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Signage Design for People with Visual Impairment at Commuter Train Station

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Abstract: The commuter train is one of the mass transportations that connect several regions around Jakarta, these regions were Bogor, Depok, Tangerang, and Bekasi. The user and the train station with all of the facilities within it are the aspects that relate to commuter train mobility activities. In practice, there are still problems relating to facilities for users with disabilities that haven't optimally functioned, including signage that designed for users with disabilities at commuter train stations. A special approach is needed to gain insights from users with disabilities related to their experience and needs that can be processed into consideration when designing signage in the commuter train station area so that they are able to overcome the problem that they encountered when using the facility..

Keywords: Signage; Disability; Low Vision; Station; Commuter train

1. Introduction

The public facilities for users with disabilities in DKI Jakarta are not yet inclusive, based on this problem a study conducted by LBH Jakarta to measure the accessibility index of public facilities for disabled users in the DKI Jakarta area in 2015. This study found that 10 commuter train stations classified as inaccessible for user with disabilities, some of them are Jakarta Kota Station, Tanah Abang Station, and Senen Station. Purnoto as a Junior Manager in the Services, Cleanliness and Passenger Facilities at the Station of PT. Kereta Api Indonesia DAOP 1 Jakarta, explained that the design of facilities and infrastructure at the train station was built based on the Minister of Transportation Regulation No. 48 of 2015 which now has already transformed into Minister of Transportation Regulation No. 63 of 2019 and also based on a decree issued by the directors of the company.

According to the observations at the Jakarta Kota train station, the signage conditions at the train station were built according with the indicator that stated in the Minister of

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Transportation Regulation no. 63 of 2019, specifically based on the minimum service standards the commuter train station but, based on interviews with one of the interviewee who are persons with low vision blinds, there are still obstacles in finding and identifying the path to the facilities at Jakarta Kota train station, one of the obstacles encountered was to find a path to the ticket counter location.

Based on data from the March 2018 Susenas there are 10.2 million people with visual impairments in Indonesia. Aria Indawati, Chairperson of the PERTUNI (Persatuan Tunanetra Indonesia) Indonesian Association of Blind, stated based on WHO the number of people with low vision in the world is 3 times larger than the people with totally blind condition, so in Indonesia it's estimated that around 3⁄4 of people with totally blind condition were people with low vision impairment. The exact total number of persons with low vision in Indonesia cannot be ascertained due to the absence of data collection regarding to the total number of people with low vision impairments.

The train station is a public facility that is used by all residents, both ordinary residents and those with special needs, a commuter train station should have adequate supporting facilities and signage so that it can support a variety of needs of the population, including residents who have special needs.

2. Literature Review

2.1 Signage

According to Calori (2015) signage is one part that forms the unity of EGD (Environmental Graphic Design) aspects. Signage has a role to help its users to navigate and show their orientation points at a location such as previous research in signage at the airport (Pinasthika & Rizaldi, 2018). Signage is also designed to show other information besides the guide at a location and harmonize the appearance of that location visually and informatively. There are often misconceptions about the use of the terms signage and wayfinding. The difference between these terms is that signage is part of a wayfinding system and a wayfinding system can be considered to be successful if involving various aspects other than signage.

2.2 Low Vision Impairment

The World Health Organization (2020) in it's report entitled Vision 2020 defines people with low vision disabilities as those who have eye disorders with vision or eye acuity less than 6/18. According to WHO (1992) 6/18 visual acuity is a condition where the normal eye is able to identify objects at a distance of 18 meters but for someone with low vision conditions the object can only be identified at a distance of 6 meters.

Based on research conducted by Lutfah Rif'ati, Rabea P. Yekti, and Lusianawaty Tana (2007) in the Riset Kesehatan Dasar 2007 Berstandar Nasional (National Basic Health Research 2007), the causes of low vision impairment are cataracts, corneal scars, glaucoma and other

diseases. Cataracts are believed to be the most common cause of low vision impairment and are followed by corneal scarring and glaucoma. Other diseases that trigger low vision problems include diabetes mellitus, hypertension, squint and pterygium.

World Health Organization (2019) states in one of its articles that there are several causes of visual impairment globally:

1. Refractive damage to the eye
2. Cataracts
3. Macular degeneration caused by old age
4. Glaucoma
5. Diabetic eye disease • corneal opacity
6. Trachoma

Conditions for the occurrence of the disease have a different pattern in each country, but there is a tendency in countries that have lower-middle income to have a high rate of cataract cases compared to countries with middle and upper income. On the contrary in countries that have middle-upper income, eye diseases related to diabetes, glaucoma and macular degeneration mostly cause cases of eye disorders.

