Pedestrian-Friendly for Redesign Leuwipanjang Integrated Terminal with Wayfinding Approach

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Abstract. This research is about the importance of user comfort in Leuwipanjang terminal, especially pedestrians, while in it. Leuwipanjang Terminal is a type A bus terminal in Bandung which will be one of the 14 proposed Transit-Oriented Development (TOD) planning points. The terminal controls the movement of traffic, namely pedestrian and vehicle traffic. Integrated Terminal Planning at Leuwipanjang Bus Terminal will accommodate many types of transportation modes so that there is an overlapping circulation when switching between modes. While passengers who have just arrived at the terminal usually feel confused to find a destination. The Leuwipanjang terminal does not currently provide clarity on circulation and does not give a pedestrian way. So Leuwipanjang terminal is needed to redesign, pedestrian-friendly terminal by providing safe and comfortable direct access to all the characteristics of users at the terminal.

1. Introduction
Bandung City is currently served by two main terminals, the Leuwipanjang bus terminal which serves arrivals from the west and the Cicaheum bus terminal, which serves arrivals from the east of Bandung. The upcoming Bandung City space structure concept is directed at the polycentric pattern, where community activities will be served by two city service centers in Alun-alun and Gedebage. With eight sub-city service centers in each sub-region of the city, in the future, it will be supported by the application of the TOD concept at several station points. There are at least 14 proposed locations that have the potential to become TOD development points. [1]
Figure 1. Location of Leuwipanjang Terminal

The project designed is the rebuilding of Leuwipanjang Terminal, an area designated by the government as the development of transportation land for the future from 2011 to 2031.

The Leuwipanjang Bus Terminal is located between Jalan Soekarno Hatta, Jalan Kopo, and Jalan Leuwipanjang. With full address Jl. Soekarno Hatta No. 205 Situsaeur Bojongloa Kidul, Bandung, West Java.

1.1. Aim and objectives
The development of Bandung City in the future requires better facilities for pedestrians. However, the current condition at Leuwipanjang Terminal does not provide this facility. To solve problems at the terminal using the wayfinding approach needed as an element to direct passengers more quickly and not lose orientation. The application of wayfinding used in the design object is spatial planning, circulation planning, and signage arrangement. The aim is to provide transportation with circulation planning that can facilitate passengers in accessing and determining the intended route.

1.2. About redesign
The redesign means to revise in appearance, function, or content a building so that physical changes occur without changing its function through either expansion or relocation [2].

Leuwipanjang Bus Terminal is included in one of the proposed locations to be designed for Transit-Oriented Development [1]. At the location of the Leuwipanjang terminal, there are residential, office, and commercial areas. In the proposed public transport service network plan, there will be a new mode of transportation in the Leuwipanjang Terminal, the Light Rapid Transit (LRT) monorail in Bandung, so the Leuwipanjang terminal needs to be redesigned. The facilities at Leuwipanjang Terminal are sufficient in quantity. Still, in terms of quality, they do not provide maximum comfort, such as not giving pedestrian ways, so it needs to be improved so that the terminal becomes comfortable and safe by standards.

2. Methods
This study will employ a qualitative approach in data collection and using two techniques to deliver analysis: first, a field study to the Leuwipanjang terminal for observation to obtain data, to look for potential aspects that can be maintained, and to find problems that exist in the terminal. Second, the literature study evaluatively reports information and regulations and standards regarding long term terminal planning. The findings then processed to be taken into consideration in determining the design guideline, which then becomes a reference for designing the Leuwipanjang Terminal.

3. Data and Analysis

3.1. About pedestrian
Pedestrian, as an active term, is a person who travels from one place of origin without a vehicle to reach the destination or place or with other purposes [2]. Whereas pedestrian ways, in an urban context, are spaces for pedestrians that serve achievement facilities and can protect pedestrians from the dangers that come from vehicles. In Indonesia, it is famous as a sidewalk, which means a small road 1.5 to 2 meters wide along a public road.

Then from this understanding, pedestrians in this study are people who travel or activities in public spaces (terminals) without using a vehicle. The pedestrian way is the part of town where people move on foot, usually along the side of the road. The function of pedestrian ways is for pedestrian safety when moving from one place to another. [3]

3.2. Typology of pedestrian ways
There are six pedestrian way typologies, namely: Sidewalk; Promenade; Arcade; Green Pathway;
Underground; Elevated; [4]. In this case, the pedestrian way elevated typology is suitable for Leuwipanjang terminal planning. The vehicle and human circulation are separated based on floor elevation to provide comfort and safety of pedestrians. The first floor is devoted to vehicle circulation, and the second floor is human circulation.

