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User Preferences for Comfortable and Functional High-Speed Railway Stations

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Abstract.

This study examines user preferences for comfortable and functional high-speed train station designs using a qualitative method with an exploratory approach, based on Google Review analysis. The purpose of this research is to explore the design elements and facilities considered important by the public and to understand their impact on the user experience. Data were analyzed using frequency distribution methods to identify main categories, such as design, facilities, accessibility, safety, circulation, and vegetation. The results show that design is the dominant factor (22.22%), followed by facilities (15.87%) and maintenance (14.29%). Vegetation has the lowest contribution (1.19%), despite supporting sustainability. These findings highlight the importance of aesthetically pleasing design, adequate facilities, and infrastructure maintenance in enhancing user comfort. In conclusion, this study emphasizes that future high-speed train station designs should prioritize responsive and holistic approaches that support efficiency, user-friendliness, and sustainability. These results are expected to contribute to the development of better public transportation systems in the future.

Keywords: User Preferences, High-Speed Train Stations, Station Design, Public Facilities.

1. Introduction

High-speed rail is increasingly recognized as a primary solution for enhancing mobility in both urban and inter-city contexts. Beyond offering travel speed and efficiency, high-speed rail also stimulates the development of surrounding areas, positioning stations not only as transit nodes but also as social, economic, and cultural centers. The design and layout of high-speed train stations therefore play a crucial role in ensuring user comfort and optimal experiences. Elements such as user preferences, station design, and public facilities must be carefully integrated to create efficient, inclusive, and sustainable transportation hubs (Cervero et al., 2002; Salat & Ollivier, 2017;Taufik 2022).

Previous research has highlighted the significance of accessibility, aesthetics, and sustainability in station design. For example, Nasri & Zhang (2014) emphasized accessibility as a determinant of inclusivity, while Delbosc & Currie (2011) underscored the importance of aligning design with user perceptions. Studies by Lee et al. (2004) and Givoni & Rietveld (2014) examined the role of high-speed rail stations in urban integration and regional competitiveness, while Milewicz et al(2023) discussed sustainability principles in railway infrastructure. Although these studies contribute

valuable insights, many of them focus primarily on technical, economic, or environmental perspectives, often overlooking direct user-based evaluations. This creates a research gap in understanding how public preferences can be systematically incorporated into station design.

To address this gap, this study adopts a user-centered approach by analyzing online reviews, which reflect spontaneous public perceptions of high-speed train stations. Unlike conventional surveys or technical evaluations, user-generated data provide contextual insights into comfort, safety, aesthetics, accessibility, and supporting facilities. This approach allows for identifying mismatches between planned design intentions and the actual experiences of users, thereby offering more human-centered evaluation criteria.

The purpose of this research is to explore public preferences for comfortable and functional high-speed train stations through the analysis of Google Reviews. A qualitative method with an exploratory approach was employed, using frequency distribution analysis to identify key categories such as design, facilities, accessibility, safety, circulation, and vegetation. By combining user-based data with a structured analytical framework, this study aims to generate practical recommendations for responsive, inclusive, and sustainable high-speed train station designs, particularly in the context of Indonesia's rapidly developing rail infrastructure.

2. Literature Review

The design of high-speed train stations is the result of integrating functionality, aesthetics, and sustainability. Optimally designed stations not only create physical comfort and operational efficiency but also strengthen the visual image of the surrounding area (Toh, Ang, & Seng, 2020). This concept aligns with the Transit-Oriented Development (TOD) approach, which positions stations as integrated urban activity hubs connected to supporting functions such as residential, commercial, and public spaces (Calthorpe, 1993; Wijayanti 2014). In the development of modern stations, attention to environmental sustainability is also increasingly prominent, particularly through the use of environmentally friendly materials and efficient energy systems (Staniewska et al, 2023).

Public preferences for station environments are significantly influenced by various factors, including comfort, accessibility, safety, and the quality of supporting facilities. A study by Soza-Parra (2019) indicates that the public tends to prefer stations with clear spatial layout, comfortable waiting areas, and good connectivity with other modes of transportation. Aesthetics are also an important factor in user perception, especially when stations are designed as architectural icons of the city (Zhang et al, 2020; Rukamana 2024). Attractive visual design can increase a sense of belonging and satisfaction with public transportation facilities.

