Research Article

# Behavioral Mapping as an Anticipation of Crowding at Manggarai Station

**Zalfa Awwala Qurrota A'yun, Priskila Andia Kristianti, Lintang Ayu Safira, and Ikhwanul Ihsan Armalid***

Psychology, Universitas Negeri Malang, Malang, Indonesia

**Abstract.**

Manggarai Station, designated as the "central station" in 2022, has sparked various conflicts that persist. The congestion at Manggarai Station arises from frequent damage to facilities and infrastructure, hindering optimal usage and impeding passenger movement to the station platforms. This article aims to review the layout of Manggarai Station using behavioral mapping. Behavioral mapping can trace the flow of congestion at Manggarai Station by focusing on the interaction between station users and the space, while also considering behavioral aspects to address the complex congestion issues and promote both mental and physical well-being for station users. Several areas were identified as congestion points at Manggarai Station, including 1) the lower platform area, 2) the upper platform area, 3) the waiting area, and 4) the escalator stairs. Future research is expected to explore further policies at Manggarai Station regarding operational systems, user movement directions, and station expansion to provide insights for policymakers for accurate improvements.

**Keywords:** behavioral mapping, Manggarai Station, crowding

Corresponding Author: Ikhwanul Ihsan Armalid; email: ikhwanul.ihsan.fpsi@um.ac.id

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## 1. Introduction

Manggarai Station is the central railway station located in the capital city of Jakarta. Since its rebranding as the "central station" in 2022, it has triggered various conflicts that continue to date. Various unique posts by netizens on TikTok reflect this, such as @faktagoogle's "An employee resigned to avoid transiting at Manggarai Station: I don't want to go crazy!", [9] "I'm loyal in friendship, but when it comes to transiting at Manggarai, sorry, we go our separate ways," and @NayReza's "Train to Busan." These posts and comments depict Manggarai Station's crowded, uncomfortable, and even horror-like conditions, with no intense interactions as everyone struggles for a spot on the commuter train, leading individuals to avoid the station, even at the cost of their jobs, affecting their psychological state ("draining" mentally).

News articles also frequently report issues at Manggarai Station. Some examples include: 1) "Transiting at Manggarai costs mental health rather than a ticket," where

users feel extended travel times, drained energy, and stress due to the station's congestion [27]; 2) Passengers feeling uncomfortable, exhausted, and nearly falling when scrambling to board the train "like being chased by zombies" at Manggarai Station due to overcrowding [23]; 3) Escalator malfunctions causing many to fall as the escalator suddenly reversed, ultimately leading to the complete shutdown of two crucial escalators at Manggarai Station on February 23, 2024 [25]. The congestion issue at Manggarai Station is primarily due to the rerouting of commuter lines, requiring transfers at Manggarai Station for trips to Bogor and Cikarang [26].

Workers favor commuter trains for their affordability and accessibility. Workers are willing to endure long journeys using commuter trains, which necessitate transfers at Manggarai Station. However, the congestion at Manggarai Station affects passengers' psychological states, causing stress, and increasing both mental and physical fatigue, among other issues. Passenger altercations in trains and around the station are not uncommon.

Manggarai Station's strategic location positions it as the central station, with restructuring efforts beginning in 2022. In 2022, Manggarai Station spanned 100m x 100m, with inadequate infrastructure, leading to passenger accumulation [23]. The station is undergoing renovations until 2025, aiming to be ready as the central station. In 2022, the construction progress was at 60% [28]. However, does the remaining 40% unpreparedness cause ongoing conflicts from 2022 to the present? Why designate it as the central station if it is not yet ready, leading to prolonged conflicts?

The proposed solution is a re-evaluation of the public space arrangement of Manggarai Station through behavioral mapping, accessible to the public and experts in Environmental Psychology. This provides an opportunity to evaluate the efficiency of passenger flow, reducing congestion. Public access to the behavioral mapping created by Manggarai Station authorities could allow experts and researchers to critique spatial organization issues. Why is a reevaluation necessary? The current high passenger density and congestion indicate suboptimal space utilization and movement organization.

## 2. Literature Review

Overcrowding, especially at train stations, is a common phenomenon in large cities. This can cause various negative impacts on individual psychology and behavior, such

as stress, anxiety, and aggression [14]. Several factors can influence the level of density at stations, including [22]:

1. Passenger volume: The number of passengers using a station at a certain time.
2. Station area: The capacity of the station to accommodate passengers.
3. Train frequency: The number of trains departing and arriving at a station at a certain time.
4. Station design: Station layout and passenger flow efficiency.
5. Special events: Events or festivals that attract large numbers of people to the station.