2.3 SEGD 2012 ADA White Paper Update: Signage Requirements in the 2010 Standards for Accessible Design

President of the United States of America, George W. Bush passed the American Disabilities Act on July 26, 1990. This regulation was passed to prevent discrimination of people with disabilities in accessing jobs, goods and services. Along with these regulations also issued a guideline regarding to the technical implementation of the American Disabilities Act, called ADAAG, the American with Disabilities Act Accessibility Guidelines. ADAAG underwent renewal and change of name to SAD, Standard for Accessible Design and also, there was an adjustment from the technical point of view of ADAAG. On March 15, 2011 this guideline was effectively implemented. This guideline regulates various technical aspects that must be followed when designing a signage for users with disability from various aspects, ranging from the size of the visual elements displayed on the signage, the height of the placement, to the level of colour contrast that is permitted to be used.

3. Design Method

The design method that used in this design is a signage design method by Chris Calori & David Vanden-Eynden (2015), which has 3 major phases; Pre-design, Design and Post-design. In the pre-design phase there is a data collection & analysis process. The second phase is the design phase. This phase is divided into 3 stages; there are the schematic design stage, design development, and documentation. In the final stage, which is Post-design, are divided

into 3 stages, bidding, Fabrication & Installation Observation and evaluation. For this case the design phase that used is limited to 2 early major stages; Pre-design & Design.

Table 1 Chris Calori & David Vanden-Eynden signage design process

Major Phase	Minor Phase
Pre-design	Data collection & analysis
Design	Schematic design
	Design development
	Documentation
Post-design	Bidding
	Fabrication & Installation observation
	Evaluation

- Data collection & analysis

This stage is also known as pre-schematic stage. In this stage the designer begin the studies and research activity to get as much data as possible that may support the signage design process. During this stage the information gathered from various methods such as interview with user with low vision condition, observation at the commuter train station, and literacy studies that can be conducted through books or studies that has been done. The information that has been gathered will be used to state the design goals and also to enhanced the design alternatives as supporting information.

- Schematic design

In this stage the signage designers did an exploration based on the data that has been obtained in the previous stage into a variety of ideas and concepts according to the approach that used in the signage design process. The main objective is to adjust and finalize the concepts that will be used in the signage design process.

- Design development

DD or design development is the processing stage of the design scheme that has been approved at the schematic design stage. Various things that have been explored in the previous stage are developed, modified and refined at this stage.

- Documentation

After the approval of the client to carry out for production stage, the detail is compiled into a document that explains the detailed specifications of the signage, signage as a solution to the problem, as well as the refinement of the problems found in signage.

- Bidding

The designer gathered various signage manufacturers who have good competence. Then the designer provides the information about the details of the design and the signage manufacturer offering costs. The budget is then offered to the client to determine the signage manufacturer to be selected to work on the project.

- Fabrication & Installation observation

In this stage the signage design are produced into their original form to be ready for use. The signage designer then conducts a review on the results of the production to ensure the aspects and elements of the signage are produced properly.

- Evaluation

At the Evaluation stage, the designer evaluates the signage to determine the level of effectiveness of the signage and also to find out the aspects and elements that are functioning well or not, so that the results of this evaluation can be collected into a document for future signage development.

4. Design Process

4.1 Data collection & analysis

The design process begins with the data collection & analysis phase. The purpose of this stage is to get the deepest information related to the design and process that information into a series of plans to be applied in the design process. The author conducted the process of finding data through several methods such as interviews with several stakeholders, both the users and also the manager of the location. Observations were also conducted at the Jakarta Kota station in order to obtain the information related to the facilities inside, the user flow in accessing the facilities at the Jakarta Kota station, as well as identifying signage that was installed at the design location. The results of the identification of signage at the Jakarta Kota station are mapped into the Jakarta Kota station floor plan so that it can be easier to analyse the signage placement at the Jakarta Kota station.

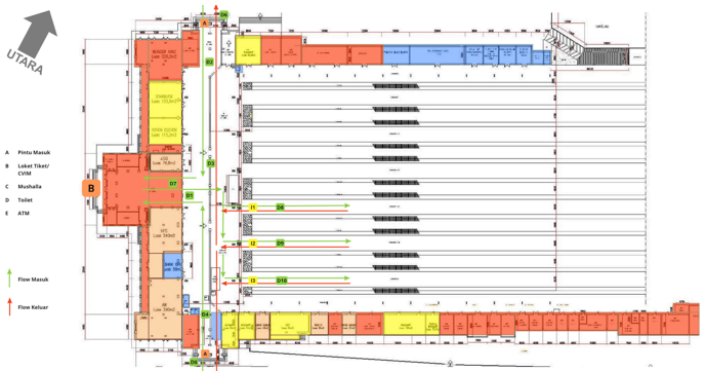

Figure 1 Jakarta kota Station site plan. [X Caption].

