and trash have a correlation with attraction factor by significance levels of 0.004, 0.038.

5. Conclusion
Based on the preferences of pedestrian, there are 5 supporting elements of the pedestrian should be available on the area of pedestrian crossing facilities consist of the availability of sidewalks, pedestrian lights, pedestrian crossing markings facilities, sign crossings facilities, and vegetation.

Based on the pedestrians preference towards the utilization factor of pedestrian crossing facilities belongs in two categories namely very considered and considered consist of: safety factor, security factor, ease factor, convenience factor, and smooth factor.

Based on chi square analysis between the supporting elements of the pedestrian with the pedestrian crossing facility usage. There are 7 supporting elements of pedestrian that has correlation and should be available in the crossing facility area are sign crossings facilities, street lighting lamps, sidewalks, pedestrian light, pedestrian crossing markings facilities, vegetation, and trash.

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