Overcrowding at stations can cause various negative impacts on individual psychology and behavior, such as stress, anxiety, aggression, fatigue, and passenger discomfort [22]. Stress arises as a result of individuals feeling pressured by narrow spaces, noise, and large numbers of people [3]. Then, anxiety arises due to the fear of getting lost, missing the train, or being a victim of crime. Overcrowding can increase aggression as individuals feel frustrated and irritable. Being in a crowd for a long time can make individuals feel tired. Lastly, crowding can cause physical discomfort, such as heat, tightness, and unpleasant odors.

Therefore, a solution is needed to overcome station density. The solutions that can be applied to overcome this are increasing station capacity by expanding the station or building a new station to accommodate more passengers, increasing train frequency by adding more trains to carry more passengers and improving station design by changing the layout. location of stations to be more efficient and facilitate passenger flow, implementing an effective queuing system using clear and organized queue arrangements to avoid confusion and chaos, improving information and signage by providing clear and easy-to-understand information about train schedules, location of facilities, and how to out of the station, as well as improving security to reduce the risk of crime and make passengers feel safer.

As has been explained, overcrowding at stations can have various negative impacts on individual psychology and behavior. Therefore, it is important to implement various solutions to overcome this problem and create a more comfortable and conducive station environment for passengers. One way to overcome this problem is to increase station capacity and improve station design using the behavioral mapping method.

Behavior mapping is a research method used to observe, record, and analyze patterns of human behavior in certain environments [21]. This method can be carried out in various ways, such as direct observation, surveys, and interviews. The results of behavior mapping can be presented in the form of maps, diagrams, or narratives, and can be used to understand various aspects of human behavior, such as movement patterns, social interactions, and space use. Behavior mapping has been implemented at various train stations, which aims to find out how people utilize or accommodate their behavior at a certain time and location at the train station [20]. The results of his research stated that overcrowding has the potential to cause deviant behavior such as pickpocketing and sexual harassment. Behavior mapping is an effective tool for understanding user movement and interaction patterns at stations. This understanding can be used to formulate solutions to overcome congestion at stations, thereby increasing operational efficiency, safety, and user comfort. Behavioral mapping can provide many benefits for overcoming congestion at stations, including:

1. Understand user movement and interaction patterns. Behavioral mapping can help understand how users move through stations, how they interact with each other, and how they use various facilities and services. This understanding can be used to identify areas prone to overcrowding and to design appropriate solutions.
2. Increase operational efficiency. Behavioral mapping can help identify inefficiencies in station operations, such as long queues or long waiting times. This understanding can be used to streamline processes and increase operational efficiency.
3. Improve user safety. Behavioral mapping can help identify potential hazards at stations, such as areas prone to crushing or areas with minimal lighting. This understanding can be used to improve user safety by implementing preventive measures.
4. Increase user comfort. Behavior mapping can help understand what makes users feel comfortable and uncomfortable at stations. This understanding can be used to improve the design and layout of stations to make them more comfortable for users.

## 3. Methods

Based on the nature of the problem, the researchers used a literature review research method, supplemented by primary data through interviews with Manggarai Station users

and secondary data including social media content reviews, indirect observation via official websites, and literature reviews from credible sources to uncover the number of users and the station's area. The literature review involves gathering information from various written works, with theoretical studies relevant to the discussed phenomenon. The data collection tools in this research include written texts from journals and other scientific works, supported by in-depth interviews with users. Content analysis involves an in-depth discussion of the information's content. Researchers also link the issues with relevant theoretical sources, facilitating the understanding of researchers when analyzing their validity through expert opinions, which then serve as research references.

## 4. Results

The researchers collected various data from both primary and secondary sources to support the study. Based on interviews with two subjects who use the train (specifically the commuter line) and must transfer at Manggarai Station, it was confirmed that Manggarai is a transit station. Therefore, passenger accumulation occurs during peak hours, from 06:30-08:00 WIB and 15:00-18:00 WIB. One subject mentioned often being squeezed at Manggarai Station due to the congestion. Additionally, the subject emphasized that "there is no friendship" at Manggarai Station as everyone rushes and competes. The subjects also stressed that commuter line passengers at Manggarai Station must mentally prepare as users are not only young people but also mothers and fathers.

