Ergonomy of Bus Entry-Exit Access for Elderly Hajj Pilgrims in Surabaya Embarkation Group 2023

Naufal Rabbani* **and Tias Pramesti Griana**

Fakultas Kedokteran dan Ilmu Kesehatan, Universitas Islam Negeri Maulana Malik Ibrahim, Malang

* Correspondence: naufalr98@gmail.com
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Abstract The implementation of hajj pilgrimage in 1444 H/2023 AD in Indonesia was quite unique, the Ministry of Religion Affairs echoed message "Fairness and Friendly for Elderly Hajj". In line with the message, everything in organizing this hajj needs to be adapted with anatomy and physiological abilities of the elderly. In this study, we observe the specifications of 4 buses specifically to transport elderly hajj pilgrims who at risk of falls and disable from Surabaya Embarkation Hajj Dormitory to Juanda Embarkation Airport. Direct observation and measurement for aspects of door height, door width, step height, ramp height, ramp inclined length, stanchion height, stanchion length, handrail height, handrail length. The observation results show that in general entry and exit access for passengers the four buses do not meet the specification criteria for creating ergonomics for elderly Hajj pilgrims.

Keywords Hajj pilgrims; Elderly; Buses; Ergonomy

1. Introduction

The Hajj pilgrimage is the fifth pillar of Islam that must be carried out by Muslims who are intelligent, mature and istithaah (capable), at least once in their lifetime. The implementation of the Hajj pilgrimage in Indonesia is facilitated by the Ministry of Religion Affairs as the responsible institution through the General Directorate of Hajj and Umrah (1). The process of departing for Hajj pilgrims begins with the journey from home to the Hajj embarkation dormitory in Surabaya to obtain some services such as customs, immigration, quarantine, health, security, transportation and city check-in services with the relevant agencies (2). The next stage of departure is to Juanda embarkation airport. Where the pilgrims will board to the bus that has been provided by the ministry of religion in an orderly manner

according to the division of teams and groups, before finally boarding the plane to Saudi Arabia (3).

In 2023, the Ministry of Religion Affairs prioritized departure quotas based on oldest age in each province, after the age restrictions on Hajj pilgrims were lifted due to COVID-19(4). So, the implementation of the Hajj pilgrimage in 2023 is entitled "Fairness and Elderly Friendly Hajj". The increasing number of elderly Hajj pilgrims in 2023 of course become a challenge in itself, especially regarding mobility going on and off the buses. Considering that naturally, the elderly will experience decline in body function as a result of accumulated damage at the molecular and cellular level over a long period of time or what is also known as aging (5). Osteoporosis and sarcopenia are major musculoskeletal problems in older people and are often accompanied by weakness (6). This condition will also affect quality of life, function and independency (7).

2. Methods

The aim of this study is to evaluate Ergonomy of bus access for Elderly Hajj Pilgrims in Surabaya Embarkation Group 2023. This study was performed by direct observation and measurement of 4 buses that would be used to mobilize elderly Hajj pilgrims from the Surabaya Embarkation Hajj Dormitory to Juanda Embarkation Airport. Measurements are made using a measuring tape. The variables measured including:

- Door height
- Door width
- Step height
- Ramp height
- Ramp inclined length
- Stanchion height
- Stanchion length
- Handrail height
- Handrail length

Ratio data is obtained from observation and measurement, where from this data a descriptive interpretation will be drawn in two categories "Suitable" and "Not suitable" with the bus specification guidelines based on anthropometric measurements of the elderly and disabled (8). Before data collection was carried out, mediation was first carried out and permission was requested from the crew of the bus. The author will also provide an explanation before data collection is carried out.

3. Results

General Information about Sample

Figure 1. Exterior of 4 buses that would be used to mobilize elderly Hajj pilgrims from the Surabaya Embarkation Hajj Dormitory to Juanda Embarkation Airport. a) is appearance of bus A, b) is appearance of bus B. c) is appearance of bus C. d) is appearance of bus D. (Resources: personal documentation of author, 2023)

From the Picture 1. shows that all of 4 buses are categorized as big buses (9) with high-deck body type, because the passengers' position is over the luggage space. This bus body type caused the passengers position will higher than ground level. Suspension type that used in this bus is leaf springs, which this type of suspension couldn't provide maximum comfort for the passengers, and also couldn't adjust the height of bus body over the ground level (10).

