SINEKTIKA Jurnal Arsitektur

p-ISSN: 1411-8912
e-ISSN: 2714-6251
http://journals.ums.ac.id/index.php/sinektika

ARCHITECTURAL DISTRESS: PRESSURE ON USER COMFORT AT THE TANJUNG DUREN BRT STOP

Ariz Fantrio Larosa
Architecture Program
Faculty of Engineering
Universitas Muhammadiyah Surakarta
d300220179@student.ums.ac.id

Muhammad Siam Priyono Nugroho
Architecture Lecturer Program
Faculty of Engineering
Universitas Muhammadiyah Surakarta
mspn@ums.ac.id

History of the manuscript:
Manuscript submitted May 6, 2026
Manuscript accepted July 1, 2026

ABSTRACT
BRT Stops in tropical urban contexts often experience operational pressures that exceed their design capacity. This study examines architectural distress at the Tanjung Duren BRT Stop, West Jakarta, as a form of performative architectural failure. A mixed-method approach was applied, comprising spatial density analysis, circulation assessment, envelope material evaluation, thermal estimation, and user behavior observation. The findings reveal extreme crowding at 5–6 persons/m², circulation conflicts caused by a ±0.9 m bottleneck, and heat accumulation reaching approximately 51.7°C. These conditions induce psychological stress and defensive user behavior. This study conceptualizes architectural distress as a spatio-temporal, multidimensional, and replicable analytical framework for transit architecture.

KEYWORDS: architecture distress, BRT stop, passenger flow, spatial density, thermal comfort

BRT Stop di kawasan perkotaan tropis sering mengalami tekanan operasional yang melebihi kapasitas rancangannya. Penelitian ini mengkaji architectural distress di Halte BRT Tanjung Duren, Jakarta Barat, sebagai bentuk kegagalan arsitektur yang bersifat performatif. Pendekatan mixed-method diterapkan, mencakup analisis kepadatan spasial, penilaian sirkulasi, evaluasi material selubung bangunan, estimasi termal, dan observasi perilaku pengguna. Temuan menunjukkan kepadatan ekstrem sebesar 5–6 orang/m², konflik sirkulasi akibat penyempitan ±0,9 m, dan akumulasi panas yang mencapai sekitar 51,7°C. Kondisi-kondisi ini memicu stres psikologis dan perilaku defensif pengguna. Penelitian ini mengonseptualisasikan architectural distress sebagai kerangka analisis arsitektur transit yang bersifat spasio-temporal, multidimensional, dan dapat direplikasi.

KATA KUNCI: *distress arsitektur, halte BRT, arus penumpang, kepadatan spasial, kenyamanan termal*

INTRODUCTION

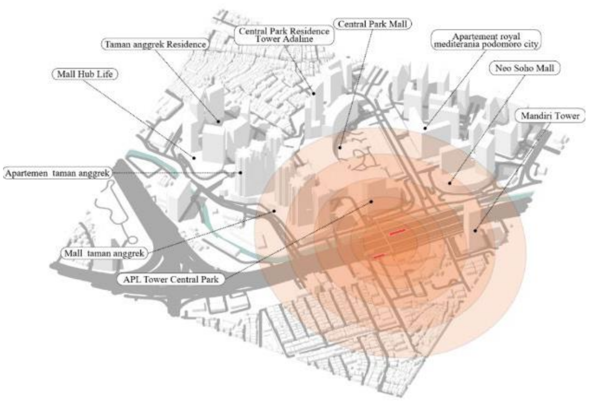


Figure 1. Master plan of the BRT Stop area located within the Podomoro mixed-use district
(Source: Author's Document, 2025)

As the backbone of Jakarta's mass transportation network, Bus Rapid Transit (BRT) provides high-capacity mobility through dedicated corridors designed to minimize the impacts of traffic congestion. Its route connectivity linking major economic activity centers has made BRT a preferred commuting mode for urban travelers who prioritize efficiency and travel time reliability (PT Transportasi Jakarta, 2024). Supported by high service frequency and affordable fares, BRT plays a strategic role in facilitating daily mobility while reducing dependence on private vehicles.

One of the key nodes in this system is the Tanjung Duren BRT Stop, which is located in a mixed-use area characterized by exceptionally high activity intensity. Based on the area map (Figure 1) and existing site conditions (Figure 2), the BRT Stop lies within walking distance of metropolitan-scale commercial centers, vertical residential developments, and office complexes, including Central Park, Central Park 2, and Mall Taman Anggrek. This combination of these surrounding functions generates a near-continuous flow of users throughout the day, with substantial increases during morning and evening peak periods. As a result, the BRT Stop as a transit node that operates under sustained occupancy pressure.

Figure 2. Tanjung Duren Halte (East) and Pedestrian Overpass with Existing Buildings
(Source: Google Maps, 2025)

Field observations indicate that the BRT Stop operates well beyond its effective spatial capacity. The facility accomodates approximately ±44 buses per hour, with arrival intervals of only 1–2 minutes, while the effective waiting area is limited to approximately 24.9 m². During peak periods, occupancy reaches around 110–130 users, resulting in a density of approximately 5–6 persons/m², which substantially exceeds the public transport comfort standard of 2–3 persons/m². This extreme crowding is clearly observable during rush hour conditions (Figure 3) and raises concern not only for user comfort but also for circulation efficiency and passenger safety.

Figure 3. Interior conditions of the Tanjung Duren Transjakarta BRT Stop during Rush Hour
(Source: Author's Document, 2025)

These conditions are further intensified by a spatial configuration that does not adequately respond to actual user demand. A circulation bottleneck of approximately ±0.9 m occurs at the transition between the pedestrian overpass, the unpaid zone, and the platform, creating queue accumulation that extends back onto the overpass (Figure 4). In addition, the absence of a clearly defined separation between incoming and outgoing passenger flows generates continuous movement conflicts across the space.

From a thermal perspective, the predominance of high thermal-mass materials, such as concrete, steel, and composite panels, combined with limited ventilation, contributes to substantial heat accumulationwithin the BRT Stop. Under full occupancy conditions, interior temperatures can reach approximately 51.7°C, far exceeding thermal comfort threshold for urban public spaces.

