E-ISSN: 2962-6110
P-ISSN: 2964-7843
JSRET
jsret.knpub.com
Journal of Scientific Research, Education, and Technology

Ergonomic Evaluation in Public Transport Particularly in Public Transportation with an Anthropometric Approach in Tegal City

Nazwa Febryana Putri, Dani Fitria brilianti
Politeknik Keselamatan Transportasi Jalan, Tegal, Indonesia

ABSTRACT

Public transportation plays an important role in facilitating portability, especially in urban areas. In Tegal City, public transportation is an important mode of transportation for its citizens. However, ergonomic assessments of public transport vehicles are often neglected, resulting in potential discomfort and welfare issues for passengers and drivers. This research evaluates the ergonomic design of public transportation using an anthropometric approach to adapt vehicle dimensions to the user's physical needs, such as seating, legroom and accessibility. The results of the analysis provide recommendations for improvements, including increased ventilation, seat adjustments and safety features, to create a more comfortable and safer transportation system. By collecting and analyzing anthropometric information from agent testing results on clients in Tegal City, this research asks questions to identify the imbalance between the physical size of public transportation and the needs of its users. It is hoped that these findings will suggest changes to the plan that increase comfort, reduce fatigue, and improve general well-being. It will also contribute to a broader understanding of how ergonomic standards can be linked to open transport frameworks to improve client experience and safety.

Keywords: *Ergonomics, Public Transport, Angkot, Anthropometry, Tegal City, Human Factors, Vehicle Design, Comfort, Safety, User Experience*

Corresponding author
Name: Nazwa Febryana Putri
Email: nazwafebryana04@gmail.com

INTRODUCTION

Transportation is a means of moving people or goods from one place to another. The aim is to help people or groups of people reach various desired places, or send goods from their place of origin to their destination. The process can be carried out using transportation facilities in the form of vehicles or without vehicles (transported by people). Public transportation is passenger transportation carried out using a rental or pay system. Included in the definition of public passenger transportation are city transportation (buses, minibuses, etc.), trains, water transportation and air transportation.(Angger, 2015)

(PP RI NO 41, 1993) Transportation is the transfer of people and/or goods from one place to another using a vehicle. Meanwhile, public transportation is any motorized vehicle that is provided for use by the public for a fee. Transportation of people by public transportation is carried out using buses or passenger cars served on fixed or regular routes and not on routes. Ergonomics in public transportation, especially public transportation, plays an important role in ensuring passenger comfort and safety. Ergonomic public transportation design can reduce the risk of injury, increase passenger satisfaction, and support operational efficiency. However, the reality on the ground often shows that there is a mismatch between existing designs and user ergonomic needs.

In many cities in Indonesia, public transportation conditions are often far from ideal, such as unergonomic seats, limited legroom, suboptimal handrails and poor accessibility. Under ideal conditions, public transportation should be designed taking into account passenger anthropometric data, which includes human body dimensions such as height, weight, leg length and shoulder width.

There are factors that contribute to the gap between ideal and existing conditions in public transportation design, including lack of anthropometric data, costs and economic priorities, lack of regulations and standards, and lack of awareness and knowledge. This gap creates various negative impacts for passengers, such as reduced passenger comfort, increased health risks, and decreased operational efficiency.

Therefore, there is a need for ergonomic evaluation in public transportation, especially public transportation, which is an important aspect that is often overlooked in planning and managing transportation systems. An anthropometric approach, which focuses on the size and proportions of the human body, offers an effective method for improving comfort, safety and efficiency in public transport. In the context of public transportation, an anthropometric approach is used to assess whether the size and design of seats, legroom and handrails suit the varying anthropometric profiles of passengers.