Jakarta Kota Station area is separated by a fence, which divides into 2 parts; the train platform and main access consisting of rooms for station operations and also some rooms for commercial needs, as well as a hall with ticket counters and computerized vending machines (CVIM). This station is also equipped with toilet facilities, prayer rooms, and ATMs. There are 12 train departure platforms at this station; there are 4 platforms that used for commuter train departures, which are platforms 9, 10, 11 and 12. The rest of the platforms are used for long distance train departure.

4.2 Schematic design

1. Idea and Concept

This stage begins with generating keywords through creating a mind map. Along the mind mapping process, the writer find some initial keywords which are; optimistic, diverse, pleasant, free obstacle, minimalistic, and other keywords. The writer eliminated that keywords into 3 main keywords that will be used for idea and concept development, which are optimistic, adaptive, and integrated. The big idea of signage design is "Guiding adaptively, moving optimistically and integrated" which was then developed into the main concept of this signage design that is “signage that is adaptive to user needs and integrated with the commuter train system and identity”.

The visual concept is based on the form of the commuter train. The basic shape of signage is obtained from the front side of the commuter train locomotive. This form will also be applied in designing other graphic elements on signage such as the pictogram, which includes arrows and symbols. The signage that designed in this case study focuses on directional signage with the primary goal of helping commuter train users with low vision impairment to easily access the station and its facilities. Apart from the aesthetic aspect, the functional aspect is emphasized in the case.

This signage is designed based on data that has been obtained through the process of collecting data through interviews, observation and literacy studies from various sources. The data also aligned with the SEGD 2012 ADA White Paper Update: Signage Requirements in the 2010 Standards for Accessible Design. This guideline talks about the considerations that must be considered when designing a signage for some users with disabilities.

2. User condition mapping and fulfilment strategy

People with low vision in Indonesia have different cases, based on this situation a mapping is created that contain list of challenge that people with low vision encountered and strategies that could potentially be used to accommodate their needs. The strategy was developed based on the 2012 SEGD ADA White Paper Update: Signage Requirements in the 2010 Standards for Accessible Design and Wayfinding's book: Design and Implementing Graphic Navigational System by Berger.

Table 2 Mapping of vision conditions for persons with low impairment and their fulfilment strategies

People with low vision impairments condition	**Fulfilment Strategies**
Visual acuity <0.3, (<5/15, 6/18, 6/20, or 20/80, 20/70	Based on the SEGD 2012 ADA White Paper guidelines, updates on the size of visual elements in signage are determined based on vertical distance (height of information placed on the surface of the floor) and horizontal distance (distance between the user and signage) The minimum height of the visual element recommended for use on signage is 50mm. The strategy used is to use the size of the visual element by considering the size and space of the signage
Able to identify boundaries in rooms, floors and ceilings	Placement of information on the floor surface in the form of floor signage to support overhead signage that attached to the ceiling. The floor signage that is used not only contains information about the facility, but also it create a path that extends to the destination
Able to identify colors with a high contrast level	Based on SEGD 2012 ADA White Paper guidelines, the color contrast level must reach 70% or more. The strategy is to use colors with a percentage of contrast between the foreground color and background color of 70% or above
Not able to identify text and symbols on signage within normal distance	In addition to setting the size of visual elements on signage based on the 2012 ADA White Paper update SEGD guidelines; there are also other regulatory provisions such as the distance between lines and the distance between letters. The strategy used is to determine the right combination of letter height, letter spacing and the exact spacing between lines adjusted to the size of the signage so that it may solve these obstacles
Challenge to identify signage in crowded station conditions	The strategies that can be used are by combining different signage placement. Placement of these varied signage aims to support each other in guiding users to destinations especially in crowded station condition.
According to Berger (2009) People with visual impairment use typography as a main point in identifying information on	Layout of information on signage is divided into two parts; the left column of the signage that contains information in the form of pictograms consisting of symbols and arrows, on the right side contain typographic information. The size of the pictogram on the signage is made smaller while the size of the main text that shows the main information of the destination is made larger so that the user can easily identify it.

