Determining an Acceptability of Pedestrian Facilities to Support the Mass Transport System in Jakarta

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Abstract. In addition to reliability and performance, convenience and aesthetics of the shelters/stations and pedestrian pathway for the last mile journey are the other factors that affected the interest of using public transportation. The purpose of this study is to review the general perception of Bus Rapid Transit (BRT) "Trans Jakarta" users in Jakarta on the aspects related to amenities and facilities for the last mile journey. The objectives of the study will have two folds: First, to determine the acceptable distance of walking and preferable condition for pedestrian pathway based on the opinion questionnaire survey, and; secondly, to understand factors determining comfort facilities in the area of BRT's shelter based on the approach of Theory Planned Behavior (TPB). Results showed that BRT users are willing to walk between 225 meters and 775 meters and prefer the pathway that is covered by shady trees or canopy structure. Related to BRT shelters majority of users considered the facilities of BRT shelter are less comfortable and did not have a good aesthetic. Moreover, continuing from the platform to pedestrian sideway is affecting the users' from choosing BRT.

1. Introduction

Encouraging walking for the last mile journey from transit modes is very important as a part of promoting green and sustainable urban areas. Walking is also having many advantages, namely to improve health and personal independence [1]. However, many factors are also affect willingness to walk such as pedestrian safety as walking is the most vulnerable users on urban streets [1][2], thus, better design is needed for improving safety along the streets, at intersections and at road crossing [1]. Some studies have evaluated facilities for pedestrians by assessing a number of criteria, i.e. security, safety, convenience, attractiveness and comfort (e.g. [1][2][3] and [4]). The studies conformed that those elements are important for attracting people to walk and use public transport.

Traffic congestion in Jakarta is believed to be one of the worst among big cities in Asia. Government of the City of Jakarta with support by Government of Indonesia constructs one corridor of Mass Rapid Transit (MRT) and four corridors of Light Rapid Transit Corridors in Jakarta with target completion in 2018/2019. Currently, the city is only served by a massive network of BRT as the backbone of public transport. For the Greater Jakarta Area is served by Commuter Line of heavy train but with limited routes. Transit access facilities such as pedestrian walkways and access/egress from and to the shelters or stations are not too much be considered in the plan. In this context, these facilities have been largely neglected in development of transit system as it happened elsewhere in developing countries [5]. The main problems are including continuity pathway from the platform to road sidewalk, better understanding shelter/station usage by adequate pedestrian path width and comfort/convenience.

Furthermore, from the literature reviews, factors that can improve transit ridership can be divided into two groups; the internal and external factors [see 6]. Many authorities concentrate the internal factors such as fare, service quantity and quality factors that they have some degree of control. The facts that in able to promote the private vehicles journey transferring to public transport, the external factors are also very important such as comfort, safe and secure pedestrian pathways for the first and last mile journey by transit modes.

The objectives of this paper have two folds: First, to determine the appropriate walking distance and preferable pedestrian facilities in the Jakarta Central Business District (CBD) and; Second the BRT users' perception regarding pedestrian and platform facilities in the shelter area and how BRT authority can improve the facilities.

2. Pedestrian Facilities and Walking Distance

2.1 Methodology

The study was carried out in the SCBD as one of the biggest central business district in Jakarta. SCBD management is also provide a shuttle bus to connect all of the building within the precinct, but the service is very limited. The reasons for choosing SCBD are that SCBD provides the high quality of pedestrian pathways (see *Fig 1*) and closed to a number of BRT shelters. In the development of MRT, one of the MRT stations is also closed to the SCBD area. Respondents for this study were 158 pedestrians that walk from the nearby BRT shelters for their last mile journey. The questionnaire was designed to obtain pedestrian preferable facilities and distance between the BRT shelter and their offices in SCBD by plot their route into map provided in the questionnaire (see *Fig 2*).

Fig. 1.View of Pedestrian Pathway

Fig. 2. Respondent's Walking Route in SCBD, Jakarta

Six options were questioned related to the pedestrian facilities and conditions and these options based on the meta-analysis finding are availability of shade such as shady trees or pergola structure [7][8] and [9]; proper width to cater demand flow [3] and [4]; continuity [6] and [10]; accessibility [6]; without any distractions from street vendors (specific issues for Indonesia), and direct connect to transit facilities [6]. These options must be answered by ranked from the most important (1st rank) to the most less important (6th rank).