3.3. Pedestrian safety
Pedestrian safety requires pedestrian design and land use planning, including safe, easily accessible, and comprehensive facilities that prioritize pedestrian needs. [5]. Planning and designing well-connected pedestrian infrastructure and providing facilities, making it easier for visitors while in the terminal. The pedestrian must be able to be used by everyone, including parents, children, families, and disabled people. Besides, visitors to the terminal carrying goods, pushing prams and wheelchairs feel safe from all criminal activities.

There are five general principles for planning pedestrian networks [6]:
- Connected – do walking networks provide excellent access to key destinations?
- Comfortable – does the path width, surface, landscaping, and adjacent scale of development provide an attractive walking environment?
- Convenient - can streets be crossed easily, safely and without delay by all pedestrians?
- Convivial – are routes interesting, clean, and free from threat?
- Conspicuous – are walking paths set out in a coherent network, clearly signposted, and are they published in local maps?

And there are nine design criteria for pedestrian ways [6]:
- Path Widths
- Street Furniture (Placement of Street Furniture, Color, Seating, Bins, Drinking Fountains, Telephones, Street Trees and Vegetation, lighting and Signs)
- Grates / Covers
- Vertical Clearances
- Surfaces
- Gradients and Ramps
- Steps and Stairs
- Crossovers / Driveways
- Barricades (including chicanes and bollards)

3.4. Pedestrian Characteristics at Terminal Leuwipanjang
Pedestrians are often found walking in a hurry at the terminal to catch a bus that will depart. In addition to regular visitors, some users need special pedestrian facilities. From the observations, in Table 1 is the result of visitors who have different characters with typical walking speeds at the Leuwipanjang terminal.

| Pedestrian Characteristics                      | Typical walking speed |
|------------------------------------------------|-----------------------|
|                                               | Slow | Normal | Scurry |
| Young children (are often considered to be smaller adults) | v    | v      | v      |
| Pedestrians with Prams                         | v    | v      |        |
| Seniors                                        | v    |        |        |
| Vision Impairments                             | v    |        |        |
| Hearing Impairments                            | v    | v      | v      |
| Cognitive Impairments                          | v    |        |        |
| Limited Walking Ability                        | v    |        |        |
| Wheelchair Users                               | v    | v      |        |
The conclusion from the analysis above is what facilities must exist in the pedestrian terminal. When considering pedestrian facilities, it is no longer appropriate to provide separate or add-on facilities for different categories of users. Pedestrian facilities should embrace the concept of Universal Design to effectively remove barriers and allow the inclusion of people of all ages and abilities. [7]

3.5. Pedestrian safety problem

Besides bus circulation as the main circulation at the Leuwipanjang terminal, there is a human circulation (pedestrians) that need to be considered. This is a unity when problems arise in the pedestrian ways, which can hamper the movement of the bus circulation. At Leuwipanjang site (see fig. 2), no pedestrians are interconnected.

There is no clarity on circulation at Terminal Leuwipanjang that makes visitors feel confused; as a result, users are free to exercise their rights in the wrong place. Table 2 is the result of field observations to find out pedestrian problems in Leuwipanjang.

| Picture | Pedestrian safety problem |
|---------|--------------------------|
| ![Not connected](image1.jpg) | 1. There is no pedestrian way in the entrance, so pedestrians must pass the motorcycle parking area. |
| ![Not connected](image2.jpg) | 2. Then from the motorcycle parking area, the pedestrian must pass the bus arrival path. |
| ![Not connected](image3.jpg) | 3. Street vendors occupy the pedestrian way, so pedestrian takes the vehicle path. |
Path widths

1. Can only be passed by one person
2. The width of the pedestrian way inside the building is also insufficient for shopping activities, roads, and disabled paths

Seating

No seats along the pedestrian ways

Bins

The trash bins that have been designed are not well maintained.
Sign

1. There are still many areas that have not been installed.
2. As for the sign that is installed, making confuse visitors because it is not placed properly.

Tactile path and handrail

Many tactile paths are stopped at a place that endangers users.

Grates / Covers

1. These are items such as maintenance hole covers or drainage grates placed along the pedestrian path of travel. Where covers are in the pedestrian ways, they should be flush with the pavement and abutting the adjacent pavement material. Tolerances should not exceed 5mm.
2. There is a damaged cover on the bus platform; this could endanger users who will get on the bus.

Stairs and ramp

Stairs and ramps do not follow the standard (there should be a handrail)
The conclusion from Table 2. The Leuwipanjang terminal is not pedestrian-friendly. The entrance is the most chaotic area, while the entrance area should provide more information for visitors who have just arrived at the terminal.

