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Optimizing Bus Stop Accessibility for People with Disabilities in Makassar through Kansei Engineering

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Abstract
This research aims to design a Transmaminasa bus stop design that is friendly to people with disabilities in Makassar City using the Kansei Engineering approach, in order to increase accessibility and user comfort. Bus stops designed with these needs in mind can increase user satisfaction and comfort, as well as encourage increased use of public transportation. Disability-friendly design includes easy access for wheelchair users, clear visual and auditory information, and facilities that support the mobility of all users. The research sample consisted of 96 people with disabilities and 100 Trans Mamminasata bus users who were randomly selected. Data Collected through a Semantic Differential questionnaire that allows evaluating user preferences and perceptions of various bus stop design attributes. Factor analysis was used to identify important attributes in the desired bus stop design. Factor analysis showed that the desired design included modern, disability-friendly, comfortable and integrated attributes. The validity and reliability of the measurement instruments were tested using Pearson correlation and Cronbach's Alpha, indicating valid and reliable data. This research makes a significant contribution to designing bus stops that are more inclusive and in line with the needs of the community, especially people with disabilities. The practical implications of this research produce 12 bus stop design categories to describe the character of the design concept to be designed. Bus stops designed with these needs in mind can increase user satisfaction and comfort, as well as encourage increased use of public transportation. Disability-friendly design includes easy access for wheelchair users, clear visual and auditory information, and facilities that support the mobility of all users. Thus, it is hoped that this research can become a reference for developing transportation facilities that are more inclusive and responsive to community needs. It is hoped that the government and public transportation managers can implement the findings of this research to improve the quality of services and accessibility of public transportation in Makassar City and other cities in Indonesia. Thus, the results of this research not only contribute to improving the quality of public transportation services, but also to improving the quality of life of people with disabilities and the general public.

Keywords
Kansei Engineering; bus stop design; accessibility

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I. INTODUCTION

Transportation systems are pivotal to the socio-economic fabric of urban environments, facilitating the movement of goods and people across various points within cities. Effective transportation infrastructure not only enhances connectivity but also plays a crucial role in fostering economic growth and social cohesion (Supriatna & Muljadi, 2019). In the context of urban development, the design and accessibility of public transportation facilities, such as bus stops, significantly impact the quality of life and mobility options for all segments of society, including individuals with disabilities (Fathimah & Apsari).

The development of inclusive transportation systems that cater to the needs of people with disabilities has gained increasing attention in recent years. Accessibility refers not only to physical access but also encompasses the provision of facilities and services that enable individuals with disabilities to navigate and utilize public transportation independently (Fadhilah, Tahir, & Manda). Despite efforts to improve accessibility, many cities face challenges in integrating these considerations comprehensively into their transportation infrastructure (Rizkiya, Yusuf, & Caisarina, 2021).

In Makassar, Indonesia, the implementation of the Trans Mamminasata bus system, exemplified by the "Teman Bus," represents a significant initiative aimed at enhancing urban mobility (Andira Salsabilah, Kamran Aksa, & Arief, 2022). However, the accessibility of bus stops within this system remains a critical issue, particularly concerning the needs of individuals with. disabilities (Dewi, 2016). Existing literature emphasizes the

importance of designing transportation infrastructure that not only meets functional requirements but also considers the emotional and psychological aspects of users, a concept central to Kansei Engineering methodologies (Lokman & Nagamachi, 2009)

This study aims to contribute to the enhancement of transportation accessibility in Makassar by applying the Kansei Engineering approach to redesign Trans Mamminasata bus stops. Kansei Engineering, a method rooted in understanding users' emotional responses to design elements, promises to offer insights into creating inclusive and user-friendly bus stops that cater specifically to the needs of people with disabilities (Syahperdana, Rahayu, & Caesaron, 2021).

By exploring the design parameters through the lens of Kansei Engineering (Padhil, 2018). This research seeks to provide practical recommendations for improving the accessibility and usability of bus stops, thereby promoting equitable access to public transportation for all residents of Makassar, including those with disabilities.

II. RESEARCH METHODOLOGY

The research location which is the object of writing in data collection is the Trans Mamminasata Bus Stop in Makassar, which will be carried out for approximately one month. The object to be researched is the design of the Trans Mamminasata bus stop to determine the needs of people with disabilities in accessing the bus stop. The research steps used in designing the Trans Mamminasata Bus Stop in Makassar, namely;

2.1 Method of collecting data

The data collection method used in this research is as follows:

1. Library Study
   Literature study was carried out to support data collection, by collecting and studying documents relevant to the research. This data is data obtained from publications, the internet, books, news, etc. regarding information related to library research carried out by collecting and studying the data obtained (Padhil, 2024)..
2. Field Research
   a. Observation is a data collection technique by direct or indirect observation of the object under study to determine its actual condition.
   b. The primary data collection technique is carried out by distributing questionnaires. Data collection was carried out by distributing a list of statements accompanied by alternative answers to Trans Mamminasata bus users, especially people with disabilities.
   c. The secondary data collection technique is carried out by looking at data or reports from the Trans Mamminasata Bus.