3. Signage shape

The form of the signage is taken from the shape of the front side of the commuter train locomotive, which is adjusted to the size, type of the signage, the type of mounting of the signage, and the placement of graphic elements on the signage panel. In designing projecting signage and overhead signage forms, the writer makes several digital sketches by applying several considerations. Making typographic elements the main elements in projecting signage so that it is easily visible from a considerable distance and also ensures the consistency of signage forms maintained from its basic shape.

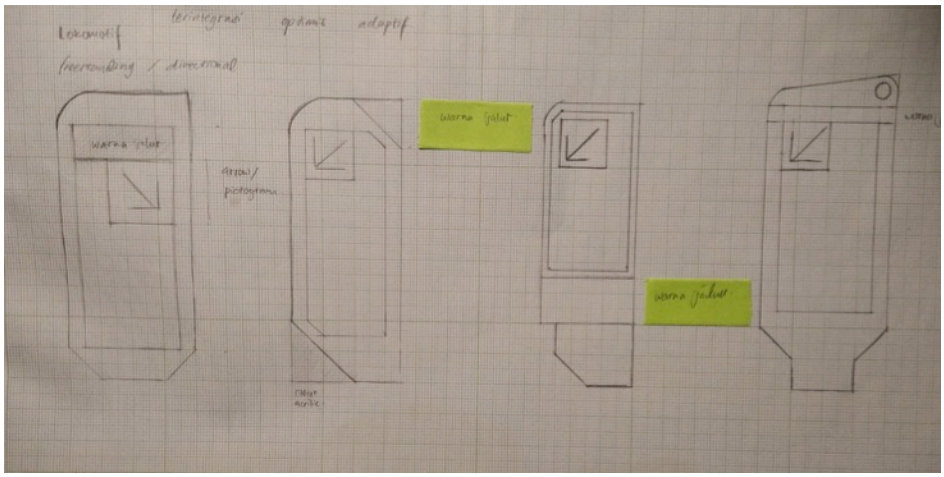

Figure 2 Initial sketch of the signage according on the front side of commuter train locomotive shape.

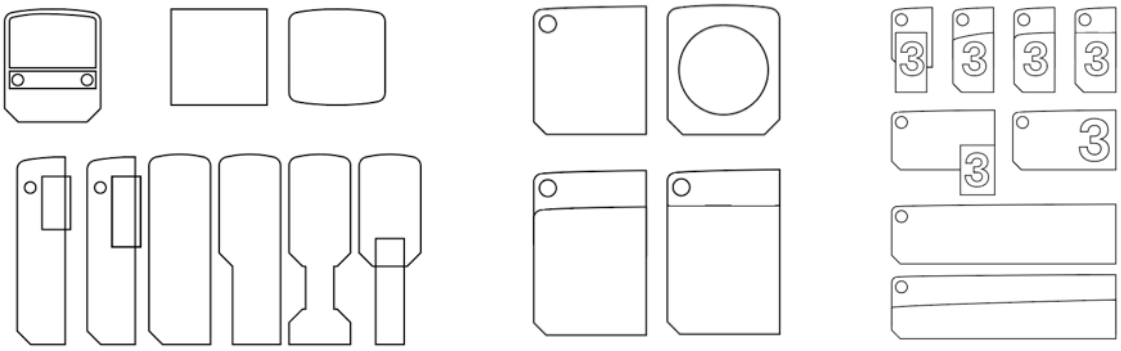

Figure 3 Different signage shape sketch according to the mounting type.

4. Typography consideration

The typeface that is used for the signage information is chosen based on the data of the visibility aspect and also the ability to identify typeface of the user with low vision. This research found that they were able to see text clearly at a distance of 6 meters or less, more than that distance in some cases only appeared wavy lines and dashed lines. They are able to identify sans serif and serif typeface but it is easier to read the sans serif typeface. To determine the type of typeface selected in this design, the data are aligned with guidelines published by SEGD; ADA White Paper Updates: Signage Requirements in the 2010 Standards for Accessible Design.

In these guidelines, there are several typefaces that meet the requirements for user with limited levels of vision to be applied to signage. Some of the typefaces are Neue Frutiger World Bold, Eurostile Bold, Futura Condensed Extra Bold, Helvetica Neue Bold, and Adobe Garamond Pro Regular. These typefaces are compared to determine the most appropriate typeface to be applied to the signage.

Helvetica Neue is used in signage because of its readability aspect advantages than the other four typefaces. There are several considerations that used to determine the size of the letters. The typeface size is chosen based on the user's ability to identify signage at a certain distance and the height of the signage against the floor surface.

