Redesign Tanah Abang Station with Architectural Wayfinding Approach in Central Jakarta

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Abstract. Jakarta is a high-density city, most people in Jakarta are from suburban around Jakarta. They come to Jakarta with public transportation, one of the public transportations is a commuter line. The commuter line arrives at many stations in Jakarta, such as Tanah Abang Station. Tanah Abang Station is the densest station in Jakarta. However, at present the Tanah Abang Station violates the Minister of Public Works Regulation standard on the accessibility of station passengers, 85% of passengers say the problem and problem that is often mentioned is circulation problems and based on the Development Master Plan book, there will be development at Tanah Abang Station ending in 2020. So that the Tanah Abang Station needed a redesign. In designing, it must solve the existing problems, namely circulation. In the world of architecture, circulation in complex buildings is arranged in architectural wayfinding, ability to identify one’s location and arrive at destinations or navigate in spatial environments, 12 components of circulation in architectural wayfinding are solutions to existing problems, and Tanah Abang Station only has 4 of 12 components. At least these components are directly proportional to the inadequate circulation at the Tanah Abang Station so that in the redesign of the Tanah Abang Station, use architectural wayfinding approach.

Keywords: Station, Commuter Line, Architectural Wayfinding, Legibility

1. Introduction

Jakarta is the most densely populated city in Indonesia. Based on Badan Pusat Statistik on 2015, Jakarta has population density 15,328 per km². It happened because Jakarta is a central business, so many migrants from suburban around Jakarta come to this city. Most of them use a public transportation, for example commuter line.

Based on data released by PT. KAI in 2018, the largest number of commuter line station passengers was Tanah Abang station, with 73,413 people / day. One factor for the number of passengers at Tanah Abang station is that Tanah Abang station is a transit station from the cities of Bogor, Serpong and Tangerang. In addition, the largest trading center, Tanah Abang Market, is located east of the Tanah Abang station. This makes Tanah Abang station always crowded with visitors every day. Based on the results of passenger reviews at Tanah Abang Station, most of which are 85% stated problems at Tanah Abang station (40% stated that Tanah Abang station was a crowded station /
congestion of passengers, 12% stated that access was not according to capacity, 10% stated that circulation was poor, difficult and chaotic or lack of flow management, 8% stated that they were prone to falls / accidents / dangers, 7% stated that they were uncomfortable, 7% stated that they did not meet their needs, and 1% stated that they had no access to disabilities. 13% of reviewers expressed suggestions (11% suggested resetting the Tanah Abang station, and 2% suggested getting off at another station). Only a small proportion, namely 2%, praised the Tanah Abang station by saying that the Tanah Abang station had good connectivity. The biggest problems at Tanah Abang station are about the lack of passenger accessibility which causes congestion / congestion of passengers.

This passenger density causes Tanah Abang station not to meet accessibility standards based on the Peraturan Menteri Pekerjaan Umum No. 03 / PRT / M / 2014. Passenger accessibility minimum standards for stations are at standard D (can run with normal currents, but must frequently change positions and change speeds because the opposite flow of pedestrians has the potential to cause conflict. This standard still produces a comfortable threshold flow for pedestrians but has the potential to arise. pedestrian contact and interaction. Pedestrian path area ≥ 1.2–2.1 m² / person with pedestrian flow> 33-49 people per minute per meter). While Tanah Abang Station existing at standard F (walking at a speed of flow is very slow and limited due to frequent conflicts with pedestrians clockwise or counterclockwise. Standard F is not convenient and is not in accordance with the capacity of sidewalk space. Wide walkways feet <0.5 m² / person with varying pedestrian flow). Tanah Abang Station is also mentioned in Studi Rencana Induk Transportasi JABODETABEK book, with project code PR19e where there will be construction at Tanah Abang Station which will be completed in 2020. The mismatch of station passenger standards and construction makes the Tanah Abang station reorganized to reach standards. To increase the accessibility to meet the standards, in architectural science there is architectural wayfinding.