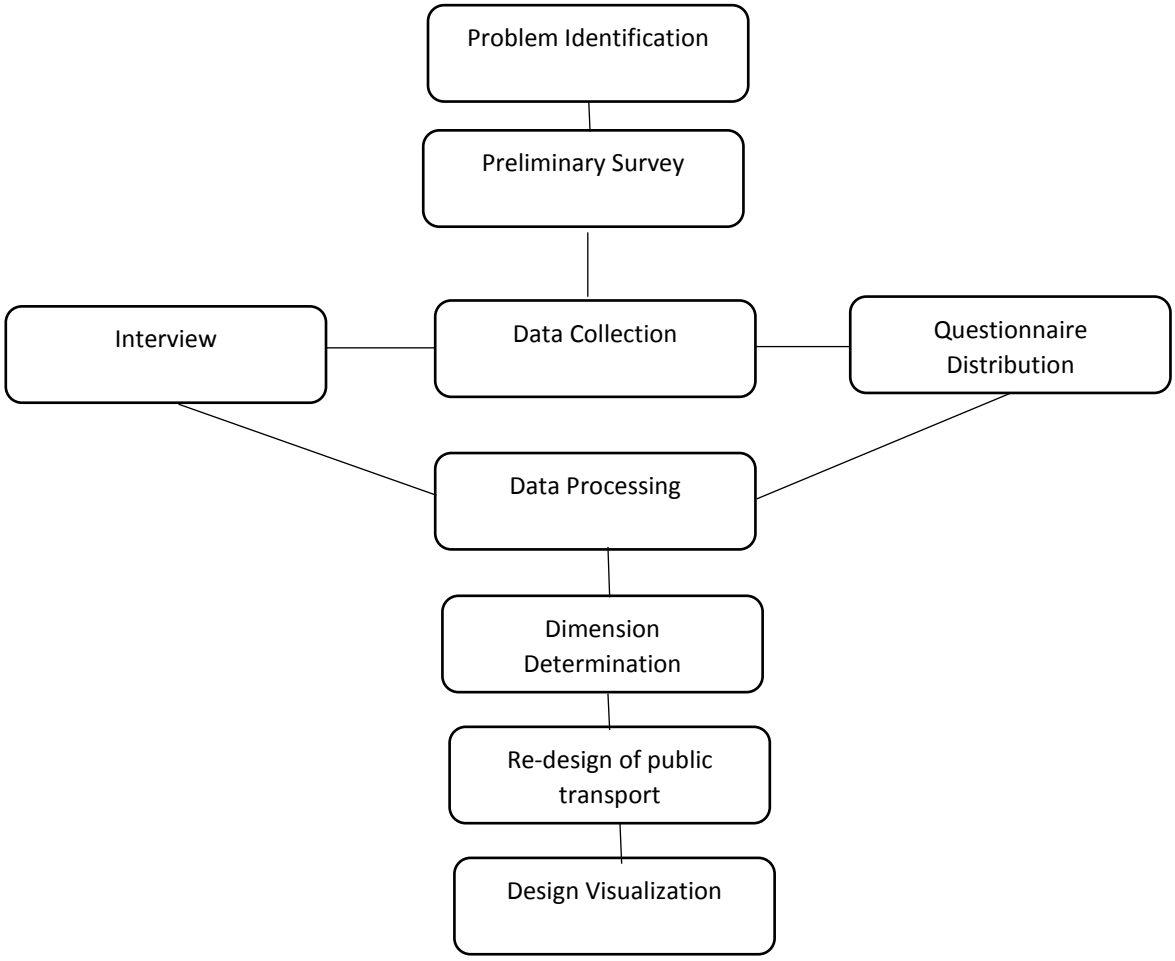
According to TEHF (Technical Committee on Transportation Ergonomics and Human Factors), which is part of the International Ergonomics Association (IEA), ergonomic design is the key to improving transportation systems. Recent research has provided a deeper understanding of various aspects of ergonomics in transportation, highlighting the importance of paying attention to driver comfort and well-being.

(Kotler and Keller, 2007) who state that: Satisfaction is a person's feeling of joy or disappointment that arises after comparing the performance or results of the product they are thinking about with the expected performance or results. Therefore, customer satisfaction is a person's feeling of happiness or disappointment that arises after comparing his perception/impression of the performance of a product and his expectations.