Figure 4. Passenger crowding at the boarding area blocking access for alighting passengers, causing bidirectional movement conflict
(Source: Author's Document, 2025)

The cumulative effects of spatial congestion, circulation constraints, and thermal discomfort directly influence users' psychological experiences and contribute to the emerge of architectural distress. According to Mahudin, Cox, and Griffiths (2011), stress associated with crowding is shaped not only by social evaluations, such as perceived loss of privacy and unwanted physical contact, but also by environmental evaluations, including thermal conditions and ventilation quality.

The findings of this study indicate that 91.1% of respondents experienced negative emotional response while waiting the bus, including stress, dizziness, and general emotional discomfort. Users reported a diminished sense of control over personal space due to unavoidable physical contact during extended waiting periods, which in turn encouraged defensive behaviours and avoidance of the BRT Stop environment.

Based on these conditions, this study aims to examine how the misalignment between the BRT Stop's physical design and users' spatial and psychological needs contributes to architectural distress at the Tanjung Duren BRT Stop. By integrating spatial, thermal, operational, and user perception data, the study is intended to provide a scientific basis for the urgency of bus stop revitalization toward a more humane transit space that is adaptive to the density pressures of the urban environment.

Literature Review

Bus Rapid Transit (BRT) Stop function as strategic transitional spaces within urban mass transportation systems, serving to organize pedestrian movement and maintain travel flow efficiency in dense urban environments (Muryanti, Mukaromah, & Putri, 2025). DKI Jakarta Governor Regulation No. 67 of 2019 reinforces the BRT Stop's role as a public transport facility that must ensure safety, order, and accessibility. Operationally, bus stop performance reflects the overall quality of the BRT system. The implementation of level boarding and off-board fare collection is particularly important in accelerating passenger circulation and shaping user perceptions of public transport service quality (ITDP, 2016; Muryanti et al., 2025). However, to fulfill this role effectively, the BRT Stop must also meet a broader set of comfort criteria for its users.

Bus stop comfort can be understood as the result of a spatial configuration that accommodates simultaneous movement and diverse user activities (Khan, Khan, & Ullah, 2024). This concept extends beyond circulation efficiency to include thermal comfort through climatic responsiveness of the building envelope (ASHRAE, 2017), safety through lane sterilization and spatial monitoring (PT Transportasi Jakarta, 2025), universal accessibility (UN-Habitat, 2020), and the provision of facilities and information that reduce users' cognitive load (ITDP, 2016). As this field has evolved, crowding has emerged as a major limiting factor, with evidence suggesting that discomfort begins to increase at densities above approximately 2 persons/m², contributing to stress, anxiety, and physical fatigue among users (Zhang et al., 2023). Understanding these limits requires closer examination of how space spatial requirements and bus stop capacity are formally defined.

In terms of space requirements, DKI Jakarta Governor Regulation No. 67 of 2019 sets the minimum static area at 0.5–1.2 m² per person to ensure safe movement and circulation. However, the effectiveness of this standard depends on actual occupancy condition and density dynamics. Evans and Wener (2007) demonstrated that densities exceeding 4 persons/m² lead to severe movement constraints and negative psychological responses, a finding that aligns with broader evidence regarding the cross-cultural sensitivity of interpersonal distance thresholds (Sorokowska et al., 2017). Zhang et al. (2023) further identified a psychological rejection threshold at approximately 2 persons/m², beyond which platform conditions are functionally perceived as uncomfortable. These findings suggest that bus stop capacity cannot be evaluated solely based on physical holding capacity. When occupancy persistently exceeds these thresholds, the cumulative effect extend beyond physical discomfort.

Architectural distress emerges when the built environment fails to accommodate users' physical and psychological needs, causing the space itself to become a source of pressure (Muryanti, Mukaromah, & Putri, 2025). In BRT Stops, this phenomenon may arise from the imbalance between a static spatial configuration and a fluctuating user demand. Under extreme crowding, the waiting area shifts from a neutral transitional environment into a source of physical and psychological pressure, increasing cognitive load, reducing perceived self-control, and encouraging defensive behavioural responses such as avoidance and spatial withdrawal (Aitbihiouali et al., 2020; Lombardi & Ciceri, 2021; Zhang et al., 2023). This pressure is cumulative and tends to intensify with prolonged exposure to the environment.

Research Gap and Contribution

Studies on BRT Stops remain largely dominated by technical and operational approaches, focusing primarily on service efficiency and minimum physical standards (ITDP, 2016; DKI Jakarta Governor Regulation No. 67/2019). Studies on density and thermal conditions are generally conducted separately, with limited integration of spatial configuration, circulation pattern, and user behavioral responses. Likewise, the concept of architectural distress in urban transit spaces has rarely been operationalized as a performative analytical framework in architectural research. However, the emergence of a psychological rejection threshold at relatively low crowd densities reveals a signicant gap between design capacity and perceived comfort (Zhang et al., 2023). This gap is particularly critical in dense tropical cities such as Jakarta, where many dimensionally constrained BRT halts are located within mixed-use districts. To address this gap, the present study examines architectural distress as an accumulative phenomenon through an integrated analysis of spatial conditions, crowd density, thermal performance, circulation patterns, and users' perceptions and behaviors.

METHODS

This study employs a mixed-methods approach to examine the phenomenon of architectural distress through both quantitative and qualitative perspectives. The quantitative approach was used to measure spatial density, ambient temperature, and the distribution of users' perceptions in numerical terms. The qualitative approach was applied to explore users' subjective experiences of insecurity, stress, and discomfort while inside the BRT Stop. Combining these approaches provides a more comprehensive understanding of architectural distress within a public transport waiting space.

