

Design Analysis of an Ergonomic Handgrip Facility for Transjakarta

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Abstract

Transjakarta is one of the public transportation that is managed by the Jakarta Government as a solution to reduce congestion. To be a solution, support for aspects of the facility must be fulfilled. This will affect the level of comfort and safety of passengers. This study was conducted to evaluate and propose improvements to the handgrip facilities provided by Transjakarta, where the handgrip is a tool for passengers who do not get a seat. The result shows that 52.47% of passengers had uncomfortable while standing and holding the handgrip for long period of time. The collection of data to support this research was conducted through questionnaires, observations, and direct measurements. This study focuses on ergonomics aspect as a basis for data processing facility as proposed improvement of Transjakarta handgrip facility. The result shows the number of handgrip facilities insufficient the number of Transjakarta passengers, so that became the basis for the proposed additional amount of handgrip facilities. In addition, the proposed improvements to the high-range handgrip on women carriages based on Anthropometric data, that is the average height of Indonesian women in 2016.

Keywords

Transjakarta, Handgrip, Ergonomics, Anthropometry

1. Introduction

Jakarta as the capital of Indonesia is a city that has heavy traffic. According to Badan Pusat Statistik, the people population in Jakarta is around 9.6 million inhabitants with a population of productive age (15-64 years) is about 7 million inhabitants. The flurry of population in the productive age and the use of private transport to support their activities will affect the congestion. The use of four-wheeled private vehicles increased by 4% and for two-wheeled vehicles increased by 11% within one year (Febriani et al., 2010). It is supporting the exacerbation of the congestion that occurs in Jakarta, especially at rush hour, as the time to go to work and return to work.

The problems are faced by the capital, encourage the Governments are increasingly expanding the number of public transportation and improve the facilities of each transportation. Improving the facilities for public transportation services are intended for people to switch to using public transportation. Bus Rapid Transit (BRT) presents a significant opportunity for the public transit industry to enhance the set of transportation options that can be brought to bear on the mobility problems experienced by urban areas across the county (Polzin, Steven E., 2002). Transjakarta is one of the public transportation is managed by the Government and officially opened for the first time from February 2004. According to PT INKA for Inobus models, capacity for Transjakarta feeder models are 135 passengers supported by 40 pieces of seat and 90 pieces of handgrip.

According to the Ergonomic science is certainly not the optimal amount because it makes the passengers standing without handgrip or holding the other passenger's handgrip. Transjakarta passengers who are standing can fall easily if they are unable to grasp any handgrip when the Transjakarta might stop suddenly or starting to run. Observing standing Transjakarta passengers, it can be seen that not only their standing position but also the direction they are facing relative to the direction of travel varies between individuals (Uetake, Teruo, 2006). So that, it will impact on the safety and comfort of passengers that can cause body stress (Liliana, 2007), both for passengers who get the facility or not. In addition, based on research on the hand grip models are applied, 52.47% said that passengers are not comfortable while standing and holding on to the handgrip for too long with a complaint that is often experienced is a tingling (Frenki et al., 2011). Based on research that has been done by Frenkie (2011) about Transjakarta handgrip models, this research will discuss about the passenger data on the number of Transjakarta facilities and development the range of Transjakarta handgrip facilities.

2. Materials and Methods

Research about Transjakarta begins with observation of the facilities provided in the bus, in particular is the handgrip, which is followed by the problem statements. The focus of the issues regarding the handgrip facilities is the number and range of handgrip facilities by passengers. This is due to relate to the comfort and safety of passengers, so it is important to be noted. The collection of data to support the solution through a questionnaire distributed to respondents who use Transjakarta and direct measurements. The questionnaires are distributed to 103 respondents who use Transjakarta, which is consist of some questions, namely, about the frequency of getting the Transjakarta facilities (seat or handgrip), the things do when not get the Transjakarta facilities, and reaction to not getting Transjakarta facilities. Then the data is processed refers to the science of Ergonomics and Anthropometry data of Indonesian people in 2016 based on the literature that has been done before collecting data through journals, articles, books, and websites. Data processing and analysis is continued by making conclusions based on the problem statements and make suggestions for Transjakarta or the other public transportation to make it better.