Based on a study by UNIKOM, Arifin Afandi Dasuki (2007) emphasizes that the design of railway stations—such as Bandung Central Station—which prioritizes the integration of local identity, spatial function, and architectural structures that are responsive to the surrounding environment can strengthen users' attachment to the station as a public space. This supports the concept of participatory design that integrates the aesthetic value of the area and service functions for users.

To gain a broader understanding of public perception, digital data such as user reviews on the Google Reviews platform are a valuable source of information. According to He, Zha, and Li (2020), digital reviews can reveal design elements that are considered successful as well as those that need improvement. Using a sentiment analysis approach,

these reviews can be classified into positive and negative categories, making it easier to identify the main themes that directly influence the user experience.

When evaluating design elements based on public perception, the Human-Centered Design (HCD) approach serves as a relevant theoretical framework. Norman (2013) emphasizes the importance of placing user needs at the core of the design process, through the identification of needs, the creation of contextual solutions, and feedback-based evaluation. This approach encourages the creation of station designs that are not only technically functional but also adaptive to the real needs of the community.

By combining architectural design theory, an understanding of user preferences, and digital data-based analysis methods, this study provides an important theoretical foundation for supporting the development of high-speed train station designs that are more inclusive, efficient, and sustainable. Understanding the design elements that contribute to a positive user experience is key to creating public transportation infrastructure that is architecturally and socially superior.

The objective of this research is to identify and analyze user preferences regarding aspects of comfort and functionality in high-speed railway station design, in order to provide design recommendations that are more responsive to user needs and support the quality of public transportation services in the future.

3. Method

This study applies a qualitative method with an exploratory approach, which is considered appropriate to explore and understand user preferences for comfortable and functional high-speed train stations. The exploratory approach allows researchers to gain new insights into users' experiences, perceptions, and expectations regarding station design and facilities. As emphasized by Budiasih (2014) and Creswell (2007), qualitative exploratory research aims to reveal meaning and develop a deep understanding of phenomena that are not yet widely studied, making it suitable for capturing the perspective of users directly.

a. Data Collection Techniques

Data for this study were collected through two main sources:

1. Online Questionnaire.

   An online questionnaire was distributed via Google Form containing open-ended questions addressed to individuals who had visited Halim High-Speed Railway Station and/or Padalarang High-Speed Railway Station. The link was shared through social media using an accidental sampling technique, enabling respondents to participate voluntarily without restrictions on age, occupation, or educational background. A total of 53 respondents were successfully recruited, providing detailed perceptions regarding station comfort, accessibility, and design elements.

2. User Reviews on Google Maps

   Additional data were obtained from publicly available user reviews of Halim and Padalarang High-Speed Railway Stations on Google Maps. These reviews provide authentic reflections of user experiences, particularly concerning facilities, accessibility, aesthetics, and comfort. Incorporating this source strengthens the validity of the findings by complementing the questionnaire data with natural, unprompted user feedback.

b. Data Analysis Techniques

The collected textual data—both from the questionnaires and user reviews—were analyzed using qualitative content analysis. Following Creswell (2007), the analysis was conducted through three sequential coding stages:

1. Open Coding: Identifying recurring keywords and concepts emerging from user statements.
2. Axial Coding: Grouping related keywords into broader categories, which were validated through peer discussions to ensure consistency and reliability.
3. Selective Coding: Establishing relationships between categories to uncover patterns of user preferences regarding station design and facilities.

To illustrate the relative importance of each category, the results were presented in the form of frequency distribution diagrams, highlighting which elements appeared most frequently and were considered significant by users. This analysis framework ensures that the findings not only reflect user perceptions but also provide a systematic basis for formulating design recommendations for more inclusive, functional, and sustainable high-speed train stations in Indonesia.