2.2 Analysis

Table 1 and Figure 3 show respondent choices related to facilities/pathway conditions that can encourage people walking for the last mile journey in SCBD.

Table 1. Respondent choice to Facilities/Pathway Conditions for Pedestrian Pathway in SCBD

No.	Aspects	Number of Respondents					
		1st choice	2nd choice	3rd choice	4th choice	5th choice	6th choice
1	Availability of Shade	30	37	30	26	27	13
3	Continuity	6	16	23	32	56	30
4	Accessibility	27	41	27	25	28	15
5	clear from street vendor	17	18	25	19	18	66
6	Connected to transit access	58	31	18	15	19	22

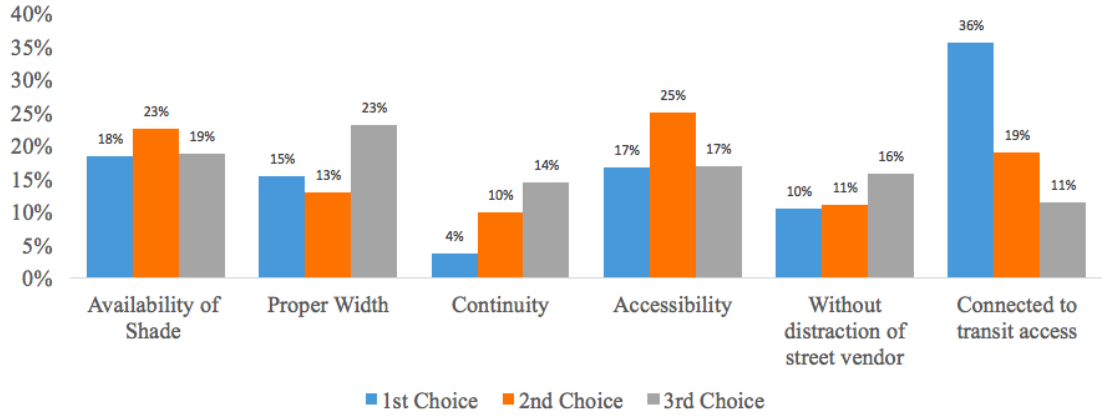

Fig. 3. Choices of Pedestrian Facilities/Conditions

2.3 Finding

Concerning the pedestrian facilities, 36% answered as the first choice is for the connection to the transit points, followed by the shadiness (18%), accessibility (17%), adequate width (15%), free from street vendor (10%) and, Continuity (4%). The fact is that in SCBD, the design is already adequate in terms of continuity, no street vendor and better accessibility to all the main buildings.

The acceptable distance for the last mile journey by foot on average is 225 meters. Although few respondents are willing to walk more than 775 meters but this is exceptional. The distance is slightly shorter than a study in China cities that shows that the pedestrian walking distance is in a range between 400-500 meters [11]. This distance of 700 meters is also important so that it can be adopted to the distance between two BRT shelters and pedestrian crossings. However, the distance of walkability can

be underestimated. It is possible to make it longer depending on the types of transit and service quality. People are willing walking longer distance for rail station compared for bus shelters [6].

It should be noted that walking velocity for Indonesian are much slower that the western norm. According HCM, the walking velocity is between 0.9 m/s and 1.1 m/s [3] compared to Indonesian walking velocity is between 1.0 m/s and 1.3 m/s [12]

3. BRT Users' Perception Regarding Shelters Facilities

3.1 Methodology

Because of the MRT construction, it is not possible to carry out survey in the BRT shelters nearby SCBD because of temporary arrangement during construction. However, the survey was carried out in other shelter (Dukuh Atas) in the same corridor that is not influence by the MRT construction. This shelter is located in the median of dual carriageway boulevard and connection to the platform from sidewalk via overpass bridge and ramps (see Fig. 5). A number of issues arise from the BRT basic design shelters. One of these issues is that the platform is too narrow to cater boarding and alighting during the peak hours and that the connection to the pedestrian pathway is through an overpass bridge (see *Fig 4*). In term of the amenities such as visual design, aesthetics, and accessibility, it is still inadequate. These are one of the factors that people are less likely to use Transjakarta. Theory of Planned Behavior (TPB) [13] has been adopted to estimate the preference and intentions of Transjakartas' user. This part of the study was also already presented by Farisi and Tjahjono [14]. The scheme of the user's preference and intentions analysis based on TPB can be seen in the *Fig 5*. Number of users who was willing to do the TPB survey was 127 respondents.