3. Results and Discussion

The results and discussions of this research will be discussed directly by the problem statements regarding the Transjakarta.

Identification Data Interpretation and Safety Passenger Facility

Based on the results of a questionnaire which is distributed to 103 respondents who use Transjakarta, obtained data as follows:

There is 66% of respondents sometimes do not get the facilities, 23.3% do not get the facilities, and 10.7% always get the facilities when using Transjakarta. The percentage is 66% of the samples sometimes do not get the facilities, so that it becomes the focus for dealing with the safety and comfort of Transjakarta passengers. Then it will attempt repairs to the facilities provided by the number of Transjakarta today.

For passenger who could not get the seat or handgrip, there is 52.4% of respondents chose to rely on Transjakarta door, where it is at risk when the door is closed or open. A total of 25.3% of respondents chose to hold another passenger's handgrip, so this will not only pose a risk to that

passenger, but also to be a risk to other passengers who first hold on the handgrip. Then, as many as 22.3% of respondents chose to stand without holding on to anything, which would be vulnerable to the risks posed when the buses run or suddenly stop.

Furthermore, a total of 71.9% of respondents had a reaction pushed forward or back when Transjakarta start walking, running or stopped. A total of 25.2% of respondents had a reaction does not happen anything. Furthermore, there is 2.9% of respondents had a reaction down by not getting the facilities. It can be concluded from this last question, that the availability of facilities on passengers using Transjakarta important to be noted because they relate to safety.

Transjakarta Handgrip Facility Layout

Transjakarta equipped with seating facilities and a handgrip for standing passengers. The purpose of standing passengers' handgrip that can have a handle so that the factor of safety during travel can be achieved. Based on the results of the questionnaire, there are 23.3% of respondents always never get handgrip and 66% of respondents sometimes get a handgrip. From these percentages indicate that during a busy time, the facilities provided at the Transjakarta have not been able to accommodate passengers who ride at that time. So it takes the addition of facilities and the improvement of the distance between the handgrip with one another.

In the layout used by Transjakarta currently has a number of facilities ie, 21 pieces of seat in the woman carriage, 19 pieces of seat in male carriage, 56 pieces of handgrip in woman carriage, and 34 pieces of handgrip in male carriage. So that the number of facilities on Transjakarta with two carriages are 130 pieces. With a capacity that is determined by Transjakarta, ie 135 passengers, the number of such facilities is certainly not adequate for the maximum busy times. Which at that time often passengers who used the Transjakarta exceeds the specified capacity, with the number of passengers who do not get the handgrip facilities while standing. So that, the increase the number of facilities and improvement of handgrip facility layout adjust the capacity specified by Transjakarta. Layout improvements and additions the handgrip facilities proposed by applying the principles of Ergonomics, ie the Indonesian Anthropometry data society and the factor of safety of passengers, is as follows:

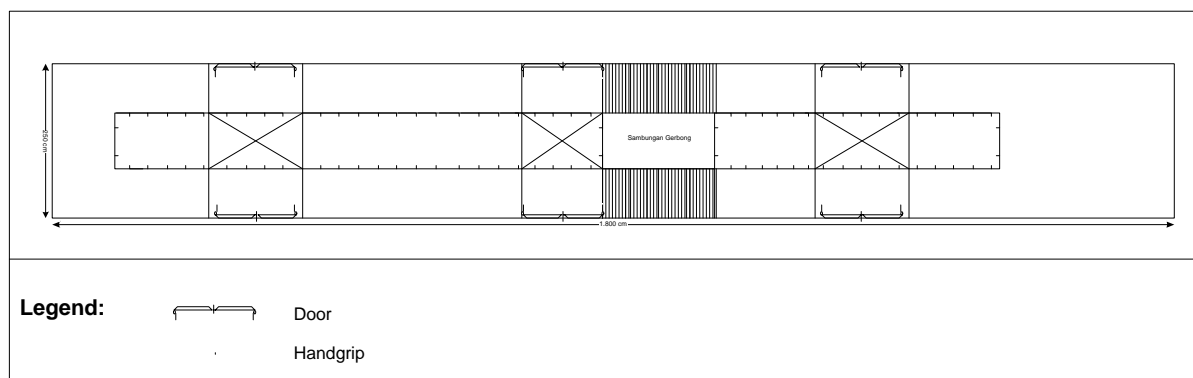


Figure 1. The Proposed Addition the Transjakarta Handgrip Facility

Proposed Improvements the Transjakarta Handgrip Facility

Transjakarta handgrip on the area near the door has a high dimension of the bus floor is 180 cm. The application of the science of Ergonomics applied to products used by humans to support activities that provide a sense of comfort, health, and safety. Design and manufacture of

products intended for humans, should refer to the Anthropometry data, in these cases the data used is Indonesian Anthropometry data. The dimensional range of floor to Transjakarta handgrip on both carriages have same dimension, it is an issue. Here is a picture of the condition of the Transjakarta handgrip facilities in women carriage:



Figure 2. Transjakarta Handgrip Facility Condition in Women Carriage

Based on the picture above shows that the handgrip on Transjakarta facilities in the carriage of the women had paid little attention to Ergonomics factors. Average height (D1) Indonesian women based on Indonesian Anthropometry data was 153.62 cm. The high range Transjakarta handgrip on both carriages are same, suggesting that Ergonomic factor in the women carriage has not been achieved, causing discomfort when the condition of the hands as shown in Figure 2. According to research conducted by Frenki (2011), the condition of the current Transjakarta handgrip facilities when used in the long term will lead to health problems, such as numbness. Therefore, there needs to be an improvement over the Transjakarta handgrip facilities on women carriage, especially in the area near the door. The proposed improvement is to decrease the high-range of the Transjakarta handgrip on women carriage, where the dimensions of the handgrip decrease is 2.31 cm. The decline in high-range of handgrip is done by extending the dimensions of the link between the handrail with a handgrip body. The improvement of Transjakarta handgrip dimensions using a reference from the science of Ergonomics and anthropometry. The revelation of the handgrip range, will increase passenger comfort and reduce the risk of accidents or injuries while in the Transjakarta. As for the improvement of Transjakarta handgrip on the women carriage that apply Ergonomic are as follows:

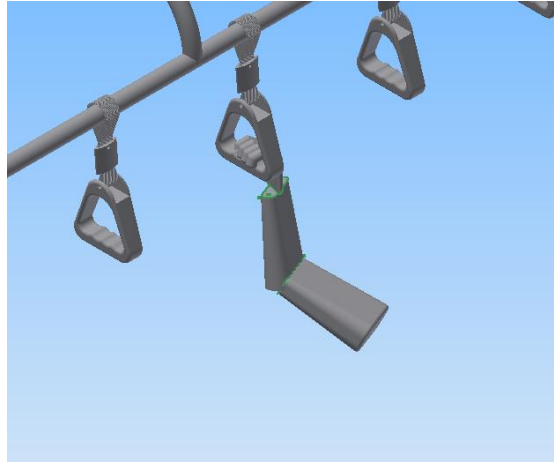


Figure 3. The Proposed Improvements of Transjakarta Handgrip on Woman Carriage

The proposed improvements above refers to the science of Ergonomics, that the work done should be close to the body, if it is too far it will cause tension in the arms. Then, avoid reaching too far and the most important is the movement of the operation must be within approximately 50 cm upwards or downwards. Therefore, the proposed improvements to the handgrip facilities made as Figure 3 with the aforementioned considerations.

4. Conclusion

Based on the results of data processing and discussion of results, some conclusions obtained in this study, namely the average Transjakarta passengers who used to support the activities during rush hour (7:00 to 10:00 or 16:00 to 20:00) sometimes do not get facilities such as seat or handgrip, with a percentage of 66%. Therefore, it takes a handgrip facility addition of at least five to meet the specified capacity. Then, to provide solutions to the grievances felt in the hands of passengers, the high-range of the handgrip decrease in women carriage, as many as 2.31 cm.

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Biographies

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