4. Results and Discussion

The initial step of the content analysis was open coding, which identified recurring keywords and themes from respondents' answers regarding user preferences for comfortable and functional high-speed train stations. For example, from the responses, frequently mentioned words and phrases included "spacious," "modern," "clean," and "comfortable." These words reflect the emphasis on physical station design and functional facilities that directly affect user satisfaction. According to Cresswell (2007), open coding is essential in qualitative research because it allows researchers to systematically capture emerging themes from unstructured responses.

An example of user feedback that illustrates these findings can be seen in the following quote:

"The station is very spacious. There are many shops and food and beverage stalls. The toilets are clean and there is a prayer room on the ground floor. There is a special waiting room for first-class passengers. There are no shade trees in the outdoor area, so it feels hot. It would be better to have live plants or ornamental plants inside the station to make the atmosphere fresher." (Account: Nadia Tenrigangka)

Another respondent emphasized both facilities and layout:

"Halim High-Speed Train Station is clean, spacious, modern, and comfortable. The car parking area is very large. On the first floor, there are restrooms, clothing booths, ATMs, and ticket printing areas. On the second floor, there are waiting areas, food and beverage booths, and check-in gates to the platforms. The Whoosh train tracks consist of two main platforms: platform 1 for arrivals and platform 2 for departures. Overall: 8/10." (Account: Lintang Wisesa)

From these examples, two main categories emerged. The physical category consists of design and facility aspects such as waiting rooms, parking areas, restrooms, and food stalls. Meanwhile, the non-physical category consists of environmental comfort elements, such as the absence of vegetation in the outdoor area, which respondents suggested could be improved by adding greenery. This aligns with previous studies indicating that station design and facilities are primary determinants of user satisfaction (Givoni & Rietveld, 2014). Moreover, the lack of green infrastructure reduces environmental comfort, whereas the integration of vegetation has been shown to improve user experience and sustainability in public facilities (Milewicz, 2023).

These findings demonstrate that while physical aspects of high-speed rail stations—such as spacious layouts and adequate facilities—are generally well-received, there is a clear need to enhance non-physical aspects, particularly environmental comfort. By combining functional design with greenery and aesthetic elements, stations can better align with principles of human-centered and sustainable design (Nasri & Zhang, 2014).

Table 1. Results of axial coding for a comfortable and functional high-speed railway station

Subcategory	Category
Poor accessibility (1)	Accessibility (12)
Good accessibility (2)	
Poor accessibility (9)	
Good design (31)	Design (38)
Spacious (3)	
Modern (4)	
Innovative (1)	
Few SME tenants (1)	Facilities (26)
Poor Wi-Fi (1)	
Disability-friendly (1)	
Child-friendly (1)	
Poor facilities (12)	
Good facilities (7)	
Many food tenants (3)	
Good security (5)	Security (5)
Complete facilities (15)	Facility completeness (15)
Poor orderliness (1)	Orderliness (4)
Fast (1)	
On time (2)	
Difficult toll access (1)	Connectivity (10)
Good connectivity (9)	
Clean (9)	maintenance (24)
Good maintenance (15)	
Good service (9)	Service (9)
Insufficient parking (1)	parking (3)
Difficult parking (2)	
Poor lighting (1)	Lighting (1)
Poor stair access (1)	Circulation (5)
Poor circulation (2)	
Insufficient elevators (2)	

Comfortable (4) Good atmosphere (9)	Atmosphere (13)
Insufficient vegetation (2)	Vegetation (2)

The results of the analysis using distribution analysis in Table 1 show that user preferences for aspects of high-speed train stations tend to be influenced by factors such as design, facilities, accessibility, safety, connectivity, maintenance, service, parking, lighting, circulation, atmosphere, and vegetation. The most dominant factor is design with a frequency of 38 (22.22%), followed by facilities at 26 (15.87%). Maintenance follows with 24 (14.29%) and atmosphere with 13 (7.74%). Meanwhile, vegetation is the category with the lowest frequency, at 2 (1.19%). The results of the analysis of the distribution of station aspects can be seen in Diagram 1.