According to secondary data—quantitatively—from commuterline.id (n.d.), at the beginning of 2024, specifically on January 1, 2024, Manggarai Station was filled with 230,000 visitors. This figure is 28%-44% higher compared to the weekend holiday volume of only 160,000 people. Moreover, indonesiabaik.id (n.d.) reports that Manggarai Station is the busiest station in Indonesia, with 726 train journeys passing through daily, and passengers reaching up to 100,000 people per day. As a central station, this number could increase by 2-3 times, causing congestion and passenger accumulation at Manggarai Station.

Crowding is a psychological condition resulting from space exceeding its available capacity. According to ecological theory, congestion occurs due to minimal repairs and unbalanced capacity. The congestion at Manggarai Station can cause commuter line passenger overcrowding, leading to indifference, reduced care among passengers, and viewing others as adversaries. This is evidenced by the post stating, "I'm loyal in

friendship, but when it comes to transiting at Manggarai, sorry, we go our separate ways." Additionally, congestion can cause psychological stress [2], as some commuter line passengers have complained about their mental health due to being at Manggarai Station.

From the presented data, correlated with environmental stress theory: The dense and non-conducive environment at Manggarai Station can cause stressors for its passengers. Environmental stress theory applies stress theory to the environment. Individual stress arises from environmental stimulation exceeding their capacity [8]. Individuals will start defending against stressors by involving psychological roles to prevent stress. However, continuous defense can lead to psychological exhaustion. On the other hand, cognition plays a crucial role in assessing the environment and influencing stress levels. If cognition perceives the environment as threatening or unsafe, stress increases [4]. Therefore, the environment will stimulate stressors causing pressure on individuals, especially in threatening conditions. Passengers are continuously stimulated by the dense environment, squeezing to secure the train for timely arrival at work. Consequently, passengers feel threatened and unsafe due to continuous environmental stress (repeat stress) from congestion and accumulation at Manggarai Station. Hence, it is not uncommon for commuter line passengers to experience stress, resulting in statements like "Better resign than transit at Manggarai" and "Pay for the commuter line with mental health!" [1].

Presentation theory suggests that any level of Presentation, whether low or high, has negative behavioral consequences. Presentation occurs when individuals try to balance themselves with their environment, as a form of habituation to their surroundings, which is assessed as either overstimulating or under-stimulating. From the presented data, high-intensity stimulation is indicated by congestion and passenger accumulation, leading to overcrowding or crowding, thus affecting passengers' psychology.

The stimulus-response theory popularized by Pavlov states that stimulus is an external human stimulus affecting humans, while the response is the behavior formed after the stimulus [11]. In this theory, the environment is the stimulus, and human behavior is the response. Specifically, a crowded environment can trigger fatigue and stress, leading to passenger altercations. A dense environment as a stimulus directly causes angry behavior due to stress. For example, passengers feeling stressed due to overcrowding and accumulation at Manggarai Station might accidentally bump into others in similar stressed conditions, potentially leading to altercations.

A public space must be comfortable, safe, and provide opportunities for individuals to achieve something. Manggarai Station is an "internal" public space managed by the government and accessible to the public. Through public space materials, researchers assess Manggarai Station from the perspective of "Responsive and Friendly Public Space Quality Assessment Standards" [10]:

Table 1: Responsive and Friendly Public Space Quality Assessment Standards.

| EVALUATION STANDARD | CRITERIA | PRESENT/ABSENT AT MANGGARAI STATION | DESCRIPTION |
|---|---|---|---|
| *Permeability* | Accessible (Easy to access) | Absent | Too crowded |
| *Variety* | Creates ambiance | Present | Transitional architectural style from Indische to Colonial |
| *Legibility* | Easy to recognize/ remember | Present | Commuter Train Transit Station & Central Station |
| *Richness* | Sensory experience | Absent | No views or fragrance, only the human touch can be assessed |
| *Personalization* | Privacy | Present | Prayer room, nursing room |
| *Visual Appropriat-ness* | Appearance & Perception | Absent | Too crowded |
| *Robustness* | Continuity of differ-ent activities | Present | Available: food stalls, phone charging stations, etc. |

If viewed from the evaluation table above, Manggarai Station cannot yet be fully assessed as a responsive and friendly public space, as several criteria have not been met, such as Permeability, Richness, and Visual Appropriateness.

On the other hand, the congestion at Manggarai Station occurs due to frequent damage to facilities and infrastructure, hindering their optimal use and impeding passengers' journeys to the station platforms. One example is the escalator; if it continuously breaks down, passengers cannot reach the platforms using it [18]. Consequently, passengers must compete to use the stairs, causing congestion on the stairway.