When a pedestrian path is no longer able to fulfill its social function, human users of the pedestrian path will try to be able to adjust to their environmental conditions. At the same time, as a result of the adjustment will arise, impacts that may be more negative than positive. Modification to the environment begins with stress, which is a situation where the environment threatens or endangers one's existence, well-being, and comfort. [8]

3.6. The concept of pedestrians with a wayfinding approach
The results of field observations, there are two problems with pedestrian in Leuwipanjang terminal. The first is the absence of pedestrian ways that are following the standard so that it endangers pedestrians. For this reason, planning pedestrian ways is designed according to comfort and safety standards. Second is that pedestrians, especially with disabilities, must quickly set goals without feeling confused; the solution is by wayfinding approach.

Definition of wayfinding
Wayfinding is a term to describe the way or process in achieving a goal in a short time, both in a familiar and unfamiliar environment. [9] The role of wayfinding in solving problems there is 3 (three) essential parts: decision making, taking action, and processing information. [10] The concept of wayfinding is related to one's perception and cognition map. A good wayfinding and orientation system will successfully direct all users regardless of the user's background, perception, and psychological abilities.

4. Result and discussion
Leuwipanjang integrated terminal planning (see figure 3) with the wayfinding approach prioritizes circulation as a reference in design. Human circulation and vehicle circulation are separated based on the floor level. At level 1 or terminal site, it is devoted to the circulation of vehicles (private vehicles, AKAP buses, AKDP buses, public transportation, and TMB), and at level 2 or skywalk is for pedestrians only. (see figure 4)

![Figure 3. Leuwipanjang integrated terminal design plan](image1)

![Figure 4. Vehicle circulation path at the Leuwipanjang terminal](image2)

4.1. Pedestrian ways
Pedestrian circulation in the terminal is one-way circulation, which is coming to the terminal -> buying a ticket -> leaving by bus. Visitors come from the Soekarno-Hatta street connected by the skywalk to the terminal building to purchase tickets after that choose the bus route to continue leaving. From the 2nd floor to the bus platform, passengers descend using stairs. Vice versa, bus passengers who come must enter the building again and exit toward the skywalk.
In figure 5, the pedestrian ways are connected to the destination without any obstacles.

![Figure 5. Pedestrian way plans at Leuwipanjang integrated terminal](image)

Figure 5. Pedestrian way plans at Leuwipanjang integrated terminal

Figure 6 is a skywalk design that also functions as a pedestrian bridge on the Soekarno Hatta road. And Figure 7 is the skywalk that connectes the building to the bus platform.

![Figure 6. Skywalk design for pedestrian bridge.](image)

![Figure 7. Skywalk Design to the bus platform.](image)

![Figure 8. Skywalk design interior](image)

Figure 6. Skywalk design for pedestrian bridge.

Figure 7. Skywalk Design to the bus platform.

Figure 8. Skywalk design interior

4.2. Path Widths

Figure 9. Paths should conform to minimum dimensional requirements to provide for the safe passage of pedestrians and other eligible road users. The path is designed wider so that pedestrians who are running normally and walking in a hurry do not crash.

![Figure 9. Paths should conform to minimum dimensional requirements to provide for the safe passage of pedestrians and other eligible road users. The path is designed wider so that pedestrians who are running normally and walking in a hurry do not crash.](image)
4.3. **Furniture**

**Seating**

![Seating](image1)

*Figure 10.* Seats are placed every 3 meters along the pedestrian way. Seat height of about 450 mm above the ground to accommodate the needs of children to seniors.

**Billboard**

![Billboard](image2)

*Figure 11.* The terminal is a public building; a place is available to put advertisements. And pedestrian ways is a very strategic place because a lot of people go through it.

**Sign, tactile path and handrail**

![Sign, tactile path and handrail](image3)

*Figure 12.* To accommodate children, people in wheelchairs and people standing, sign is placed above a pathway with design cantilevered above a height of 2.5 m. The use of plain language and symbols is to enhance information accessibility for those with cognitive disability. Yellow text on black background provides a good color contrast.

4.4. **Stairs**

Pedestrians who go up and down from the skywalk use the stairs. Characteristics of visitors at the terminal always carry goods with large sizes and large quantities, up and downstairs will be very troublesome. For this purpose, a machine that is driven using a machine (see figure 15) is installed. It also can be used for wheelchair users.

![Stairs](image4)

*Figure 13.* The use of wheelchair stair machine

*Figure 14.* Slip-resistant color contrast nosings to be applied to the tread on every step.
5. Conclusion
Many pedestrian safety problems are found in the Leuwipanjang terminal. So, it needs to be redesigned to be an integrated terminal using the wayfinding approach to find solutions to existing problems so that the Leuwipanjang terminal becomes a pedestrian-friendly terminal.

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