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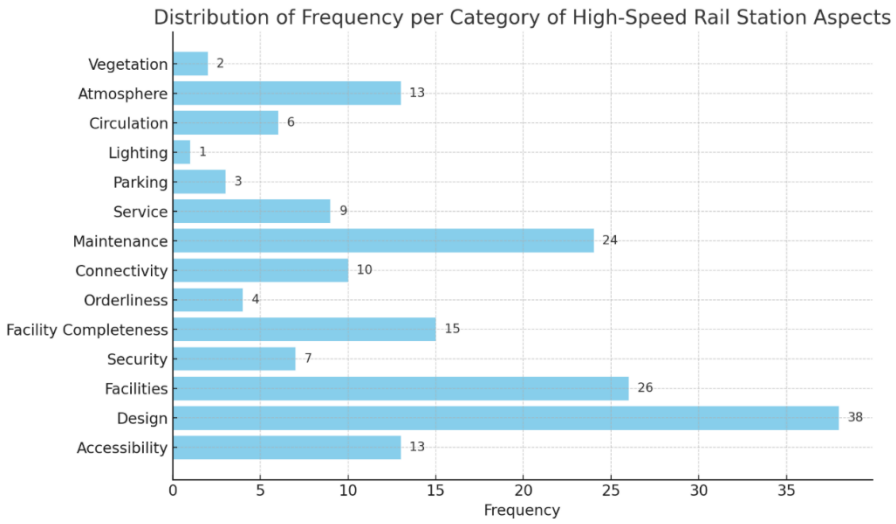

Diagram 1. Frequency Distribution Analysis of High-Speed Railway Station Aspect Categories
Source: Personal Analysis Results

The results of the frequency distribution analysis (Table 1) show that user preferences for high-speed train stations are influenced by multiple factors, including design, facilities, accessibility, safety, connectivity, maintenance, service, parking, lighting, circulation, atmosphere, and vegetation. Among these, **design emerged as the most dominant factor** with a frequency of 38 mentions (22.22%). This finding indicates that users highly value architectural quality, spatial layout, and aesthetics in shaping their overall station experience. Previous studies confirm that design strongly affects perceptions of comfort and the identity of transport infrastructure, often making stations symbolic urban landmarks (Givoni & Rietveld, 2014).

The second most significant category is **facilities**, with 26 mentions (15.87%). Users emphasized

the importance of waiting rooms, restrooms, food stalls, ATMs, and other supporting facilities. The adequacy of these elements plays a critical role in enhancing the functional quality of stations, consistent with findings by Delbosc and Currie (2011), who argued that supporting facilities directly influence user satisfaction and the attractiveness of public transport hubs.

Maintenance also emerged as a priority, with 24 mentions (14.29%). Cleanliness, upkeep of infrastructure, and the condition of supporting facilities were repeatedly highlighted in user feedback. This aligns with Milewicz (2023), who emphasized that maintenance is a cornerstone of sustainable station management, ensuring long-term usability and positive user experiences.

In addition, **atmosphere** was mentioned 13 times (7.74%), showing that users also consider intangible aspects such as spatial comfort, ambience, and crowd management. Environmental psychology literature suggests that spatial atmosphere directly influences emotional well-being and satisfaction in public spaces (Mehrabian & Russell, 1974).

Finally, **vegetation received the lowest frequency**, with only 2 mentions (1.19%). While it appears to be a minor concern, the lack of greenery was pointed out by some respondents as reducing thermal comfort in outdoor areas. Previous studies highlight that integrating vegetation into transport infrastructure not only improves microclimate conditions but also supports sustainability principles (Salat & Ollivier, 2017).

Overall, these results suggest that while users prioritize tangible aspects such as design, facilities, and maintenance, there is also a growing recognition of non-physical factors such as atmosphere and vegetation. This indicates the importance of adopting a **holistic design approach** that balances functional, aesthetic, and environmental elements in developing future high-speed train stations.

4.1. Maintenance Factor Category Analysis

Maintenance factors at high-speed train stations are very important for creating a comfortable, safe, and attractive environment for users. In this analysis, two subcategories related to maintenance were found, namely cleanliness (9 ratings) and good maintenance (15 ratings).