2.2 Data Analysis Methods

The steps in data processing or data analysis in this research are as follows:

1. Collect the necessary data, namely:
   a. Bus stop sample data
   b. Trans Mamminasata bus user data
   c. Data on people with disabilities in Makassar City
   d. Kansei Words
2. Data processing with the following steps:
   a. Identify Kansei Words
   b. Grouping Kansei Words
   c. Semantic Differential (SD)
   d. Validity and Reliability Test
   e. Factor Analysis
   f. Determination of bus stop properties/items
   g. Bus stop design mapping
   h. Designing bus stop designs that suit the needs of people with disabilities using Kansei Engineering.

III. RESULTS AND DISCUSSION

Through field studies and online questionnaires for 196 respondents, 115 Kansei words were obtained and then Kansei Words were grouped.

Table 1. Kansei words responen

Kansei Words Grouping			
Modern	**Colorful**	**Artsy**	**Informative**
Modern	Colorful	Artsy	Informative
Futuristic	Attractive colors	Innovative	Signs
Elegant	Colored	Creative	Markers
Aesthetics	Imaginative	Local wisdom	Information boards
Artistic		Local culture	Interactive

Protected	**Spacious**	**Minimalist**	**Integrated**
Protected	Spacious	Minimalist	Integrated
Doesn't get hot	Open	Ergonomic	Connected
Doesn't get caught in the rain	Accommodates lots of people	Simple	Increases mobility
Safe	Hassle-free	Simple	Connecting
Friendly	Lost of space	Efficient	Expands access
Durable	**Clean**	**Comfortable**	**Sophisticated**
Durable	Clean	Comfortable	Sophisticated
Tough	Neat	Homey	Superior features
Durable	**Clean**	**Comfortable**	**Sophisticated**
Sturdy	Well maintened	Relaxed	Digitalization
Strong	Not shabby	shady	The latest technology
Durable		Harmonious	Multifunctional
Ramah Disabillitas		**Use Friendly**	
Disability friendly		Use friendly	
Inclusiom		Universal	
Special disability areas		Make it easy	
Oriority seats		No hassle	
Disability specific components		Easy to access	

After grouping the Kansei Words, a Semantic Differential questionnaire is then carried out, where in this questionnaire the respondent will assess the desired bus stop by providing an assessment of the Kansei words using the semantic differential technique which will be used as a questionnaire. The following are the results of distributing the Semantic Differential questionnaire with 3 bus stop samples given to 196 respondents which can be seen in the table below:

Table 2. Semantic Differential Questionnaire Results.

Kansei Words	**Sample 1**	**Sample 2**	**Sample 3**
Modern	701	837	769
Colorful	603	772	543
Artsy	781	684	621
Informative	713	765	720
Protected	643	773	633
Area	703	777	691
Minimalist	760	711	755
Integrated	729	773	738
Durable	728	761	735
Net	727	788	761
Convenient	715	764	708
Advanced	588	771	615
Disability friendly	673	753	670
Use ftriendly	713	760	729

Based on the table above, in the answers of respondents who filled out the Semantic Differential questionnaire, there were no additions by the respondents to the 14 attributes of the Kansei words given, so that these attributes were in accordance with the respondents' wishes and expectations. The data that has been collected will then be translated into attributes for determining items and categories.
Determining bus stop items and categories aims to improve the classification of objects and their categories which will later influence the design of the proposed bus stop that is made.

Table 3. Bus stop items and categories

No	**Item**	**Category**	**Variable Group**
1	Bus Stop Visual	a. Modern appearance b. Has ornaments typical og local aesthetic identity	Aesthetics
2	Bus Stop Clolors	a. Colors tend to be bright b. Colors tend to be dark	
3	Lighting	a. Direct lighting b. Indirect lighting	
4	Seat	a. Direct lighting b. Long Seat	Integrated
5	Information Boards	a. Ordinary information board b. LED information board	

6	Guidance Signs	a. Road marking b. Prohibition sign c. Disability sign	
7	Trans Cans	a. Recycling bin b. Sorting waste bin	
8	Security System	a. There is CCTV b. Emergency button	
9	Charging Stations	a. Electric socket b. USB charging	
10	Special Disability Area	a. Waiting zone with special signs b. Enough space for wheelchair	Accessiblility
11	Guilding Blocks	a. Guide path from the entrance to the waiting area b. Non-slip material for accessibility safety	
12	Access Ramps	a. Tilt angle according to standard b. Handrails on both sides	

Determination of product properties is done by observing bus stops. Searching for product properties is also done through literature studies such as through central and regional government regulations and several related journals.

IV. CONCLUSION

This research aims to identify and classify optimal bus stop items and categories based on user preferences, highlighting the importance of aesthetics, functionality, and accessibility in bus stop design. The identification of items such as bus stop visual appearance, color, lighting, seating, information boards, signs, trash bins, security systems, charging stations, special areas for disabilities, guiding blocks, and access ramps was conducted through observation and literature review. Factor analysis revealed three main factors valued by users: Aesthetic Quality, Function and Security, and Accessibility and Comfort, with a strong preference for modern appearances and local ornaments. These findings emphasize the need for bus stop designs that are not only aesthetically pleasing but also functional and inclusive, considering facilities for disabilities. The strength of this research lies in its comprehensive methodology, although it is limited by sample size and geographical focus. Overall, the implementation of the research findings is expected to enhance the comfort and satisfaction of public transportation users.

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