Based on the problem analysis associated with theory, a solution related to Environmental Psychology is needed, namely a review of the behavioral mapping of Manggarai Station. This review is expected to be accessible to station users or concerned parties.

Through behavioral mapping, it is hoped to reduce congestion and overcrowding at Manggarai Station by providing opportunities for improvement and efficiency in the flow of commuter train passengers entering and exiting the station to prevent passenger accumulation in the station area.

## 5. Discussion

The congestion at Manggarai Station creates an uncomfortable atmosphere due to the high volume of visitors daily, as Manggarai Station has now become a transit/central station, coupled with inadequate facilities. This situation adversely affects the psychological development of individuals involved. Negative psychological conditions generally arise in crowded and congested environments, leading to stress and various negative social activities such as theft, lost children, and other criminal actions. Physical and psychological issues in crowded situations typically include increased blood pressure, stress, and psychosomatic symptoms [16].

The congestion problem at Manggarai Station is detrimental in all aspects, especially to each individual's psychological condition. If this issue is not promptly addressed, it will lead to complex and prolonged mental disorders [16]. Therefore, behavioral mapping is a viable solution to address the congestion problem at Manggarai Station. Behavioral mapping can track the flow of congestion at Manggarai Station as it focuses on the interaction between station users and the space, considering behavioral aspects to solve the complex congestion problem at Manggarai Station, aiming for both psychological and physical well-being for station users (Fitria, 2018). The detailed issues in each area of Manggarai Station and the solutions proposed by the researchers are outlined in the table below.

Moreover, the policy regarding the establishment of transit at Manggarai Station is deemed inappropriate at this time. PT KAI should consider the readiness of Manggarai Station as a central station. Although 60% of the station's development was completed in 2022, the remaining 40% still causes widespread and ongoing conflicts, such as congestion that results in discomfort for commuter train passengers. It would be beneficial for future research to further explore the policies at Manggarai Station concerning operational systems, user movement directions, and station expansion. This would provide policymakers with insights to make accurate improvements, thereby making the station fit to serve as a central station and a transit hub to other stations.

TABLE 2: Issues in each area of Manggarai Station and the solutions.

| Area | Issues | Behavior Setting | Psychological Conditions | Solutions/ Recommendations |
|---|---|---|---|---|
| Lower Platform Area | Based on indirect observation through YouTube, the lower platform area at Manggarai Station is quite narrow with a high volume of users every day. | The narrow lower platform space causes users to crowd together while waiting for the train to arrive. | A layout with ample and tidy space allows users to move more freely. In this case, users have limited movement space, which can lead to stress due to feeling cramped. | Since Manggarai Station serves as a transit or central station, the station should expand the platform area to match the volume of Manggarai Station users. |
| Waiting Area (Seating Area) | Indirect observation through YouTube shows that the number of waiting seats is insufficient. | Users stand while waiting for the train due to the mismatch between the number of waiting seats and the volume of station visitors. | The mismatch between the volume of visitors and the number of waiting seats forces users to stand while waiting for the train, causing extra fatigue for Manggarai Station users. | This issue can be addressed by increasing the number of comfortable waiting seats along the platform. |
| Escalator Area | According to a survey through interviews with current users of Manggarai Station and supported by news data from reliable sources, the escalator, which should be a main facility for users to easily access the platforms, often malfunctions, and the escalator is just a staircase escalator. | The frequently malfunctioning escalator and staircase escalator make it difficult for users to reach the platform, especially if they are in a hurry. This often causes congestion in the escalator area since there is only one escalator per platform. | Congestion in the escalator area induces significant stress due to the high stressor of crowding during peak work hours. | Regular maintenance and daily checks on the operational feasibility of escalators are necessary. Additionally, the staircase escalator could be replaced with a flat escalator/travelator to make it easier for users to quickly reach the platform. It would also be better to add more escalators per platform to avoid congestion during peak hours. |
| Upper Platform Area | Similar to the issue in the lower platform area, the upper platform area at Manggarai Station is also quite narrow with a high volume of users every day. This was revealed through indirect observation on YouTube. | The narrow upper platform space, similar to the lower platform, causes users to crowd together while waiting for the train to arrive. | A layout with ample and tidy space allows users to move more freely. In this case, users have limited movement space, which can lead to stress due to feeling cramped. | Since Manggarai Station serves as a transit or central station, the station should expand the platform area to match the volume of Manggarai Station users. |

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