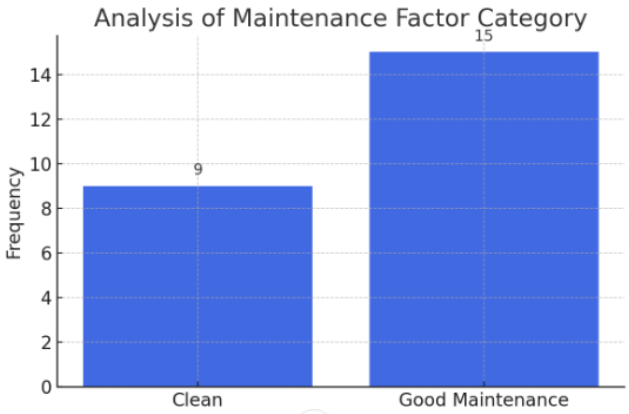

Diagram 2. Frequency Distribution Analysis of Maintenance Categories
Source: Personal Analysis Results

The results of the frequency distribution analysis (Diagram 2) indicate that the **maintenance category** is divided into two subcategories: *cleanliness* (9 mentions; 37.5%) and *good maintenance* (15 mentions; 62.5%). These findings confirm that the quality of station upkeep is a significant concern for high-speed train users, as it directly affects both physical comfort and perceptions of safety. Mohammadi (2019) emphasize that effective maintenance practices contribute to passenger comfort and enhance the

perceived quality of station services.

The **cleanliness subcategory** shows that nine respondents considered the stations to be clean and well-organized, creating a positive user experience, particularly in crowded public spaces. Cleanliness is an important factor in shaping trust and comfort, as Norman (2013) argues that a well-maintained service environment signals professionalism and user-centered management.

Meanwhile, the **good maintenance subcategory** (15 mentions) highlights user appreciation for the proper upkeep of facilities such as restrooms, seating, and platforms. This result aligns with Zhang et al (2020), who found that cleanliness and infrastructure maintenance are strongly correlated with user satisfaction, since they enhance comfort and ensure safety within station areas.

Overall, these findings demonstrate that high-speed train stations in Indonesia have been successful in meeting public expectations in terms of hygiene and facility maintenance. This implies that **sustaining and consistently improving maintenance practices is essential for reinforcing positive user experiences** and ensuring long-term trust in high-speed rail services.

4.2. Analysis of Facility Factor Categories

The results of the analysis show that facilities are an important determinant of user comfort at high-speed train stations. Based on user responses, three subcategories emerged: insufficient MSME tenants (1 mention; 33.3%), insufficient Wi-Fi (1 mention; 33.3%), and disability-friendly facilities (1 mention; 33.3%). These findings highlight that while core facilities are generally functional, users expect more diverse and inclusive supporting facilities. According to Staniewska (2023), stations equipped with additional services such as commercial areas and digital access significantly enhance user comfort and satisfaction.

The presence of MSME tenants is not only related to user convenience but also contributes to the local economy. One respondent noted the limited availability of MSME vendors at Padalarang Station compared to Halim. This supports Calthorpe's (1993) argument that integrating economic and social functions in public spaces is essential to foster a community-oriented and vibrant environment. Thus, expanding MSME opportunities in stations can create a more engaging and lively atmosphere.

Field observations indicate that facilities at KCIC Padalarang Station are relatively complete, including toilets, prayer rooms, and food stalls, although not as extensive as Halim Station. However, challenges remain, such as narrow station exits and limited food tenant options. These findings resonate with Guo, Li, and Song (2020), who emphasized that spatial adequacy and service diversity strongly affect passengers' perceptions of comfort and usability.

Further confirmation comes from a user review stating: "The station is not as big as Halim Station, but all the facilities work well, including clean toilets and a prayer room. The parking area is not too spacious, and the exit is relatively small. Food and minimarket options are limited compared to Halim" (Bagus, 2024). This aligns with Lee (2004), who argue that accessibility and diversity of amenities are central to shaping positive travel experiences in transport hubs.