Table 1. Measurement Time Variables for Temperature and User Density at Tanjung Duren BRT Stop

Time	Halte Operational Condition	Description
09.00 – 13.00	No users present	Effect of solar radiation without user load
09.00 – 13.00	Approximately ±50% room capacity	Solar radiation with moderate heat load
09.00 – 13.00	High density during peak hours	Maximum thermal pressure
17.00-21.00	No users present	Control condition without radiation
17.00-21.00	Approximately ±50% room capacity	Effect of metabolic heat from users
17.00-21.00	High density during peak hours	Heat accumulation at high density

Table 2. User Perception Variables and Bus Stop Spatial Exposure Duration

Variable	Indicator	Data Output
Comfort perception	Level of comfort while waiting	Percentage (%)
Spatial stress perception	Feeling of pressure due to crowding	Percentage (%)
Safety perception	Sense of safety regarding physical contact and personal belongings	Percentage (%)
Personal space (proxemics)	Discomfort due to interpersonal distance	Percentage (%)
Exposure duration	Length of waiting time at the BRT Stop	Time distribution (%)
Cumulative distress	Relationship between waiting duration and stress level	Percentage (%)
Adaptive behavior	Tendency to avoid the BRT Stop during peak hours	Percentage (%)

The study was conducted at the Tanjung Duren BRT Stop in West Jakarta, which was selected due to its location in a high-mobility urban area that experiences significant crowding during peak hours. The research focused on the BRT Stop's physical characteristics, spatial organization, passenger circulation, and users' perceptions of comfort and spatial pressure during waiting and boarding activities.

As shown in Tables 1 and 2, this research examines the BRT Stop's physical conditions and user perceptions simultaneously. Spatial pressure is conceptualized as an accumulative phenomenon influenced by density, temperature, and waiting duration. Accordingly, perception and waiting duration variables were included to represent the psychological and behavioral impacts that cannot be captured through technical measurements alone.

Data Collection Procedures

Field observations were conducted to identify the BRT Stop's spatial configuration, zoning, circulation bottlenecks, and passenger movement patterns. Spatial measurements included the effective area of the waiting zone, circulation widths, and the locations of fixed physical elements. The collected data were visualized through a three-dimensional (3D) model of the existing conditions, zoning maps, and passenger movement flow diagrams.

Ambient temperature measurements were conducted using a digital thermometer under six operational conditions, representing daytime and nighttime periods at empty, half-full, and full occupancy levels. These measurements were intended to examine the influence of solar radiation and passenger density on increases in the interior temperature.

User perception data were obtained through structured interviews with active passengers during peak hours using purposive sampling. The interviews explored perceptions of comfort, sense of safety, stress levels due to crowding, ease of movement, and behavioral responses to bus stop environment.

Data Analysis Techniques

Analysis was conducted in several stages. Spatial density was analyzed by calculating the ratio of the available area to the number of users, while thermal conditions were assessed by comparing interior temperatures across different operational conditions and examining their relationship with material properties and natural ventilation. Interview data were analyzed using descriptive statistics and presented as frequencies and percentages. Finally, the finding from all analyses were synthesized to identify pattern of architectural distress resulting from crowding, elevated temperatures, and circulation conflicts.

Research Workflow

The study began with a literature review to establish the conceptual framework, followed by field data collection through observation, spatial measurement, and structured interviews. The collected data were analyzed in an integrated manner to identify the primary spatial problems of the BRT Stop. Based on these findings, design recommendations were formulated to improve spatial quality and mitigate architectural distress in the BRT Stop.

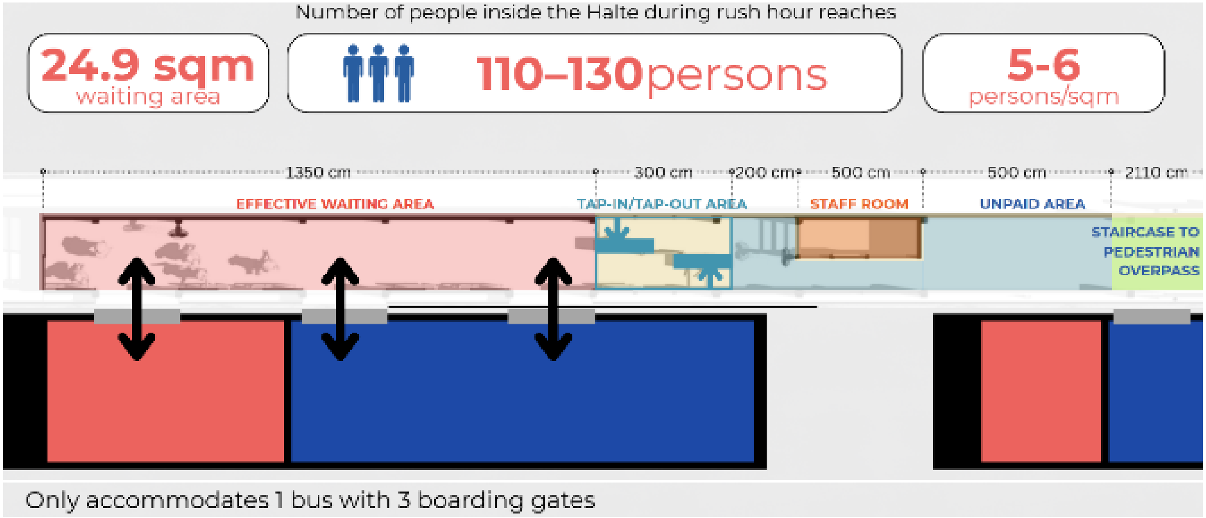


Figure 5. Floor Plan of Tanjung Duren BRT Stop
(Source: Author's Mapping, 2025)

RESULTS AND DISCUSSION

Existing Conditions of the Tanjung Duren BRT Stop

The Tanjung Duren BRT Stop is located within a high-intensity mixed-use urban area. As shown in Figure 5, the surrounding area within a 100–300 meters service radius is predominantly characterized by commercial and office developments, including Central Park and Taman Anggrek. Within a 500-meter radius, high-rise residential buildings and dense settlements further contribute to substantial daily passenger movement toward the BRT Stop. These surrounding land-use characteristics confirms the BRT Stop's role as a primary transit node serving a diverse range of urban activities. The intensity of the surrounding urban environment is reflected in the BRT Stop's operational patterns.