Fig. 4. Dukuh Atas BRT Shelter Connector

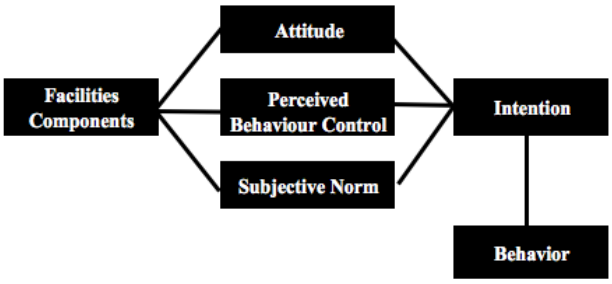

Fig. 5. TPB Scheme for Users' Preference and Intentions

3.2 Analysis

Assumption of the model is correlation among the facilities component, perception and intention is a linear function. This correlation was drawn in form of equation developed by structural equation model (SEM). In the construction of SEM, each facilities component was defined as indicators of the models. There were 22 indicators under the 4 variables i.e. Attitude (S), Subjective Norms (NS), Perceived Behaviour Control (PBC) and, Intention (I).

Indicators that used in the TPB for describing facilities components are follows:

1. Attitude variable: Shadiness (S1), Noisiness (S2), Ramp Hilliness/Gradient (S3), Cleanliness (S4), Continuity (S5);

2. Subjective Norms variable: Shadiness (NS1), Noisiness (NS2), Ramp Hilliness/Gradient (NS3), Cleanliness NS4), Continuity (NS5);
3. Perceived Behavior Control (PBC): Shadiness (PBC1), Noisiness (PBC2), Ramp Hilliness/Gradient (PBC3), Cleanliness PBC4), Continuity (PBC5), and
4. Intention variable: Availability (I1), Functionality (I2), Diversity (I3), Aesthetic (I4)

Based on 127 respondent of BRT TransJakarta with origin or destination at Dukuh Atas shelter, it can be drawn that 37% of them are routine users (more than 3 days every weekdays), and 23% of them are frequent users (3 days per week). Characteristics of the respondents can be seen in Fig 6 to Fig 9 for the reasons of using the BRT, which are perception of the facilities provided, perception for convenience and comfort, and perception of aesthetical of the facilities respectively.