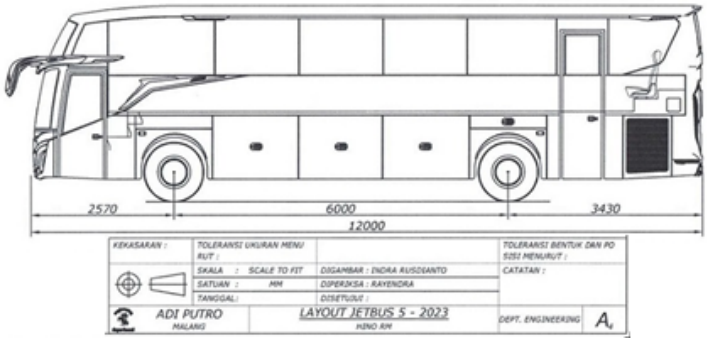

Figure 2. Sketch of the Structure of a Big Bus with a High Deck. The passenger position (red circle) inside the cabin is higher than ground level. (Resource: E-catalogue Layout Jetbus 5 2023)

Measurement and Intrepretation of Variables. The measurements on the four buses obtained the results as in the following Table 1.

Table 1. Measurement of Entry and Exit Access Variables for Bus Cars

	Bus A (cm)	Bus B (cm)	Bus C (cm)	Bus D (cm)
Door Height	221	178	177	180
Door Width	86,5	75,0	76,0	81,0
Step Height	23,0	25,0	26,0	23,0
Ramp Height	-	-	-	-

Ramp Inclined Length	-	-	-	-
Stanchion Height	91,0	124	121	-
Stanchion Length	5,00	5,00	5,00	-
Handrail Height	100	99,0	104	103
Handrail Length	67,0	67,0	67,0	67,0

Resource: Processed primary data, 2023

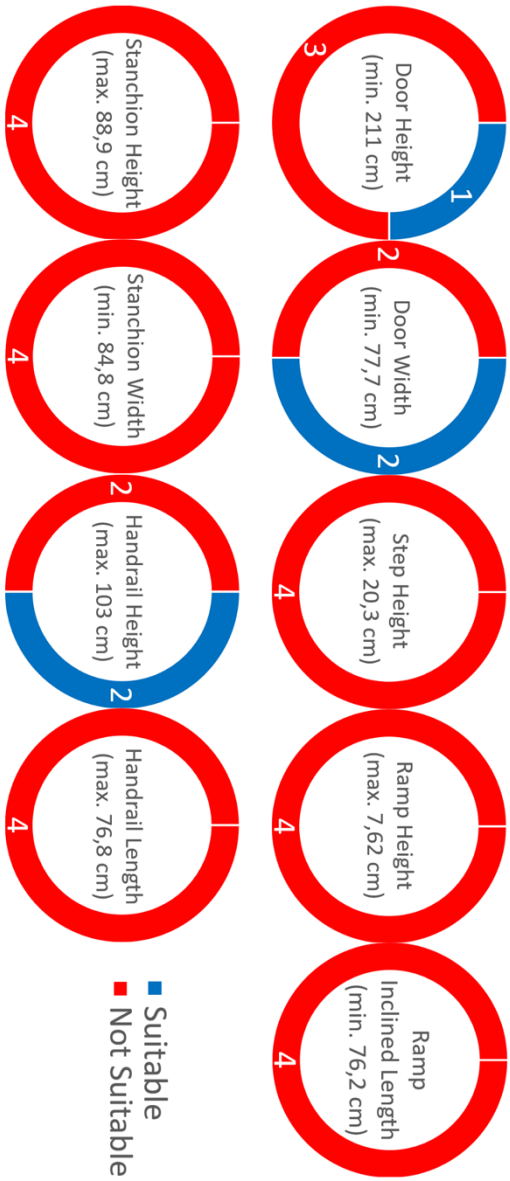

Figure 3. Interpretation of Bus Measurement Results According to Bus Specification Guidelines Based on Anthropometric Measurements. (Resource: Processed primary data, 2023)

Based on Table 1 and Figure 3, it can be seen that the specifications for entry and exit access for the four buses tend not to comply with the proposed standard specifications. Suitability can only be found in terms of door height (bus A), door width (bus A and bus D), height of handrails (bus A and bus B).

4. Discussion

Bus door height is a standard measure of the vertical clearance for passenger access. This size at least involves the components of the average maximum passenger height, step height, and ramp height, so that it does not pose a risk of hitting the head for passengers with a minimum size of 83 inches (211 cm) (8). Meanwhile, the width of bus doors is generally determined based on the widest lateral distance from the passenger (shoulder width or hip width) with additional distance on both sides for allowance. In order to create a bus that is able to accommodate passengers with disabilities, the width of the bus door must be able to be passed by a wheelchair with a minimum size of 30.5 inches (77.7 cm) (8). Step height is based on the passenger's stepping ability. For the elderly and disabled, the step height that can be tolerated with the help of handrails is less than 20 cm (11).