Based on the thesis entitled Spatial Familiarity As a Dimension Of Wayfinding by Güler Ufuk Doğu Demirbaş. Wayfinding in architectural or architectural wayfinding is formed due to the increasingly complex structure of a building so that user objectives are increasingly diverse and user capacity increases, such as in public transport buildings and urban development. The diversity of goals makes the need for circulation patterns for different attainments. According to Perry Kuklin, if circulation and access are inadequate, it will hamper road flow and result in congestion. The build-up can also increase the hazard for psychological health and safety. Therefore, architectural wayfinding is aligned as a solution to the problems that exist at the Ground station.

Architectural wayfinding has three components, namely creating a clear circulation design, integrating communication systems, and clear and coherent articulation between interior and exterior spaces. To answer the problems at Tanah Abang station regarding the lack of circulation and accessibility, a clear circulation design component is a suitable component to be applied to the Tanah Abang station. Based on these components, Tanah Abang station only has 4 out of 12 elements or the equivalent of 30%. The few elements owned by the Tanah Abang station make it necessary to rearrange the Tanah Abang station with an architectural wayfinding approach so that it can answer problems that exist at the current Tanah Abang station, and are expected to improve circulation, accessibility and passenger safety at Tanah Abang station.
2. The Methodology

The research method is descriptive quantitative, which describes the circumstances that occur factually and then processed using numerical.

2.1 Object of research

The object is Tanah Abang Station.

2.2 Method of collecting data

The method used to collect data is observation. Observation is the activity of an object with the intention and then thinking of knowledge about phenomena and knowledge that have been known beforehand, to obtain the information needed to continue a study. The observation was carried out using Wayfinding Architecture indicators based on the journal Design Resources: DR-01 Wayfinding Architecture by Sarah Hunter, Ph.D., M.Arch.

3. Result and Discussion

3.1 Existing Tanah Abang Station

Figure 1. Existing Tanah Abang Station

Tanah Abang Station currently has two entrances, namely north and south. The north entrance with overpass and access to DKI Jakarta Government Office Distric. The south entrance with access to the Integrated Pedestrian Bridge and access to Tanah Abang Market. There are two stairs on each platform and one escalator. Tanah Abang station passanger are quite hectic, especially in peak hour, at 06.00-08.00 am, most cause by office employees, except Monday and Thursday the passanger are office employees and traders, and at 4.00-8.00 pm, most cause by the office employees and traders who have finished shopping at Tanah Abang Market. Based on architectural wayfinding analysis, Tanah Abang Station only has 4 elements out of 12.
From this data it is evident that the Tanah Abang station has a small percentage of architectural wayfinding at the station (66.7%). Thus, the minimum percentage of architectural wayfinding at the station is 66.7%.

3.2 Architectural Wayfinding Analysis

Case study of architectural wayfinding are from station in Indonesia, and overseas, 16 railway station in total. There are 10 commuter station in Indonesia (Karet Station, Palmerah Station, Cisauk Station, Sudirman Station, Cikini Station, Juanda Station, Manggarai Station, Jakarta Kota Station, Cakung Station, and Klender baru Station), and 6 overseas station (Malmö Central Station in Sweden, Løren Metro Station in Norway, Cermak McCormick in United States, Newport Station in England, Miaoli Station in Taiwan, and Montpelier Station in France).

Table 1. Architectural wayfinding analysis in existing Tanah Abang Station

| Objective | Components | Elements | Object |
|-----------|------------|----------|--------|
| II. Creating legible circulation systems design | A. External and internal circulation system | II.A.1. Design concept (paths, markers, nodes/intersections, edge/links) | - |
| | | II.A.2. Roadways | - |
| | | II.A.3. Parking | - |
| | | II.A.4. External path and walkways | - |
| | | II.A.5. Entrances and exits | - |
| | | II.A.6. Connection to mass transportation | ✓ |
| | B. Level change devices | II.B.1. Elevators | - |
| | | II.B.2. Staircase | ✓ |
| | | II.B.3. Escalator | ✓ |
| | C. Internal transportation | II.C.1. Mobility aids | - |
| | | II.C.2. People movers | - |
| | | II.C.3. Fixed rail system | ✓ |
| | | Total | 4 |
| | | Percentage | 30 |