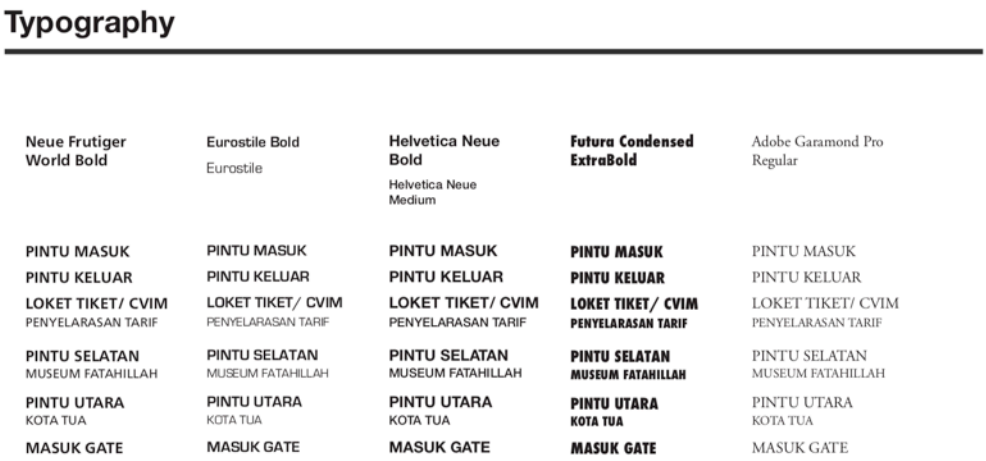

Figure 4 Typeface comparison based on the guidelines.

5. Color consideration

Color delivers their own meaning based on its context (Aaker, 1997; Febriani & Selamet, 2020). The colors that used in the signage design are divided into 2 types; the main color that are applied to all types of signage to maintain the level of consistency of the signage

and the secondary color, which is the color that used to distinguish the commuter train route. There are 3 colors used for the main color; orange with hex code # f9a236, blue with hex code # 0c1637 and gray with hex code # e8e7e6.

The orange, blue, and gray colors combination is also selected based on the color contrast calculation that stated in the ADA White Paper Updates: Signage Requirements in the 2010 Standards for Accessible Design. The recommended percentage of color contrast to be used on the signage for users with low vision is 70% or more.

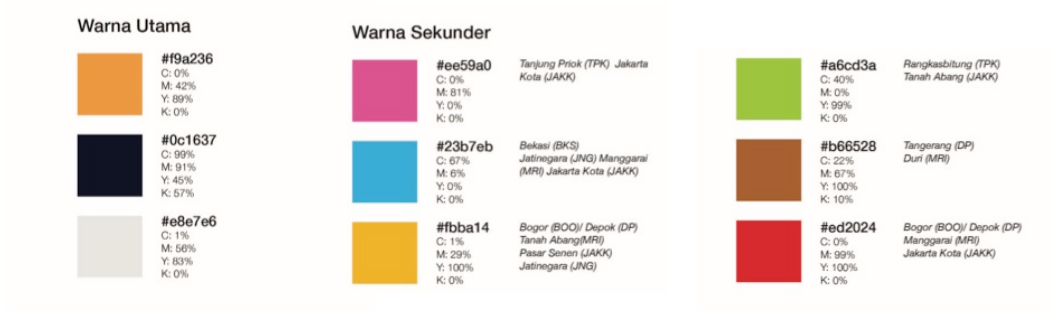

Figure 5 The main color and secondary color that used in the signage design.

In the research process we find some consideration related to the color issues. One of the issues is about the user that has a difficulty to identify analogous color, the case was the difficulty to identify red, orange, and yellow color. This consideration is applied in the color combining process for selecting the main color. The main color play a big role in the signage system, to avoid the difficulty issue of identifying the signage element and also the contrast aspects of the color combining process the writer selects orange color with complementary color of the orange which is blue. Due to the surrounding color of the station is dominated with grey and white color the writer chooses the orange color to make sure the signage is visible from a long distance.

There are few similar color that used in the main color and secondary color, because there is similarity in the color aspect but the purpose of the main and the secondary color is difference, the secondary color is equipped with additional information regarding of the destination information that can be differ from the number and the destination code as it shown on figure 13.

6. Symbol and Arrow

The design of symbol and arrow selected from the collection of symbols and arrows for transportation facilities that released by SEGD for transportation purposes. The shape of the arrow and symbol is modified with the visual concept by integrate the shape of the front side of the locomotive. The design of symbols and arrows uses a modular grid to ensure the consistency of the line thicknesses in the arrows and also to maintain size the symbol.