METHOD

In this research, a survey was conducted and used data collection in the form of primary data originating from field surveys, online questionnaires, interviews and other supporting data. In this research, the data collection technique

used is by reviewing and measuring public transportation and distributing questionnaires to the community, especially public transportation users. The data analysis techniques that have been used are quantitative and qualitative data analysis techniques, which explain and analyze the data by calculating the scores for the questions from the questionnaire given. The following are the steps.



FINDING AND DISCUSSION

In this chapter, data collection and processing will be presented. The data collected is data regarding the results of surveys and questionnaires for public transport users.

A. Interview and Observation Results

Based on field surveys, questionnaires and interview surveys, the weaknesses and shortcomings of existing public transportation can be identified. We conducted the survey for approximately one hour and distributed the questionnaire in the attachment. However, even though angkot public transportation has economic value compared to other forms of transportation, there are still many disadvantages to angkot public

transportation. Based on the results of the questionnaire that was distributed, there are still many transportation users who complain about the comfort and safety of this public transportation. These shortcomings are the condition of the transport doors which are less ergonomic for transport users, the location of the seats which are less ergonomic, the condition of the transport lacking air or ventilation when the transport is full, and the cleanliness of the transport.

Diagram 1 : Results of the level of comfort in transportation

This diagram describes the level of user comfort when riding public transportation which is grouped into three categories, namely very comfortable, quite comfortable and not comfortable.

The diagram results show that the majority of respondents feel quite comfortable taking public transportation. This shows that users still get an adequate travel experience, although there are several aspects that can be improved, such as vehicle cleanliness or seat availability during peak hours.

While the percentage of respondents who felt very comfortable was relatively smaller, this shows that there are opportunities for improvement in the public transportation service sector. The number of respondents who felt uncomfortable was also not significant, meaning that public transportation is still a suitable mode of transportation for daily use. This diagram provides important insights for efforts to improve the comfort of public transportation to meet user expectations.

Diagram 2: Results of the level of safety in transportation

The diagram illustrates the level of safety perceived by angkot users, divided into three categories: very safe, fairly safe, and unsafe.

The results reveal that the majority of respondents feel fairly safe while using angkot. This indicates that users generally trust the safety of angkot services, though there are areas where improvements could be made, such as traffic management, vehicle maintenance, or driver discipline.

The percentage of respondents who feel very safe is smaller, suggesting that some users might have reservations about certain safety aspects. On the other hand, the proportion of respondents who feel unsafe is minimal, showing that angkot is still perceived as a reasonably secure mode of transportation for daily use. This diagram highlights the importance of addressing safety concerns to increase users' confidence in the service.

B. Respondent's Complaint

Respondents were obtained based on direct interviews and also distributing questionnaires to users and non-users of public transportation. Based on interviews and questionnaires, complaints were found regarding public transportation.

No	Respondents' Complaints
1.	Cleanliness in public transportation
2.	Capacity of angkot space
3.	Safety in public transportation
4.	Lack of space for the placement of goods
5.	Seat and air vent conditions
6.	Seat arrangement
7.	Compliance of angkot drivers to traffic

C. Respondent's Needs (Voice of Customer)

Voice of Customer or user needs for the product are obtained by detailing the results of interviews and questionnaire results regarding respondents' complaints and additional features that respondents would like. The raw data from interviews and questionnaires is then processed again and will produce the Voice of Customer. This data from Voice of Customer will later be used as a basis for determining the level of importance, level of assessment and level of expectations of respondents regarding the proposed redesign of public transportation.