Table 2. Architectural wayfinding analysis

| Elements of Architectural Wayfinding in creating legible circulation system design | Karet Station | Palmerah Station | Cisauk Station | Sudirman Station | Cikini Station | Juanda Station | Manggarai Station | Jakarta Kota Station | Cakung Station | Løren Central Station | Løren Metro Station | Cermak McCormick | Newport Station | Miaoli Station | Montpelier Station |
|-------------------------------------|--------------|----------------|----------------|-----------------|---------------|--------------|------------------|--------------------|--------------|--------------------|----------------|---------------|----------------|---------------|----------------|----------------|
| II.A.1. Design concept (paths)     | ✓            | ✓             | ✓              | ✓               | ✓             | ✓            | ✓                | ✓                  | ✓            | ✓                  | ✓              | ✓             | ✓              | ✓             | ✓              | ✓              |
| II.A.2. Roadways                   | ✓            | ✓             | ✓              | ✓               | ✓             | ✓            | ✓                | ✓                  | ✓            | ✓                  | ✓              | ✓             | ✓              | ✓             | ✓              | ✓              |
| II.A.3. Parking                    | ✓            | ✓             | ✓              | ✓               | ✓             | ✓            | ✓                | ✓                  | ✓            | ✓                  | ✓              | ✓             | ✓              | ✓             | ✓              | ✓              |
| II.A.4. External path and walkways | ✓            | ✓             | ✓              | ✓               | ✓             | ✓            | ✓                | ✓                  | ✓            | ✓                  | ✓              | ✓             | ✓              | ✓             | ✓              | ✓              |
| II.A.5. Entrances and exits        | ✓            | ✓             | ✓              | ✓               | ✓             | ✓            | ✓                | ✓                  | ✓            | ✓                  | ✓              | ✓             | ✓              | ✓             | ✓              | ✓              |
| II.A.6. Connection to mass transportation | ✓            | ✓             | ✓              | ✓               | ✓             | ✓            | ✓                | ✓                  | ✓            | ✓                  | ✓              | ✓             | ✓              | ✓             | ✓              | ✓              |
| II.B.1. Elevators                 | ✓            | ✓             | ✓              | ✓               | ✓             | ✓            | ✓                | ✓                  | ✓            | ✓                  | ✓              | ✓             | ✓              | ✓             | ✓              | ✓              |
| II.B.2. Staircase                 | ✓            | ✓             | ✓              | ✓               | ✓             | ✓            | ✓                | ✓                  | ✓            | ✓                  | ✓              | ✓             | ✓              | ✓             | ✓              | ✓              |
| II.B.3. Escalator                  | ✓            | ✓             | ✓              | ✓               | ✓             | ✓            | ✓                | ✓                  | ✓            | ✓                  | ✓              | ✓             | ✓              | ✓             | ✓              | ✓              |
| II.C.1. Mobility aids             | ✓            | ✓             | ✓              | ✓               | ✓             | ✓            | ✓                | ✓                  | ✓            | ✓                  | ✓              | ✓             | ✓              | ✓             | ✓              | ✓              |
| II.C.2. People movers              | ✓            | ✓             | ✓              | ✓               | ✓             | ✓            | ✓                | ✓                  | ✓            | ✓                  | ✓              | ✓             | ✓              | ✓             | ✓              | ✓              |
| II.C.3. Fixed rail system          | ✓            | ✓             | ✓              | ✓               | ✓             | ✓            | ✓                | ✓                  | ✓            | ✓                  | ✓              | ✓             | ✓              | ✓             | ✓              | ✓              |
| Total                              | 4            | 7             | 11             | 6               | 5             | 8            | 6                | 7                  | 8            | 9                  | 9              | 10            | 9              | 11            |                | |
| Percentage (%)                     | 30           | 58            | 92             | 50              | 42            | 67           | 50               | 58                 | 67           | 75                 | 75             | 83            | 75             | 75            | 92             | |
architectural wayfinding average (30% or 4 of 12 elements). Therefore, in redesigning the Tanah Abang station, an architectural wayfinding design strategy to achieve 66.7% or at least 8 of 12 elements.