Table 3. Wall Material Composition of the BRT Stop

Bus Code	Destination (West Halte) / (East Halte)	Headway (min)	Buses/ Hour
9A	Grogol /Cililitan	5	12
3F	Kalideres / Senayan	6	10
8M	Tanah Abang / Tanjung Duren	18	3-4
9E	Jelambar / Kebayoran	18	3-4
7R	Pluit /Cibubur	20	3
9	Pluit / Pinang Ranti	7	8-9
8	Lebak Bulus / Pasar Baru	15	4
Total buses per hour (West / East Halte)			**41–42**

Based on Table 3, the BRT Stop serves approximately 41–42 buses per hour, with an average arrival interval of 1–2 minutes. In theory, this high service frequency is intended to facilitate efficient passenger flow and reduce waiting times. Physically, however, the BRT Stop has only a single active platform capable of accomodating one bus at a time. This imbalance between service frequency and platform capacity result in passenger accumulation within the waiting area, particularly when multiple buses arrive in rapid succession.

Physical Conditions of the Tanjung Duren BRT Stop

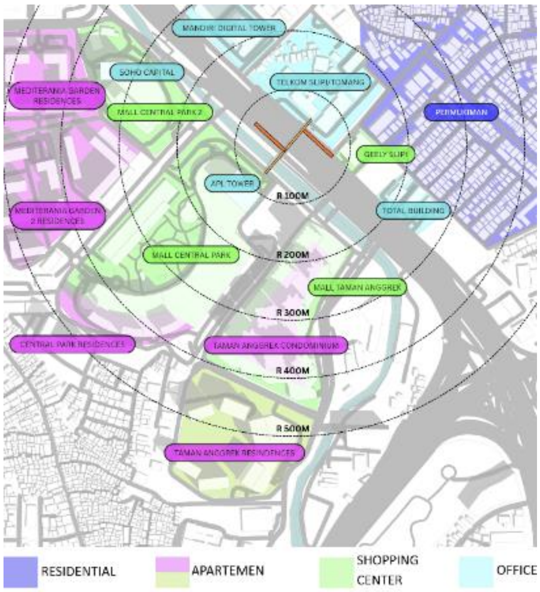


Figure 6. Existing Conditions of Tanjung Duren BRT Stop within a 500-Meter Radius
(Source: Author's Mapping, 2025)

Spatially, the waiting area of the Tanjung Duren BRT Stop (Figure 6) has an effective area of approximately ±24.9 m² with a linear configuration parallel to the bus lane. During peak hours, this space accommodates 110–130 users, bringing the density level to 5–6 persons/m². This figure far exceeds the public facility comfort standard of 2–3 persons/m² and indicates extreme spatial pressure.

Density Patterns and Passenger Movement

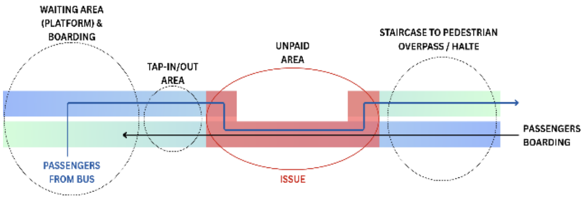


Figure 7. Zones and Circulation Flow at the Tanjung Duren BRT Shelter
(Source: Author's Mapping, 2025)

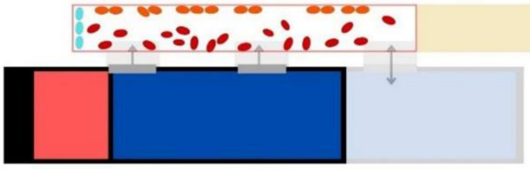
The BRT Stop is organized into several functional zones, including tap-in/tap-out area, staff room, unpaid area, and staircase access. However, the spatial allocation of these zones is not proportional to actual user demand. The most critical constraint occurs at the transition between the tap-in/tap-out area and the unpaid zone, where a circulation bottleneck of approximately ±0.9 m reduces movement capacity by an estimated 50%. This condition is further intesified by the placement of the staff room mass, which narrows the corridor and contributes to circulation breakdown during peak periods.

Circulation analysis indicates a predominantly linear movement pattern with overlapping incoming and outgoing passenger flows and no physical separation between them, forcing direct movement conflicts when buses arrive. This condition becomes more severe because the platform accommodates only one bus at a time, concentrating waiting, queuing, boarding and alighting activities at a single point simultaneously.

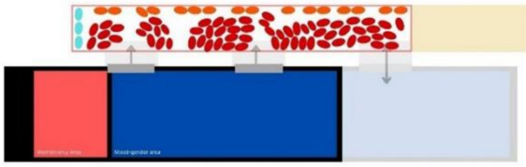
Figure 8. Location of Tap In/Out Machines Adjacent to the Platform
(Source: Author's Document, 2025)

Density distribution within the BRT Stop is further influenced by the interior zoning of buses, particularly the separation between women-only and mixed-gender sections. Users tend to position themselves at the BRT Stop segment corresponding to their intended boarding area, resulting in higher passenger concentration toward the rear section of the platform.

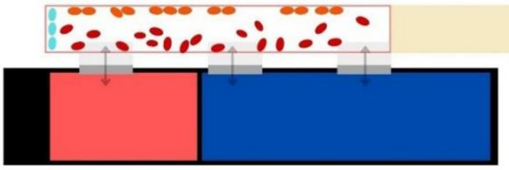
Under low-occupancy conditions (Figures 9A and 9C), user distribution remains relatively balanced across the space. However, under high-occupancy conditions (Figures 9B and 9D), this tendency to cluster near preferred boarding zones generates localized crowding, narrows movement space, and intensifies spatial conflict among users.



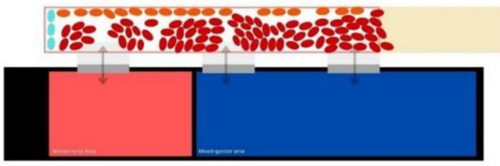
(A) Queue Pattern during Off-Peak Hours (Medium Bus)



(B) Queue Pattern during Peak Hours (Medium Bus)



(C) Queue Pattern during Off-Peak Hours (Articulated Bus)



(D) Queue Pattern during Peak Hours (Articulated Bus)

Figure 9. Queue Patterns at Tanjung Duren Shelter
(Source: Author's Mapping, 2025)

Figure 10. Passengers queuing onto the Pedestrian Overpass (Peak Hour)
(Source: Author's Document, 2025)

Conditions become more critical when articulated buses are in operation. Their greater length and passenger capacity are not adequately accommodate by the BRT Stop's existing dimensions, causing outgoing passenger flows to be repeatedly obstructed by queueor boarding passengers. This bidirectional movement conflict generates backflow and circulation breakdown, indicating the space's inability to manage simultaneous opposing flows effectively.