Overall, the findings suggest that facilities in high-speed train stations already meet basic functional standards but require further improvements in terms of diversity, inclusivity, and accessibility. Prioritizing Wi-Fi, MSME integration, and disability-friendly features will not only enhance user satisfaction but also strengthen the station's role as a multifunctional public space.

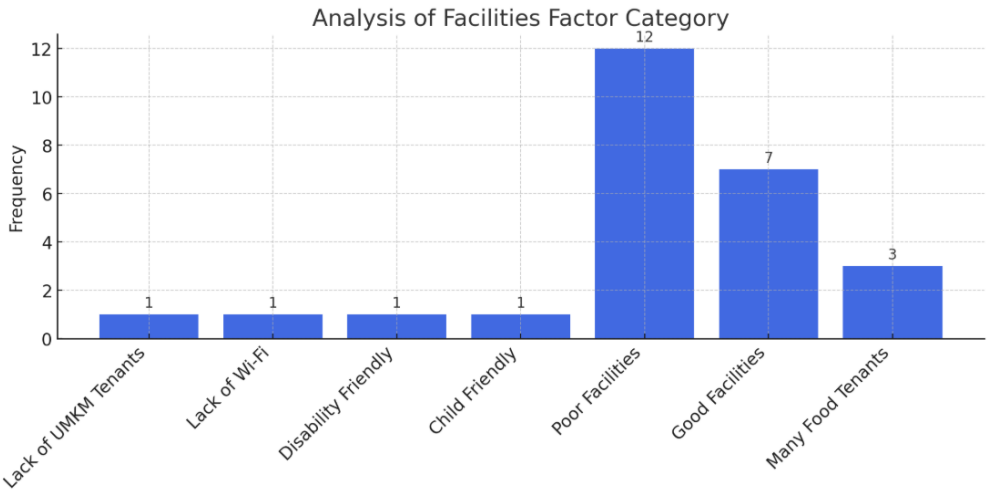

Diagram 3. Frequency Distribution Analysis of Facility Categories
Source: Personal Analysis Results

Diagram 3 shows that better Wi-Fi coverage is essential, especially in today's digital age, where connectivity is one of the main requirements in public spaces such as stations. Internet access can support users' activities while waiting, such as working, communicating, or obtaining real-time travel information. Staniewska (2023) emphasize that digital facilities such as Wi-Fi contribute significantly to the perception of comfort and enhance the added value of public transportation services.

Additionally, it is important to consider accessibility aspects, where adequate access—such as ramps, elevators, guide paths, and accessible restrooms—must be an integral part of station design. Spaces designed with high accessibility not only reflect inclusivity but also enhance overall user satisfaction. Calthorpe (1993) states that public space design should accommodate the diversity of its users and support equitable access for all segments of society, including people with disabilities.

Meanwhile, 12 respondents noted poor facilities, indicating that there are still aspects that need improvement, such as the comfort of the waiting room, the cleanliness of the facilities, or the availability of other supporting elements. A study by Norman (2013) emphasizes that the quality of the physical environment significantly influences users' perceptions of the service: small details such as cleanliness, lighting, and basic facilities can have a major impact on overall comfort and satisfaction. Therefore, regular evaluations and continuous improvements to the facilities are necessary to ensure they remain in line with the comfort standards expected by users.

4.3. Analisis of Design Factor Category

The design of high-speed train stations plays a central role in shaping a positive user experience. Based on the analysis, 31 respondents emphasized that good design is one of the most influential factors affecting their comfort. Good design integrates aesthetic and functional elements, including efficient layout, intuitive navigation, comfortable spatial arrangements, and adequate lighting. Such design principles ensure that stations are not

only visually appealing but also user-friendly and supportive of smooth passenger circulation.

These findings align with Calthorpe (1993), who highlights that integrated and human-centered design can foster urban environments that are both efficient and enjoyable. Similarly, Zhang et al (2020) argue that the design quality of public transportation facilities directly impacts user comfort and satisfaction, as the physical environment sets the tone for the overall service experience.