No	***Voice of Customer*** **from public transportation**
1.	For security factors, public transportation is given CCTV
2.	Give space to put passengers' luggage
3.	Limiting passenger quotas
4.	Cleanliness of the interior of the vehicle
5.	Supplied with Air Conditioning
6.	Improve public transportation interior facilities such as comfortable seats, sufficient lighting, and good air ventilation.
7.	Feasibility of a transport car
8.	Angkot drivers obey traffic rules
9.	Seat arrangement
10.	Improvements to additional seats in the middle of the angkot which, because it is difficult to access out of the angkot
11.	Air vents in hard-to-open windows

D. Data Management

INFORMATION	**SIZE**
Door Height	140 cm
Door Width	70 cm
Stairs from the ground	67 cm
Stairs to public transportation	29 cm
Ladder width	68 cm
Seat width	28 cm
Width of the seat near the door	147 cm
Width of the front door center seat	54 cm
Height of the front door center seat	24 cm
Inner angkot width	142 cm

Seat spacing	**SIZE**
Side	50 cm
Back	60 cm
Front	65 cm

Window width	SIZE
Side	30 cm
Front	130 cm
Back	123 cm
Distance between windows	7 cm

E. Determination of Dimension of Public Transportation Design for Public Transportation

The determination of the dimensions of public transportation design, especially city transportation, involves several important aspects that must be considered to ensure safety, comfort, and operational efficiency. The following are some factors that are usually considered in determining the dimensions of the design:

1. Passenger Capacity

The number of passengers that can be transported safely and comfortably. Space to sit and stand for passengers. The average passenger capacity on public transportation is 10-12 passengers.

2. External Dimensions

The length, width, and height of the vehicle. The wheelbase and overhang distance. The following are the average external dimensions on public transportation, namely:

a. Length : 3.5 – 4.5 m
b. Width : 1.5 – 1.7 m
c. Height : 1.6 – 1.8 m

3. Internal Dimensions

Passenger cabin space: ceiling height, cabin width, cabin height, Cabin length, legroom, seat width, door access. Seat layout and space to move around in the vehicle. The following are the average internal dimensions of public transportation, namely:

a) Ceiling height, at least 1.5 – 1.8 m so that the passenger's head is not formed and attached to the ceiling height of the angkot.
b) The width of the cabin, about 1.4 – 1.6 m wide of this cabin should be enough to accommodate 2 rows of seats on the side with enough aisle space in the middle.
c) The cabin height, about 1.2 – 1.5 m this height should be sufficient to allow passengers to sit comfortably.
d) The length of the cabin, about 2 – 3 m in length determines the number of seats that can be installed.
    i. Space for legs, about 30 – 40 cm.
    ii. The width of the seat, about 40 – 45 cm/wide seat, is enough for passenger comfort, especially on longer trips.
    iii. Door access, door width is about 60 – 70 cm; The door height is about 1.2 – 1.5 m, this size ensures that passengers can get on and off easily and safely.

4. Accessibility
    a. The number and
    b. Entrance and exit positions.
    c. He floor height from the ground to make it easier for passengers to get on and off. Ease of access for passengers with disabilities.
5. Safety

Safety features such as seat belts, handrails, and secure seats. Strong frame and body structure to protect passengers in accidents.

6. Comfort
    a. The window that can be opened is closed.
    b. Sound cancellation to reduce noise in the cabin.
    c. Comfortable seats and adequate space to move around.
7. Regulations and Standards

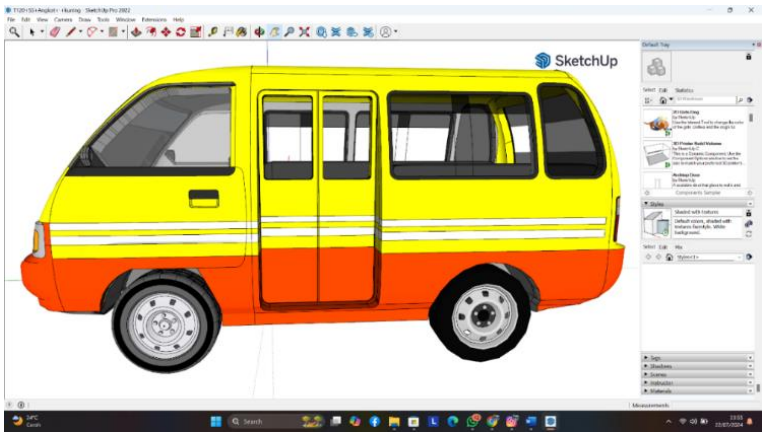
City transportation regulations and standards vary depending on the country and region, but there are some general guidelines that are typically applied to ensure safety, comfort, and operational efficiency.