Thermal Conditions of the Waiting Area

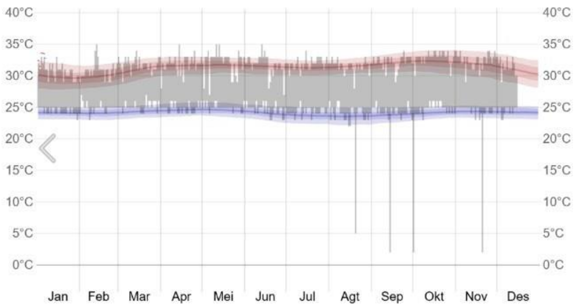


Figure 11. 2025 Temperature History in Jakarta (Source: Weather Spark, 2025. Weather History for Jakarta in 2025)

Figure 11 shows that Jakarta experiences relatively high and stable ambient temperatures throughout the year, with average daily maximum temperatures ranging from 31–33°C and average daily temperatures between 27–29°C. To quantitatively assess thermal pressure within the study, air temperature measurements were conducted in the main waiting area of the Tanjung Duren BRT Stop using a digital room thermometer.

Measurements were carried out under six occupancy conditions at two different times of day while maintaining comparable outdoor temperature conditions (T_out). This approach was designed to capture variations in thermal condition directly experienced by users as an indicator of architectural distress. The percentage increase in indoor temperature relative to outdoor temperature was calculated using the following formula:

$$\textbf{\% Temperature increase} = \frac{T_{in} - T_{out}}{T_{out}} \times 100\% \quad \textbf{....(1)}$$

The results presented in Graph A (Figure 12) show that indoor temperatures increased substantially relative to outdoor conditions during daytime operation. Even when the BRT Stop was unoccupied, indoor temperature had already increased by +40.9% compared to outdoor temperature. This increase became more pronounced with rising occupancy, reaching +48.9% under half-full conditions and +56.7% at full capacity, with a recorded maximum indoor temperature of 51.7°C.

The substantial temperature increase observed even in the absence of user occupancy suggest that the dominant source of heat gain originates from the building envelope rather than solely from occupants' metabolic heat. Occupancy contributes additional thermal load, but the findings indicate that material characteristics, solar exposure, and limited heat dissipation within the enclosure play a more significant role in driving thermal stress inside the BRT Stop.

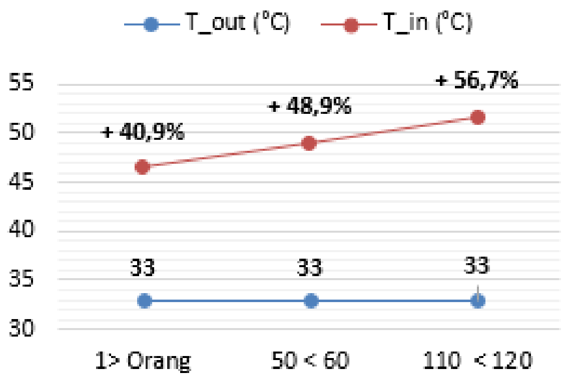


Figure 12. (A) Daytime Thermal Conditions (Source: Author's Field Survey, 2025)

At night, when solar radiation influence has decreased, outdoor temperature stabilizes at around 26°C. Indoor temperatures, however, still remain elevated, increasing by up to +20% under full occupancy conditions. This pattern suggests that the waiting area is unable to dissipate accumulated heat effectively, causing heat stored within building elements to continue being released into the interior environment. In other words, the thermal pressure experienced by users appears to be residual and structurally embedded within the built environment rather than incidental or occupancy-driven.

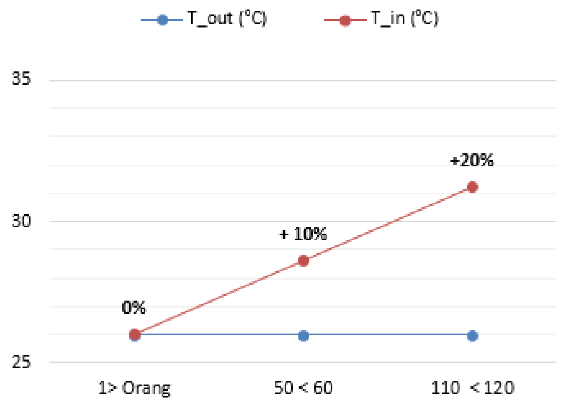


Figure 13. (B) Nighttime Thermal Conditions (Source: Author's Field Survey, 2025)

Physical Conditions of the Tanjung Duren BRT Stop

Based on the material composition (Table 4), the building envelope of the Tanjung Duren BRT Stop is dominated by conductive materials with high heat storage potential. Aluminum composite panels (ACP) account for 31.32%, of the envelope surface, followed by extruded aluminum louvers at 30.28%, and glass walls at 29.32%, meaning that these elements collectively comprise more than 60% of the enclosure.

The high thermal conductivity enables rapid heat transfer following solar exposure, while the BRT Stop's orientation further intensifies this effect. The east-facing glass facade receives direct solar radiation during the late morning, whereas the west-facing ACP surfaces are exposed to intense solar gain from midday to afternoon, as shown in Figure 14. Heat absorbed and retained by these surfaces is subsequently re-radiated into the environment, causing the envelope itself to function as a persistent secondary source of heat.