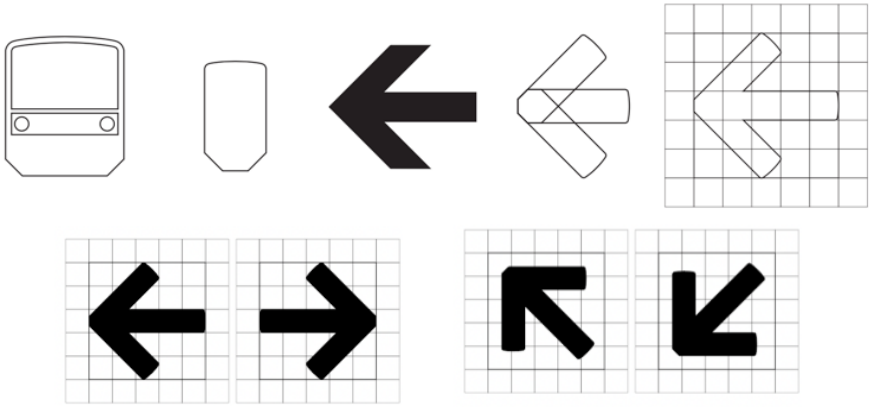

Figure 6 The arrow design process.

7. Signage Layout

This signage used a modular grid, which is a grid that used vertical, and horizontal lines to divide space into certain columns and segments. The layouts on signage is divided into 2 parts, the left column is used to place the pictogram elements while the right column is used to place the information elements in the form of text. In some signage the layout is also divided into 3 sections; the top section is divided again into 2 parts, the left column is used to place the pictogram elements, and the right column is used to place the information in the form of text, and the bottom section, which has a different background color is used to place the information that printed in braille. This 3-section layout is applied to projecting signage and freestanding signage. The layout on the overhead signage is divided into 2 columns; the left column is used to place the information in the form of a pictogram and the right column is used to place the information in the form text.

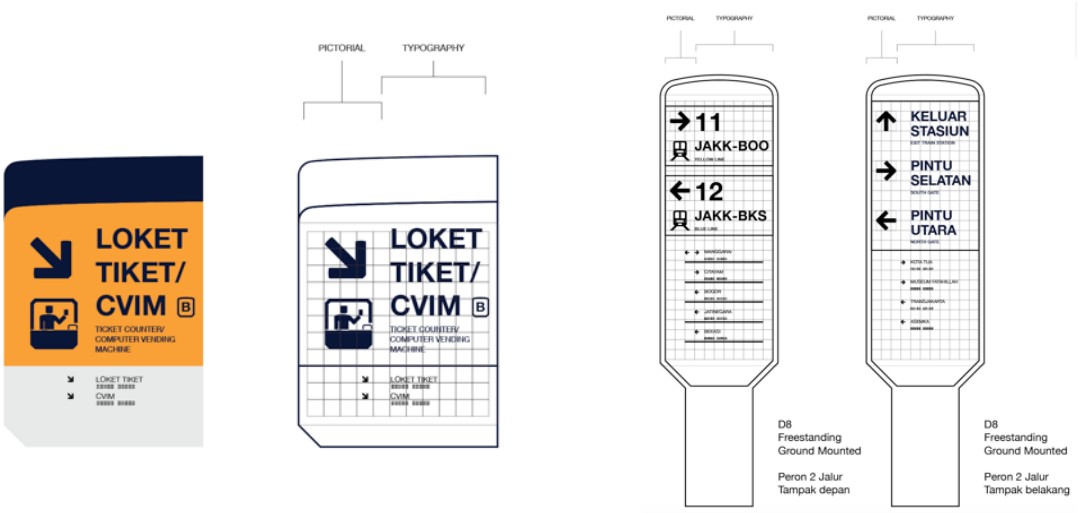

Figure 7 Projecting signage layout (left), Freestanding signage layout (right) .

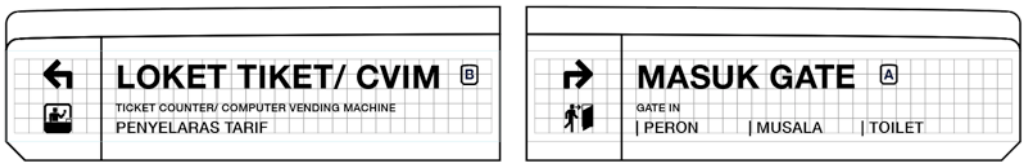

Figure 8 Overhead signage layout

8. Signage implementation

The signage design is limited on the directional signage by focusing on the wayfinding function with the goal to facilitate the mobility process from the entry point at the station to the ticket counter and towards the departure platform and vice versa for users with low vision. The design of this directional signage also takes several considerations of designing signage for users with visual impairment.