Figure 4. The Process of Elderly Hajj Pilgrims Entering the Bus. It seems that the Hajj pilgrims need help from 3 people around them. (Resources: personal documentation of author, 2023)

The length of the inclined plane and the height of the ramp in the bus are influenced by the height of the type of passenger deck used (12). The proposed minimum length of ramp is 30 inches (76.2 cm) and the proposed height of ramp is not more than 3 inches (7.62 cm) (8), so that with the Pythagorean theorem a maximum tilt angle of 5.7° is gained. Access routes in the form of ramps or lifts are more recommended than stairs because they can accommodate passengers in wheelchairs and reduce the risk of falls in the elderly. On the buses used for elderly Hajj pilgrims, the access route used is in the form of stairs.

Figure 5. The Access Route is in the Form of Stairs within the buses. (Resources: personal documentation of author, 2023)

The Stanchion has the function of supporting the stability of passengers when standing in the bus. Proposed height of Stanchion (8) based on the passenger's average shoulder height when seated and seat height with a maximum total of 35 inches (88.9 cm). Meanwhile, the proposed length of the Stanchion is based on the width of two seats with a minimum total of 33.4 inches (84.8 cm). Of the four buses observed, one of them did not have a Stanchion and the remaining three had Stanchions but did not meet the proposed standards.

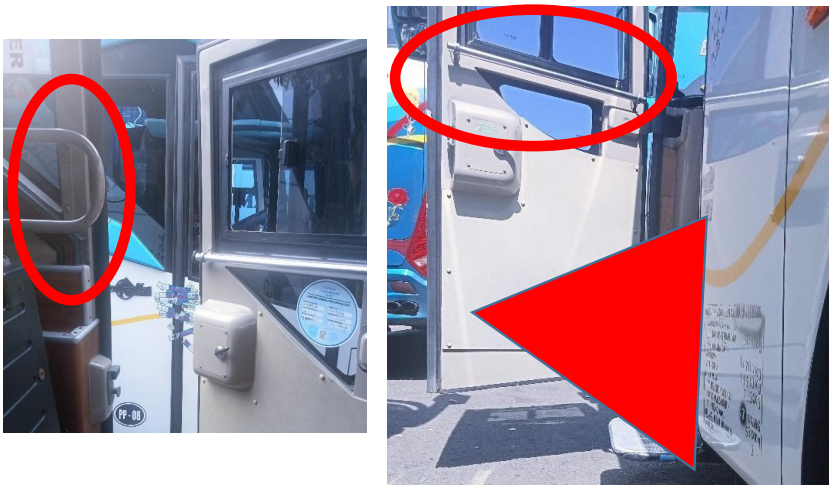

Figure 6. View of a stanchion in the bus (left [red circle]) and Handrail on the Bus (right), it appears that the handrail (red circle) is not in the same direction as the stair pathway (arrow). (Resources: personal documentation of author, 2023)

Handrails are the main aids to support the ability to stepping for the elderly and disabled (13). The proposed handrail height (8) for easy access by passengers is 40.5 inches (103 cm) and the handrail is 30 inches (76.2 cm) long. The placement and position of the handrails also need to be considered. Placing the handrail on the door leaf can cause instability. The position of the handrail needs to be parallel to the direction of the descending/uphill route travelled by passengers.

5. Conclusion

Through observations and reviews carried out in this research, it can be concluded that the entry and exit access of buses that have been provided to transport elderly and disabled Hajj pilgrims from the Surabaya Embarkation Hajj Dormitory to Juanda Embarkation Airport in general still does not comply the bus specification criteria according to the anthropometry of the elderly and disabilities. This condition will of course lead to poor ergonomics which will lead to safety risks and low

independence for elderly Hajj pilgrims. Even though the level of independence of the Hajj pilgrims is very necessary, considering the policy of the Hajj pilgrimage in 1444 H/2023 AD which is priority according to oldest age, in the absence of the younger companion from the family. Apart from that, safety is not something that can be compromised for any reason, including ignorance and negligence.

Figure 7. A Hajj Pilgrim Using a Wheelchair is "Forced" to Stand and Walk to enter the Bus. (Resources: personal documentation of author, 2023)

Considering the conditions encountered in this research, the author provides several recommendations for related parties:

1. Determine the criteria for buses that can be used during the process of organizing the Hajj pilgrimage, both in Indonesia and in the Kingdom of Saudi Arabia
2. Carry out systematic supervision regarding the implementation of provisions related to the criteria for buses starting from the regional level up to within the Kingdom of Saudi Arabia
3. Conduct systematic evaluations to improve the quality of comfort, safety and health of Hajj pilgrims

Figure 8. The Hajj pilgrims are Carried Out of the Buses. (Resources: personal documentation of author, 2023)

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