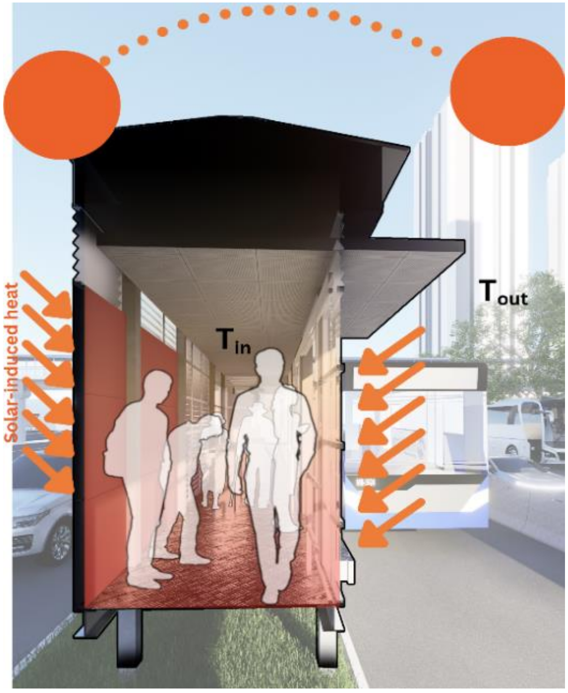


Figure 14. Schematic Analysis of Solar Radiation and Heat Accumulation on Architectural Elements of Tanjung Duren Shelter
(Source: Author's Field Survey, 2025)

Structural elements such as concrete columns (3), lightweight steel frames (5), and textured steel flooring (6) further contribute to internal heat accumulation. These materials absorb and retain substantial amounts of heat and release it gradually, causing indoor temperatures to remain elevated even solar radiation intensity begins to decline. Meanwhile, the roof overhang functions primarily to reduce rain intrusion during boarding and alighting activities and provideslimited protection against solar exposure on vertical surfaces and the glass façade.

The failure to achieve thermal comfort at Tanjung Duren Halte appears to result from interaction between envelope design and the surrounding microclimate. Although passive ventilation openings account for 20.04% of the envelope area, they do not generate effective cross ventilation. Instead, they may allow the entry of heat and pollutants originating from adjacent road surfaces. This effect is intensified by low albedo of asphalt, approximately 0.05, which promotes substantial solar heat absorption. According to Richard et. al (2015), asphalt with 95% radiation absorption can reach temperatures up to 50°C above the surrounding air, and this heat enters the BRT Stop and becomes trapped by the high-conductivity steel and aluminum structural materials.

Figure 15. Materials at Tanjung Duren Shelter
(Source: Author's Field Survey, 2025)

Table 4. Wall Materials of the BRT Stop

No. (Fig. 15)	Element / Material	Area (m^2)	(%)
1	Extruded aluminum louvers	31.06	30.28%
2	Aluminum composite panel / ACP (light gray)	32.13	31.32%
4	Glass wall (steel frame)	30.08	29.32%
-	Openings (doors & open ventilation)	20.56	20.04%
	Total	102.59	100%

The roof overhang provides little protection for the glass facade or vertical wall against solar radiation, allowing solar heat gain to occur with limited obstruction. The use of textured steel flooring further compounds heat accumulation, as this material absorbs and retains heat before releasing it gradually overtime, causing interior temperatures to remain elevated even after solar radiation intensity begins to decline. The combination of conductive materials, facade orientation, and limited solar protection creates sustained heat buildup within the BRT Stop, reducing its ability to dissipate acuumulated heat and increasing thermal pressure on users.

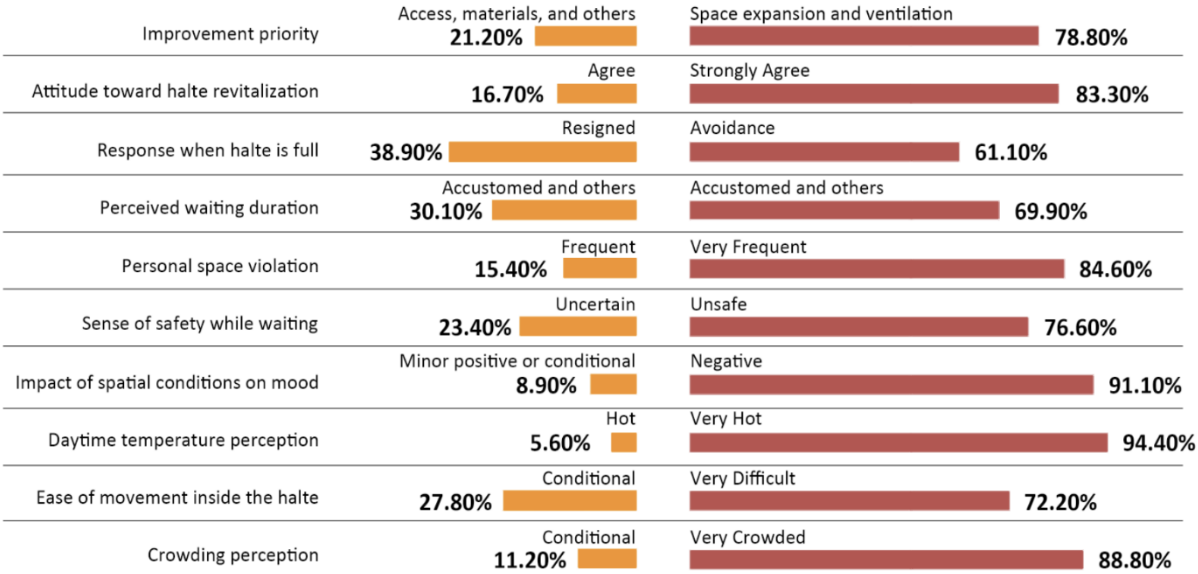


Figure 16. Chart of Results from Tanjung Duren BRT Station Users
(Source: Author's Field Survey, 2025)

Physical Conditions of the Tanjung Duren BRT Stop

As shown in the Figure 16, user perception data indicate that the Tanjung Duren BRT Stop has exceeded its basic function as a transit facility and transformed into a space that actively produces psychological pressure. The integration of quantitative data from 90 respondents and qualitative user statements reveals a systematic and recurring decline in perceive well-being, particularly during morning and afternoon peak periods.