User feedback further illustrates these perspectives. According to CV. Trirasa, the station is “clean and has a futuristic, luxurious feel,” representing the image of a modern high-speed rail facility. However, the user also expressed concern about the sustainability of this condition, pointing out that many public facilities in Indonesia decline over time due to lack of maintenance. Another user, Aaron Hasibuan, highlighted the station’s spaciousness and integration with other transportation modes, such as the Whoosh feeder train and long-distance rail. Despite these positive aspects, he noted inadequate lighting on the feeder train platform, describing it as “extremely dim” compared to the brightness of the upper level.

Overall, the results indicate that users appreciate the modern and luxurious station design, which contributes to comfort and ease of use. However, they also stress the importance of consistent quality management, particularly in maintaining design standards and addressing technical shortcomings such as lighting. This confirms Norman’s (2013) argument that even small design details significantly shape user perceptions and can determine whether public facilities remain trusted and appreciated over the long term.

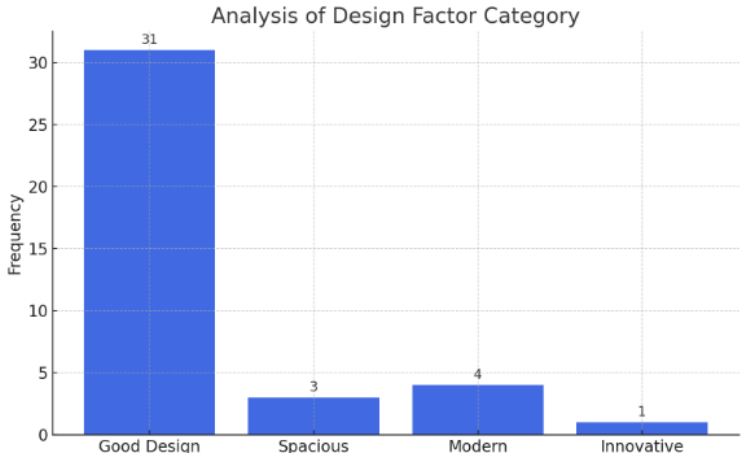

Diagram 4. Frequency Distribution Analysis of Design Categories
Source: Personal Analysis Results

Other subcategories found were spacious (3 people), modern (4 people), and innovative (1 person). Diagram 14 shows that most users rated the design of Halim High-Speed Railway Station and Padalarang High-Speed Railway Station as good, with 30 ratings, followed by the subcategories modern (4 people), spacious (3 people), and innovative (1 person). This indicates that the design of high-speed train stations that are responsive to user needs, such as Halim High-Speed Train Station

and Padalarang High-Speed Train Station—in terms of spacious layout, visual aesthetics, and technology integration—plays a significant role in shaping perceptions of comfort and efficiency. Spacious designs create an open feel and support free movement of visitors, while modern and innovative designs indicate that the stations have adopted contemporary design elements, the use of environmentally friendly materials, and the latest technology in spatial layout and service. According to Toh et al. (2020), good station architecture design must consider operational efficiency, physical comfort, and aesthetic appeal simultaneously. This aligns with Norman's (2013) concept of Human-Centered Design, which emphasizes the importance of designing spaces that are not only functional but also capable of addressing users' emotional and psychological needs. Furthermore, innovative design can contribute to shaping the identity of a city and become a tourist attraction in its own right (Calthorpe, 1993).

5. Conclution

This study concludes that public preferences for high-speed train station design are primarily influenced by design (22.22%), facilities (15.87%), and maintenance (14.29%), with design emerging as the most dominant factor reflecting the importance of aesthetics, layout, and physical comfort. While other factors such as atmosphere, accessibility, safety, connectivity, services, parking, lighting, circulation, and vegetation also contribute, their roles are less significant, with vegetation being the least prioritized (1.19%). These findings emphasize the need for stations to integrate functional and aesthetic design, provide comprehensive facilities, ensure consistent infrastructure maintenance, and guarantee user safety through adequate lighting, surveillance, and circulation systems. Moreover, inclusive accessibility and integration with other modes of transportation should be prioritized to enhance overall comfort and efficiency. By incorporating these elements, future high-speed rail station designs can become more user-friendly, sustainable, and responsive to community needs.

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