3.3 Architectural Wayfinding Design Strategy in Tanah Abang Station

A. External and internal circulation system

1. Design Concept

![Figure 2. Majority of Circulation at Tanah Abang Station](image)

The main factor of the station is the train passengers. So that the circulation of train passengers to get on and off commuter is the most important thing. The majority of passenger dense is in the north on the Sudirman platform and south on the Rangkas Bitung platform. On Sudirman platform, the majority of passengers moved northward for transit to the Rangkas Bitung platform. On Rangkas Bitung platform, the majority of passengers moved from the south to the north for transit to the Sudirman platform. If a straight line is drawn from the two stacks of, a transverse line is formed. And that line is applied in this design, especially in transfer area, and light is the guide to find a way.

2. Sidewalks, Entry and Exit, Parking, and Connection to Other Mode of Transportation

| Station                  | External path and walkways | Entrances and exits | Parking         | Connection to mass transportation |
|--------------------------|-----------------------------|---------------------|-----------------|-----------------------------------|
| Karet Station            | Gate                        | x                   | x               | Bus Stop                          |
| Palmerah Station         | Gate                        | Two-way direction   | Motor (Series)  | Bus Stop                          |
| Cisauk Station           | Gate                        | Two-way direction   | Motor (Series)  | Bus Stop                          |
| Sudirman Station         | Gate                        | x                   | x               | MRT Bus Stop                      |
| Cikini Station           | Gate                        | x                   | x               | Bus Stop                          |
| Juanda Station           | Gate                        | Two-way direction   | Motor (Series)  | Bus Stop Online transportation    |
| Manggarai Station        | Gate                        | x                   | x               | Bus Stop                          |
| Jakarta Kota Station     | Gate                        | Two-way direction   | Car (Series)    | Bus Stop                          |
| Cakung Station           | Gate                        | x                   | x               | Bus Stop                          |
| New Klender Station      | Gate                        | x                   | x               | Bus Stop                          |
| Malmo Central Station    | Plaza                       | One way             | Car (Parallel)  | Bus Stop Taxi                     |
| Løren Metro Station      | Plaza                       | One way             | Car (Parallel)  | x                                 |
| Cermak McCormick Place Station | Plaza                | One way             | Car (Series)    | Bus Stop                          |
| Newport Station          | Plaza                       | One way             | Car (Parallel)  | Bus Stop Taxi                     |
| Miaoli Station           | Plaza                       | One way             | Car (Series)    | Bus Stop Taxi                     |
| Montpellier Railway Station | Gate                  | One way             | Car (Parallel)  | Bus Stop                          |

Based on the analysis, there are 2 accesses from the sidewalk to the station, namely in the form of a gate / railing and in the form of a plaza. Based on 16 stations, 10 stations implement gate / railing and 6 stations implement plazas. All 10 stations are commuter line stations in Indonesia, and 6 stations are
overseas. Even though there are more stations implementing gate / railing, the 10 stations based on the research are only 40% above the architectural wayfinding average while the 6 overseas stations are 100% above the architectural wayfinding. So that implementing the plaza at 6 stations is stronger than 10 stations. Therefore, the shape of the plaza is applied to this design.  

Based on the results of the analysis of the entry and exit paths, of the 16 stations, 6 stations have one-way lines, 4 stations with two-way lines, and 6 stations do not have lines to enter and exit. So that in this design using a one-way street.  

Based on the results of parking analysis, from 16 stations, there are 2 parking lots, namely for motorbikes and cars. Motorbike parking at 5 stations all use a serial form in the parking lot. Car park at 7 stations, parallel park at 4 stations, and serial park at 3 stations. 6 stations have no parking. So that in this design implementing a parking lot in a series form in the motorbike parking lot, and parallel parking in the car park.  

Based on the analysis of connections to other modes of transportation, there are 4 types of transportation modes, namely MRT, Busway Stop, Online Ojek, and Taxi. There is no MRT around the site so the MRT cannot be implemented. The Busway stop has been integrated with Tanah Abang Station. There are no online motorcycle taxis and taxis at Tanah Abang Station yet so this design will be applied.  