This consideration as it is explained by Berger (2009) are; the application of consistency in the signage design, contrasting colors and simple information and the placement of information on railings and floors to strengthen the wayfinding feature. The design uses 4 types of signage placement; projecting signage, overhead signage, freestanding signage, and floor signage.

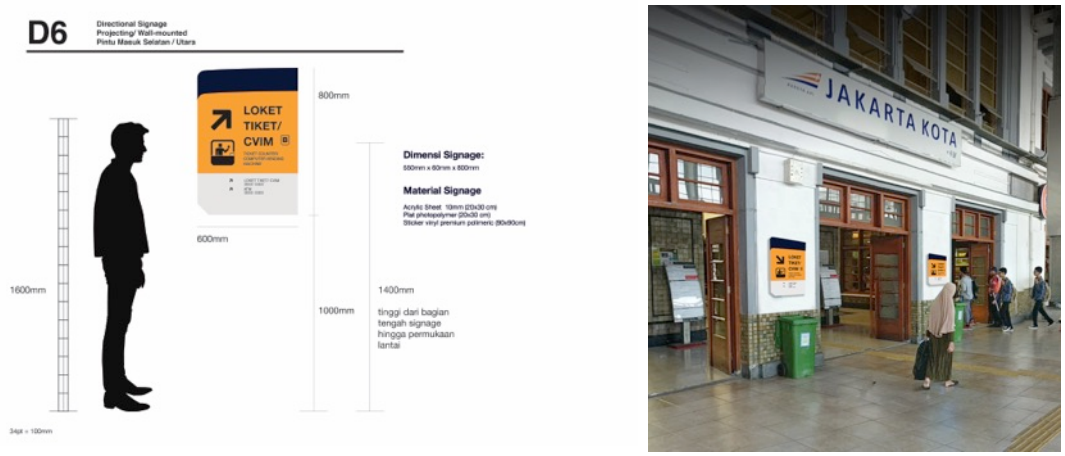

Figure 9 Projecting signage (left) & visualization of projecting signage implementation (right).

Projecting signage is placed in a particular location where its placement can be supported by the presence of a wall. The signage placement height is also adjusted to the height of the user so that the placement of information is aligned with the user's view and makes it easier for the user to see information on the signage as it shown on figure 9.



Figure 10 Overhead signage (left) & visualization of overhead signage implementation (right)

The overhead signage at the station can be found in the corridor at the station entrance, both the north entrance and the south entrance. The design of overhead signage contains information in the form of pictograms and text printed in large sizes so that users may identify it from a considerable distance as it shown on figure 10.

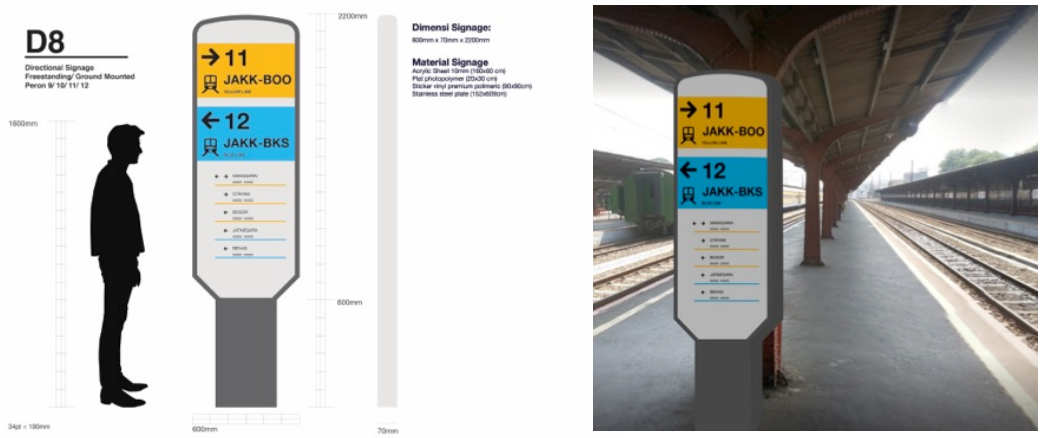

Figure 11 Freestanding signage (left) & visualization of freestanding signage implementation (right).

The freestanding signage functions are to provide information related to the destination of the train. The placement is focused on the train departure platform. Information about the train's departure lane is also adjusted to the color system that has been implemented to distinguish each train route. This signage has 2 sides with different information; the front side that the one is facing the passengers who walks away from the station contains the information about train routes and platform numbers with the colors that already adjusted to the lane. On the backside contain the information to direct the passengers who get off from the train to the exit gates.