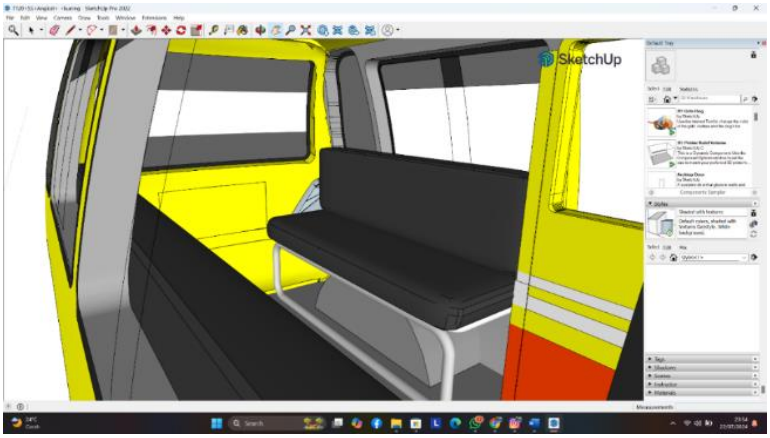
8. Fuel Consumption

The average fuel consumption on public transportation is around 6-9 km per liter.

F. Visualization of Public Transportation Design of Angkot

The visualization of ergonomic angkot designs in accordance with the expectations of the community aims to provide a design regarding the design of angkot that is in accordance with ergonomic criteria.





DISCUSSION

The findings from this study on ergonomic evaluation in public transportation in Tegal City reveal critical insights into the current state of *angkot* and its impact on passenger comfort and safety. Public transportation is a vital component of urban mobility, yet this study highlights several areas where *angkot* falls short of meeting users' expectations. While many respondents reported feeling moderately comfortable, the lack of ergonomic considerations in design has led to persistent issues. Limited seat dimensions, insufficient legroom, and poor air ventilation were frequently mentioned as key factors contributing to discomfort, particularly during crowded conditions. Moreover, the cleanliness of the interior was a recurring concern, with many respondents emphasizing the need for better hygiene to ensure a more pleasant travel experience.

Safety was another area of concern, with most respondents describing their experience as only moderately safe. Driver behavior, including a lack of discipline in adhering to traffic regulations, emerged as a significant issue affecting passengers' sense of security. Additionally, the physical condition of the vehicles was often found to be suboptimal, with malfunctioning doors and windows, as well as a lack of basic safety features such as CCTV and seat belts. These shortcomings highlight a gap between the

current design of *angkot* and the necessary standards to ensure passenger safety and trust.

Anthropometric analysis further revealed a mismatch between the physical dimensions of *angkot* and the ergonomic needs of its users. For example, the dimensions of doors and seats often fail to accommodate passengers' physical requirements, particularly for elderly individuals or those with disabilities. This discrepancy underscores the need for a more inclusive design approach that prioritizes user-centered improvements. The lack of storage space for passengers' belongings further limits the functionality of *angkot* as a reliable mode of transportation.

The study recommends redesigning *angkot* to better align with ergonomic principles. Proposed improvements include adjusting seat dimensions, increasing legroom, enhancing air ventilation, and incorporating features such as luggage compartments and surveillance systems. Additionally, greater emphasis on driver training and compliance with traffic regulations is essential to improve overall safety and reliability. Implementing these changes would not only enhance passenger comfort and reduce fatigue but also build public trust in the *angkot* system.