B. Level change devices  

Tanah Abang station passengers at peak hour per day is 7343 / hour. The capacity of commuter line passengers in one carriage is 250 people. The number of commuter line cars that stop at Tanah Abang Station is 8-12 cars, so that the maximum passenger capacity coming from commuter line is 3,000 people. Whereas the platform can only accommodate 1,500 people at a time, so the platform is only a place to move so that it does not become stacked, and is extended to the upper level to become a waiting area. Time- prone (headway) for commuter line at Tanah Abang Station, which is 10-30 minutes. To maximize circulation at the station, in less than 10 minutes passengers who have just gotten off the commuter line have to change levels.  

1. Escalator  
The escalator in this design is used as a level shift up circulation, the escalator has a speed so that it can quickly move large numbers of passengers, namely passengers who get off the commuter line.  

Based on the book Building Systems High by Jimmy S. Juwana, escalator with speed 0.65 m / s and a width of 1000mm can haul reach 450 people within five minutes. The maximum number of passengers who disembark from the two commuter line on the platform is 6,000 people. In 10 minutes, the escalator can carry 900 people, or the equivalent of 3.6 commuter line cars, if rounded up to 3 commuter line cars. So an escalator is needed for every 3 commuter line cars.  

2. Stairs  

In standard stairs the minimum width is 1.65m, so that if rounded to 2m. The stairs can accommodate 60 people per minute in a width of 1 meter. With a width of 2m the stairs can accommodate 120 people. Within 10 minutes, the stairs can accommodate 1,200 people, more than the capacity of an escalator.  

3. Elevator  
The elevators based on precedent are located at the end of the train such as Palmerah Station, Cisauk Station, Malmö Central Station, Loren Metro Station, Cermak McCormick Place Station, Newport Station, Miaoli Station, and Montpellier Railway Station.  

In every 3 commuter line cars there is an escalator, but if it exceeds the capacity, namely at crowded points, the stairs can accommodate more people. When using stairs, people with special needs cannot move levels, so the stairs will be juxtaposed with the lift. The level shift circulation points are also adjusted to the location of the commuter line door.
C. Internal Transportation

1. Mobility aids

| Station                | Unpaid Area | Paid Area |
|------------------------|-------------|-----------|
| Karet Station          | Ramp        | Ramp      |
| Palmerah Station       | x           | x         |
| Cisauk Station         | Ramp, Elevator | Elevator |
| Sudirman Station       | x           | x         |
| Cikini Station         | x           | x         |
| Juanda Station         | x           | x         |
| Manggarai Station      | Ramp        | Ramp      |
| Jakarta Kota Station   | Ramp        | Ramp      |
| Cakung Station         | Ramp, Elevator | Elevator |
| New Klender Station    | Ramp, Elevator | Elevator |
| Malmö Central Station  | Ramp        | Elevator  |
| Lorena Metro Station   | Elevator    | Elevator  |
| Cermak McCormick Place Station | Ramp  | Elevator |
| Newport Station        | Elevator    | Elevator  |
| Miaoli Station         | Ramp        | Elevator  |
| Montpellier Railway Station | Ramp  | Elevator |

*Table 4. Analysis of mobility aids at stations*

Based on the analysis of the use of Mobility Aids at stations using ramps and lifts. In unpaid areas, most stations use ramps, and in paid areas most stations use lifts. So that in this design, the unpaid area uses a ramp and the paid area uses a lift.

2. Fixed Rail System

The station has many circulation purposes, but in this design it is a one-way circulation, such as at Juanda Station which also has a lot of passengers and is located in Indonesia. Juanda Station applies a one-way system with continuous entrances and exits, so that passengers have clear circulation. The one-way application of this design is different from Juanda Station. In this design, the circulation is still in one direction but not continuous but opposite the opposite circulation, so that two strands are formed. To separate the two grooves, a railing and barrier are designed.
4. Conclusion Remarks