The first layer of architectural distress emerges as an accumulative thermal burden. A total of 94.4% of respondents perceived the daytime temperature within the waiting area as hot to very hot. This pressure intensified with longer exposure duration, with users waiting for 15–20 minutes reporting substantially greater level discomfort. With recorded indoor temperatures ranging from 32°C to 51.7°C, thermal exposure can no longer be interpreted solely as a matter of comfort but also as a condition associated with physical strain. One respondent described the environment as extremely stuffy and potentially dangerous for users with respiratory or cardiovascular conditions. These findings indicate that prolong exposure amplifies thermal stress and forms the initial layer of architectural distress.

The second layer emerges through violations of proxemics boundaries caused by extreme crowding. A total of 88.8% of respondents perceived the BRT Stop as very crowded, while 84.6% reported unavoidable physical contact. Density levels of 5–6 persons/m² force users into intimate interpersonal distances without consent, reducing control over bodily privacy and personal space. This condition triggers feelings of discomfort and frustration and is reflected in the 76.6% of respondents who reported feeling unsafe while inside the BRT Stop.

The combined effects of thermal and spatial pressure culminate in psychological strain and behavioural adaption. A total of 91.1% of respondents reported negative mood changes, including irritability, dizziness, and mental fatigue. At this stage, distress triggers coping mechanisms, with 61.1% of respondents exhibiting defensive behaviors such as avoiding the center of the waiting area, standing near the doors, or choosing to wait on the pedestrian overpass staircase and outside the BRT Stop despite exposure to direct sunlight. These behaviors reflect efforts to reduce visual, social, and thermal pressure within the platform environment.

This pattern is further reinforced by the horizontal bar chart of user perceptions (Figure 16), which shows that nearly all comfort indicators are concentrated at high negative levels, with the majority exceeding 70%. The dominant concerns relate to room temperature (94.4%), emotional impact (91.1%), and extreme crowding (88.8%). The consistency of these findings across variables suggests that the observed conditions are not incidental but represent a systemic failure between the spatial design and actual user demand.

RESULTS AND DISCUSSION

User Perceptions of Waiting Area Conditions at the BRT Stop

This synthesis formulates the manifestation of architectural distress at the Tanjung Duren BRT Stop as a form of performative architectural failure to mitigate the destructive interaction among spatial crowding, circulation anomalies, and excessive thermal load. Rather than representing static physical deterioration, this phenomenon emerges as a spatio-temporal condition that accumulates when user demand exceeds the adaptive capacity of the space during peak periods.

Through the convergence of these pressures, the architecture undergoes a shift in functional role shift from a supportive transit environment to a stress-inducing environment that actively undermines users' psychological well-being and physical comfort.

Table 5. Manifestations of Architectural Distress at the Tanjung Duren BRT Stop

Spatial Aspect	Element / Material	Area (m²)
Spatial	Extreme crowding (±5–6 persons/m²) occurring continuously	Space loses adaptive capacity against user surges
	Linear configuration and spatial narrowing	Space is unable to absorb and distribute spatial pressure
Circulation	Converging incoming and outgoing flows within a confined space	Architecture fails to orchestrate movement flow
	Openings (doors & open ventilation)	Effective spatial capacity decreases drastically
Thermal	Congestion during boarding and alighting	Building envelope amplifies internal heat load
	Ineffective passive ventilation	Architecture fails to function as a climate mediator
Behavioral	Users pressing against walls and avoiding contact	Space triggers defensive responses
	Grouping based on perceived safety	Space loses social neutrality
Perceptual	Feelings of stuffiness, heat, and urgency to leave	Space is perceived as a burdensome environment

Manifestations of Architectural Distress in the BRT Stop Space

The manifestations of architectural distress can be identified through changes in spatial performance and user behavior. The following table summarizes the **observable forms of distress and their corresponding** architectural implications. Collectively, these conditions indicate a functional role inversion within the built environment.

At this stage of distress, architecture no longer maintains its role as a supportive setting for user activity but instead becomes an active source of environment pressure. Rather than facilitating comfort and movement, the built environment functions as a stress-inducing condition that intensifies physical and psychological strain.

Manifestations of Architectural Distress in the BRT Stop Space

The analysis indicates that architectural distress is a sequential and performative process of environmental degradation. Rather than emerging instantaneously, it develops progressively from normal operational conditions toward functional failure as accumulated spatial and thermal pressures exceed the adaptive capacity and design threshold of the space.

Table 6. Stages of Architectural Distress Formation

Stage	Spatial Characteristics	Architectural Performative Status
Normal condition	Controlled density, smooth circulation, relatively stable temperature	Space functions supportively
Stressed condition	Load approaching capacity, circulation beginning to be disrupted	Space becomes reactive
Distress condition	Load exceeds capacity, heat accumulates, defensive behavior emerges	Space fails to perform its basic function

At the distress stage, the BRT Stop is no longer able to maintain a functional balance between users, movement flows, and environmental conditions. As a result, the quality of the user experience deteriorates, while the effective spatial capacity capacity of facility is substantially reduced.

Final Synthesis

Based on this synthesis of findings, architectural distress at the Tanjung Duren BRT Stop can be understood as a condition of performative architectural failure resulting from the space's inability to simultaneously manage crowding, accommodate circulation demands, and respond to climatic conditions. Rather than occurring incidentally, this condition develops through the cumulative effect of recurring pressures during peak periods.

This interpretation suggests that architectural distress may serve as a conceptual framework for understanding spatial failures in other urban transit environment facing comparable conditions, while asldo providing a basis for developing redesign strategies that are more adaptive, responsive, and human-centered.

CONCLUSION

This study concludes that the Tanjung Duren BRT Stop is experiencing architectural distress, defined as a condition of performative architectural failure arising from the inability of the space to simultaneously respond to pressures of crowding, circulation, and climate. This condition is not caused by physical deterioration of the building but by the BRT Stop's inability to fulfill its mediating role as an adaptive and humane transit environment.

Architectural distress develops through the cumulative interaction of spatial, circulatory, and thermal pressures. Extreme crowding at 5–6 persons/m², a circulation bottleneck of approximately 0.9 m that generates bidirectional movement conflict and flow breakdown, and structural thermal loading that increases waiting-area temperatures to approximately 51.7°C collectively exceed the space's performance capacity. Under peak-hour conditions, the architecture undergoes a functional role inversion, shifting from a supportive environment into a stress-inducing environment.