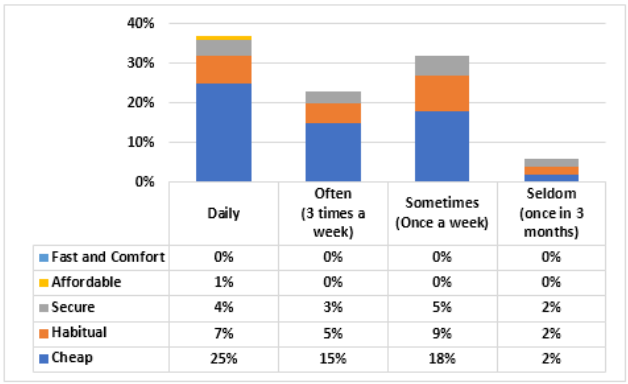

Fig. 6. Reasons for Using BRT

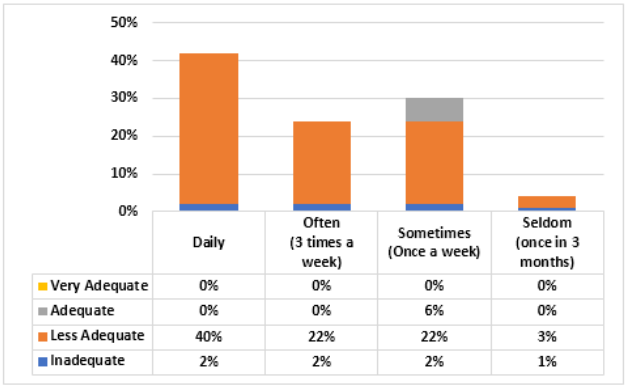

Fig. 7. Perception for Facilities Provided

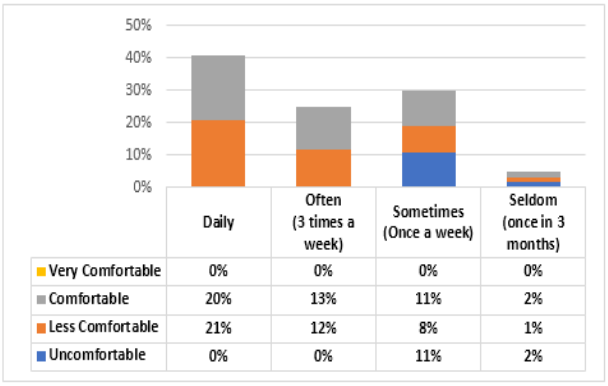

Fig. 8. Perception for Convenience and Comfort

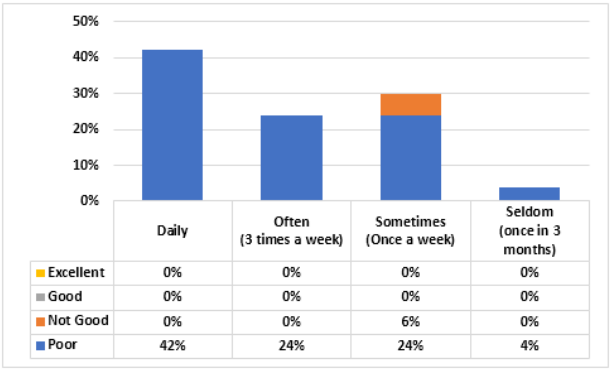

Fig. 9. Perception of aesthetical of the facilities

Assessment BRT users to various pedestrian facilities components based on scoring from the questionnaire (from 1 to 5 of liker scale) such as: Strongly disagree, Disagree, Neither agree nor disagree, Agree and Strongly agree. Results of descriptive analysis and match pair test between

components and intention is presented at Table 2. Standardized Loading Factors (SLFs) show that the most influence indicators for attention is continuity. For the subjective norm is the availability of shading; for the perceived behavior control is the availability of shading and continuity pathway, and finally, for intention is aesthetical. All of Construct Reliability (CR) values are greater than 0.7. The results suggested that the data supported the analysis of the model. Statistics test of structural causal model with significant level of 5% (t value is ± 1.96) west carried out as can be seen in Fig 10. Final results are summarized in Table 3.

Table 2. Statistical Descriptive Analysis

Perception Variables	Indicators	Average	Standard Deviation	Variables Average	SLF	CR
1. Attitude	Shadiness (S1)	57,6	20,3	60,6	0,85	0,89
	Noisiness (S2)	60,2	23,9		0,75	
	Ramp Gradient (S3)	69,5	12,4		0,83	
	Cleanliness (S4)	82,4	6,5		0,86	
	Continuity (S5)	60,7	18,4		0,87	
2. Subjective Norms	Shadiness (NS1)	59,9	19,3	61,6	0,87	0,89
	Noisiness (NS2)	57,9	22,7		0,81	
	Ramp Gradient (NS3)	77,1	11,8		0,82	
	Cleanliness (NS4)	82,8	6,2		0,53	
	Continuity (NS5)	60,8	17,4		0,85	
3. Perceived Behavior Control	Shadiness (PBC1)	58,3	20,5	59,6	0,88	0,88
	Noisiness (PBC2)	45,9	17,4		0,60	
	Ramp Gradient (PBC3)	79,9	9,6		0,83	
	Cleanliness (PBC4)	83,4	6,7		0,66	
	Continuity (PBC5)	47,3	20,4		0,88	
4. Intention	Availability (I1)	65,1	5,1	55,2	0,81	0,91
	Functionality (I2)	78,3	10,1		0,83	
	Diversity (I3)	77,2	8,9		0,83	
	Aesthetic (I4)	88,4	10,5		0,89	