Table 5. Architectural Wayfinding Response at Tanah Abang Station

| Architectural Wayfinding | Existing Condition | Design Response |
|--------------------------|--------------------|-----------------|
| **Internal and External Circulation System** | | |
| Design Concept | There is no clear circulation on design concepts such as lines, markers, nodes, and edges at Tanah Abang Station. Many circulation collisions cause congestion, and block other circulation. | The majority of passenger circulation forms a transverse line from north to south to facilitate circulation in the transfer area. The beam also serves as a roadfinding aid, designing skylights over the transfer area. |
| parking area | Tanah Abang Station does not have a parking lot, only a few motorcycle taxi drivers hang around the empty area of Tanah Abang station. | The parking circulation in this design is continuous from the driveway circulation, one-way with a parallel parking arrangement according to the analysis results. |
| Sidewalk | Does not have clear circulation from the sidewalk area to Tanah Abang station. | To respond to the sidewalk circulation in this design, a plaza was implemented, at the point where most users walk. |
| Entrance and Exit | There is no clear circulation of the entry limit to the entrance | Entrance and exit are one-way design, entry point from Jl. Jatibaru Raya, where vehicles usually stop to drop off passengers who want to go to Tanah Abang Station, and go straight through the site, from the entrance, turn right is the parking lot, and left is the drop off and pick up area. |
| Connection to Other Mode of Transport | Tanah Abang Station already has connections to other modes of transportation. | Taxi and online transportation are combined into a drop-off and pick-up area that can also be used for those who take or pick up passengers at Tanah Abang Station. The vehicle arrangement is parallel for cars, and series for motorbikes. |
| Level Switching | Elevator | Tanah Abang Station does not have an elevator for level shift circulation. | To provide clear circulation for the lift the lift area is designed according to the standard. Based on the Decree of the Minister of Public Works No. 468 / KTSP / 1998 the minimum lift opening is 1100mm and the minimum queuing distance is 3000mm. So that each elevator will have at least 3m of space so |
Tanah Abang Station has stairs for level shift circulation. There are 2 access stairs on each platform, but there is often a buildup on the stairs. To provide clear circulation for the stairs, the staircase is designed according to standards. Minimum queue distance is 4000mm. So that there is a minimum of 4m space on each staircase so as not to interfere with the main circulation.

Tanah Abang Station has an escalator for level shift circulation. There is 1 access staircase on each platform, but there is often a buildup on the escalator. To provide clear circulation for the stairs, the escalator area is designed according to standards. The minimum width of the escalator is 1000mm and the minimum queue distance is 8000mm. So that there is a minimum of 8m space on each escalator so as not to interfere with the main circulation.

There is no Mobility Aids at Tanah Abang station, so users with special needs cannot access Tanah Abang Station. Ramp is applied to unpaid areas, namely to access from plazas, parking lots, online motorcycle taxis, taxis, and commercial areas. Based on the Railway Station Standardization Book, the ramp ratio at the station is 1:10. This design is applied to a height of 3 meters, with a length of 30 meters. Lift is also applied to this design according to the analysis results, namely in the paid area at the end.

There is already a fixed railing at Tanah Abang Station, which acts as a barrier between paid areas and non-paid areas. Railing is applied in this design to separate two different circulations, so that there are no collisions that create buildup and impede circulation. Almost all parts of this design use railings and barriers.
The area built in the Tanah Abang Redesign Station is 12,241 m$^2$, with 4 floors and 1 basement floor. The development covers 3 zones based on RDTR, namely zones P1, H6, and S7. Based on the capacity of this station, it can accommodate 5,580 paid passengers on the platform area, waiting and transferring at one time. The structure used is steel, and uses a waffle structure over a wide span. Electrical installations to supply electricity come from PLN and also generators, and water installations meet the needs of water pumps and plumbing.

Based on the research, the average for applying architectural wayfinding at the station is 8 components from 12 components. To achieve this average, 10 architectural wayfinding components were applied to the Tanah Abang station. These components are divided into three groups. In the group of internal and external circulation systems, clear circulation is applied to the design concept, on parking lots, sidewalks, entrances and exits, other modes of transportation. In the level-shift group, clear circulation is applied to elevators, stairs and escalators. In the internal transportation group, Mobility Aids and fixed railings are applied. So as to increase the architectural wayfinding component at Tanah Abang Station, from the initial 4 components to 10 components, to solve the problem in Tanah Abang Station.

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