This study offers four original contributions:

1. Formulating architectural distress as an operational concept in urban transport architecture research by framing architectural failure as performative failure rather than physical deterioration.
2. Demonstrating that architectural distress forms through cross-dimensional accumulation involving spatial, circulatory, thermal, and behavioural factors rather than a single cause mechanism.
3. Revealing a process of architectural role inversion in which transit space transforms from a supportive environment into a source of environmental and psychological pressure under high-density conditions.
4. Developing a replicable analytical framework for identifying and evaluating architectural distress in Haltes and other transit facilities within dense tropical urban contexts.

These findings imply that the evaluation and design of urban transit facilities cannot be limited to physical capacity standards and operational efficiency alone. Architectural failure emerges when spatial, circulatory, and thermal performance are unable to respond to actual user demand and exposure duration. BRT Stop design should therefore be understood as a performative system capable of mediating both physical and psychological pressures.

Accordingly, revitalization of the Tanjung Duren BRT Stop should adopt a performance-based design approach across three interconnected dimensions: (1) spatial and circulatory reconfiguration to eliminate bottlenecks and separate opposing flows; (2) thermal envelope modification through through lower-conductivity materials and improved cross ventilation to reduce structural heat accumulation; and (3) integration of real-time information systems to reduce uncertainty associated with waiting time. Collectively, these interventions aim to restore the BRT Stop's capacity to function as a supportive, adaptive, and humane transit environment under sustained density pressure.

REFERENCES

Aitbihiouali, L., Graham, D., Barron, A., & Trompet, M. (2020). Gender differences in the perception of safety in public transport. *Journal of the Royal Statistical Society: Series A (Statistics in Society), 183*(3), 737–769. doi:https://doi.org/10.1111/rssa.12558

ASHRAE. (2017). *Standard 55-2017: Thermal Environmental Conditions for Human Occupancy.* American Society of Heating, Refrigerating and Air-Conditioning Engineers: Atlanta. Retrieved from https://www.ashrae.org/technical-resources/bookstore/standard-55-thermal-environmental-conditions-for-human-occupancy

Evans, G., & Wener, R. (2007). Crowding and personal space invasion on the train: Please don't make me sit in the middle. *Journal of Environmental Psychology, 27*(1), 90-94. doi:10.1016/j.jenvp.2006.10.002

ITDP. (2016). *The BRT Standard 2016.* New York: Institute for Transportation and Development Policy. Retrieved from https://itdp.org/wp-content/uploads/2024/03/BRT-STANDARD-Bahasa-2024.pdf

Khan , M., Khan , S., & Ullah , I. (2024). A Planning Study on the Spatial Configuration of Bus Rapid Transit Stations-Focused on Sustainable Mobility. *Journal of Development and Social Sciences, 5*(2), 484-495. doi:10.47205/jdss.2024(5-II)54

Lombardi, D., & Ciceri, M. (2019). Dealing With Feeling Crowded on Public Transport: The Potential Role of Design. *Environment and Behavior*, 1-40. doi:10.1177/0013916519879773

Mahudin, N., Cox, T., & Griffiths, A. (2011). Modelling the spillover effects of rail passenger crowding on individual well being and organisational behaviour. *Urban Transport XVII* (pp. 227-238). Southampton: WIT Press. doi:10.2495/UT110201

Muryanti, Mukaromah, H., & Putri, E. P. (2025). Persepsi Pengguna Layanan Bus Rapid Transit (BRT) Transjakarta, Batik Trans Solo, dan Trans Jogja. *JURNAL SOSIOLOGI USK: MEDIA PEMIKIRAN & APLIKASI, 19*(1), 103-115. doi:10.24815.jsu.v19i1.45593

Pemerintah Provinsi DKI Jakarta. (2019). *Peraturan Gubernur Provinsi Daerah Khusus Ibukota Jakarta Nomor 67 Tahun 2019 tentang Penyelenggaraan Prasarana Bus Rapid Transit.* Jakarta: Sekretariat Daerah Provinsi DKI Jakarta. Retrieved from https://jdih.jakarta.go.id/dokumen/detail/3395/peraturan-gubernur-nomor-67-tahun-2019-tentang-penyelenggaraan-kawasan-berorientasi-transit.

PT Transportasi Jakarta. (2024). *Laporan Kinerja 2024: Tumbuh Tinggi dan Semakin Efisien.* Jakarta: PT Transportasi Jakarta. Retrieved from https://transjakarta.co.id

PT Transportasi Jakarta. (2025). *Laporan Inovasi Layanan 2025: Digitalisasi Informasi dan Fasilitas Pelanggan.* Jakarta: PT Transportasi Jakarta.

Richard, C., Doré, G., Lemieux, C., Bilodeau, J., & Simon, D. (2015, December). Albedo of Pavement Surfacing Materials: In Situ Measurements. *16th International Conference on Cold Regions Engineering* (pp. 366-377). Salt Lake City (UT): American Society of Civil Engineers (ASCE). doi:10.1061/9780784479315.017

Sorokowska, A., Sorokowski, P., Hilpert, P., Cantarero, K., Frackowiak, T., Ahmadi, K., . . . Bettache, K. (2017). Preferred interpersonal distances: a global comparison. *Journal of Cross-Cultural Psychology, 48*(4), 577-592. doi:10.1177/0022022117698039

UN-Habitat. (2020). *World Cities Report 2020: The Value of Sustainable Urbanization.* Nairobi: United Nations Human Settlements Programme. Retrieved from https://unhabitat.org/sites/default/files/2020/10/wcr_2020_report.pdf

Zhang, L., Aziz, S., Oluwadare, O., Pan, L., Lamorea, S., & Mäkelä, V. (2023). Passenger Perceptions, Information Preferences, and Usability of Crowding Visualizations on Public Displays in Transit Stations and Vehicles. *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (pp. 1-17). Hamburg: Association for Computing Machinery (ACM). doi:10.1145/3544548.3581241