Figure 12 Floor signage that located in the entrance gate corridor (left) & visualization of floor signage implementation (right).

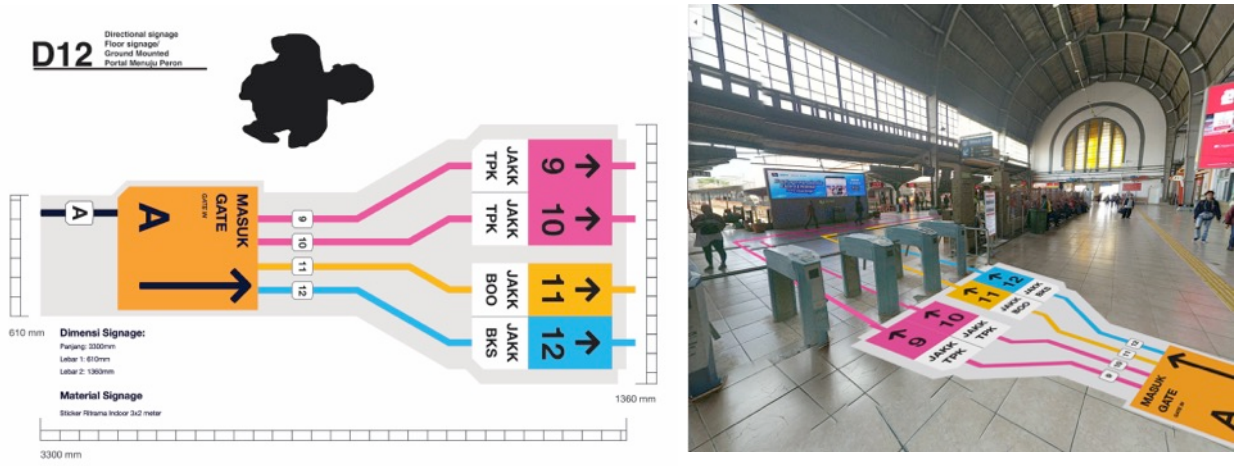

Figure 13 Floor signage that located near the gate to the departure platform (left) & visualization of floor signage implementation (right).

The floor signage are designed to direct users to certain facilities by providing the information through the signage that placed on the floor, this signage will direct and guide the user toward the intended location. This signage has several models that are designed based on the number of destinations. The information panel on the signage floor is identified by a different letter code. This letter code has a function to distinguish the destination. There are also lines that combined with the letter codes to direct the user towards the intended facility as it shown on figure 12.

The floor signage that placed at the entrance gate as it shown in figure 13 has 3 different paths that can be distinguish based on the color of the route. There is information about the platform number printed in large size so that the users can easily identify it.

This signage also had a smaller line connected to the information panel. This line color is selected according to each train travel route. This line function is to guide the user to the destination platform by providing a path to be followed up to the destined platform.

5. Conclusion

Commuter train stations are also a part of in public facilities that are used by all people. The infrastructure as well as facilities at the station are an inseparable part of the station, there are some problem encountered by the user with certain condition, in this case the user with a limited vision. The users still encountered some challenge related to search the direction of a facility at the station. These challenges include identifying signage on the station, looking for directions to facilities in the station area and finding the platform location according with the intended travel route. The design approach taken for this case is by emphasizing to the user needs. These approaches require deep user understanding in terms of their strengths and constraints, their capabilities and limitations, and their experience in accessing commuter train stations.

Based on the research and design process the writer found that the user has various difficulties in the visual ability. We aligned those difficulties with the element of the signage, which is shape, color, typography, symbol, layout, and the placement in order to create the signage system that may solve the user problem. The signage helps the user as a whole system. The placement of the signage that combine the eye level signage, overhead and the floor signage as path to ensure the user walk in a path toward the desired destination.

The typography that applied in the signage use sans serif typeface to make sure that the legibility and readability issue to the user are removed and the size and thickness also chosen considerately to make sure it could be read in certain distance. The color in the signage is also selected to make sure the signage is visible from the surrounding and to differ the train destination. The layout of the signage element is also put the user priority to identify the signage elements into account.

The user will use this signage as a wayfinding and guiding system to make sure they are on right destination as they use the commuter train facilities independently for daily activities. The signage system serve for main purpose of mobility in accessing, departing to desired destination, and leaving the commuter train station.

The main point of the whole process is to maintain an understanding of user during the data gathering process until the designing process so it may build an user based solution as it carried through the whole design process. This case study is far from perfection and the author wish this study may be continue with more of research process along the way so it may build more developed solution.

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