Overall, this study demonstrates the importance of integrating ergonomic considerations into public transportation design. By addressing both comfort and safety concerns, the findings contribute to the broader goal of creating a more efficient and user-friendly transportation system in Tegal City. These improvements are not merely practical adjustments but also steps toward fostering a culture of accessibility, inclusivity, and sustainability in urban transportation.

CONCLUSION

This study demonstrates that the design of public minivans (angkots) in Tegal City requires significant improvements to meet comfort and safety standards. Based on surveys and anthropometric analysis, it was found that limited seat dimensions and legroom reduce passenger comfort. Furthermore, safety issues, such as driver non-compliance and a lack of surveillance features, need to be addressed. It is recommended that the seat dimensions and overall vehicle layout be adjusted to ergonomic standards, and safety features such as CCTV and improved ventilation be implemented. These changes are expected to enhance comfort, safety, and the public's trust in public transportation.

REFERENCES

Angger, W. P. (2015). Problematika Pelayanan Umum. *Efikasi Diri Dan Pemahaman Konsep IPA Dengan Hasil Belajar Ilmu Pengetahuan Alam Siswa Sekolah Dasar Negeri Kota Bengkulu*, *6*.

Darmawan, R., Andari, T. T., & Silaningsih, E. (2022). Kualitas Pelayanan Angkutan Kota (Angkot) Berbasis Standar Pelayanan Minimal (SPM) Terhadap Kepuasan Penumpang Pada Wilayah Kota Bogor. *Karimah Tauhid*, *1*(5), 561–579.

Hanafie, A., Abbas, H., Samang, L., & Hamid, S. (2015). Kajian Utilitas Kendaraan Angkutan

Kota Yang Bernilai Ergonomi Dengan Pendekatan Antropometri. *Ilmu Teknik*, *10*(19), 1325–1330. https://osf.io/preprints/inarxiv/2xthq

Hanafie, A., Abbas, H., Samang Lawalenna, & Hamid, S. (2015). a Study of Ergonomic City Transport Utilities By Anthropometric Approach. In *The 1st International Conference on Civil Engineering and Infrastructure (ICCEI)* (pp. 97–101). https://doi.org/10.31227/osf.io/rh3n2

Hörcher, D., & Tirachini, A. (2021). A review of public transport economics. *Economics of Transportation*, *25*(January). https://doi.org/10.1016/j.ecotra.2021.100196

Márquez, M. A., & Garcia, J. M. (2006). Ergonomics of urban public passangers transportation. *9th Annual Applied Ergonomics Conference 2006, Conference Proceedings*, *2006*(September).

PP RI NO 41. (1993). Peraturan Pemerintah (PP) Republik Indonesa Nomor 41 Tahun 1993 Tentang Angkutan Jalan. *Peraturan Pemerintah Republik Indonesa Nomor 26 Tahun 1985 Tentang Jalan*, *2016*(1), 1–56. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwjWxrKeif7eAhVYfysKHcHWAOwQFjAAegQICRAC&url=https%3A%2F%2Fwww.ojk.go.id%2Fid%2Fkanal%2Fpasar-modal%2Fregulasi%2Fundang-undang%2FDocuments%2FPages%2Fundang-undang-nomo

Wakari, V. V., Rogi, O. H. A., & Makarau, V. H. (2019). Daya Dukung Layanan Angkot Berdasarkan Jarak Jangkauan Masyarakat Terhadap Jalur Trayek Di Kota Manado. *Jurnal Spasial*, *6*(3), 554–560.

Wulandari, S. A., & Widiyastuti, D. (2016). Persepsi Penumpang terhadap Kenyamanan dan Keamanan Angkutan Umum di Kota Pekanbaru. *Jurnal Bumi Indonesia*, *5*(3), 1–9.

Kotler, P., & Keller, K. L. (2007). *Manajemen Pemasaran.* Jakarta: Jakarta Indeks. Jilid 1. 444 halaman.