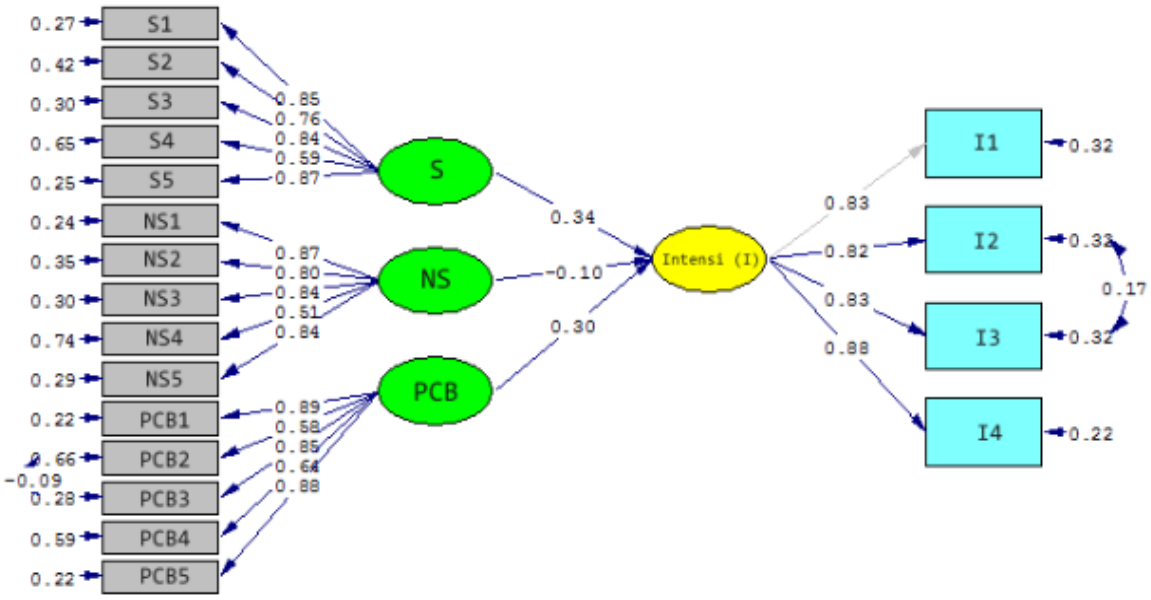

Fig. 10. Perception and Intention in Structural TPB Model (t-Value)

Table 3. TPB Model Results

Variable	Parameter	t result	t table	Remarks
Attention (S)	0.34	2.22	1.96	Significant
Subjective Norm (NS)	0.10	2.70		Significant
Perceived Control Behavior (PCB)	0.30	2.60		Significant

3.3 Findings

- The most TransJakarta's user at Dukuh Atas 1 Shelter stated that the convenience and aesthetics aspects were inadequate. However, for the comfortability aspect there were some differences among users. Some stated that was uncomfortable but the others stated otherwise. Based on that result, it shows that comfortability of the facility is varying depending on the user perspective.
- There is a difference assessment between individual perception (Attitude) and society perception (Subjective Norm) towards the indicator that can affected the assessment to amenities aspects on the pedestrian facility. For individual perception the indicator was the continuity of the pedestrian pathway, while for society perception was the availability of shade.
- Most of affected indicator of amenities aspects on pedestrian facility in term of intention and interest to use TransJakarta Bus is aesthetics aspect. The aesthetics aspect are the pedestrian facilities that can provide a wonderful atmosphere and comfortable.

4 Conclusion

Conclusion can be drawn as follows:

1. Appropriate walking distance for the last mile journey from transit modes is 225 metres for the desirable maximum and 775 meters for the absolute maximum. Within this distance people are willing to walk from the nearby transit shelters or stations. Pedestrian pathway should be installed

properly and connecting to the transit shelters or stations.

2. Preferable, the pathway should be covered at least with shady trees and should be accessible to the entire main destination in the CBD. Pedestrian pathway should have adequate width according pedestrian flows. It suggests using Highway Capacity Manual - Level of Service method to determine the adequate path width. Unfortunately, the Indonesian Highway Capacity Manual did not cover the pedestrian facilities.
3. BRT shelters should be modified to be more impressive and aesthetical aspect must be considered to attract people to use the BRT. Continuity is the most important issues from the platform to the pedestrian sidewalks.

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