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Traffic Circulation Evaluation Model in Hospital Facility Area

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Abstract—Accessibility measures the ease of location to be reached from other locations through the transportation system. Accessibility measures include ease of time, circulation, cost, and effort in moving between places or areas. Therefore, circulation is essential to fulfill this accessibility. This research aims to identify the factors that cause congestion in the accessibility of the Orthopedic and Traumatology Hospital of Surabaya visitors to comfort and analyze the quality and comfort of other road users, especially hospital visitors. This research was conducted using a qualitative descriptive method, which included conducting field observations, direct documentation, and filling out questionnaires with a purposive sampling method. The data collection was obtained by direct observation by describing the factual conditions in the field with the research object, namely the Surabaya Orthopedic & Traumatology Hospital. This study found that the congestion on the road section at intersection 4 of the Citraland area is caused by inefficient circulation, which impacts the accessibility of motorists, especially visitors to the hospital.

Keywords: accessibility; traffic; transportation; hospital.

1. Introduction

Surabaya City is the second largest city in Indonesia, with an area of ±335.28 km² and has 3,000,076 inhabitants. Like Jabodetabek, Surabaya City is also a metropolitan area with rapid business, industry, and education development and is the main port of commercial trade in Indonesia. Not surprisingly, many Indonesians from various regions choose to migrate to this city because they see many opportunities to get a job (Institut Kesehatan dan Bisnis Surabaya, 2023).

Because of these factors, Surabaya City gradually experienced a large population density with high mobility. The problem is no longer about land shortage or social issues but transportation problems. Indonesian citizens prefer to use private vehicles rather than available public facilities. In Indonesia itself, the majority of vehicles used are motorcycles and cars, as well as in the city of Surabaya, which is recorded in the data of the Korlantas Polri Polda East Java, the total number of motorcyclists and cars in 2022.

Table 1. The number of cars and motorcycles in Surabaya City in 2022

Year	Polres/TA	Cars	Motorcycles
2022	Surabaya, Kota	173.514	2.935.199

Sources: BPS East Java Province in Figure 2022

Along with the rapid increase in population and the development of the use of private vehicles, congestion has become a significant problem that is easily found. Moreover, weather factors and personal convenience are the main reasons Indonesians choose to do their daily activities using private vehicles.

For example, the Wiyung Sub-district in Surabaya is one of the destinations for people to migrate to this area because there are many jobs and adequate educational facilities. Additionally, the Wiyung Sub-district is where most of the land is used as housing. One of them is the CitraLand area, which became the area where the Orthopedic and Traumatology Hospital of Surabaya project was established.

In the CitraLand area, many people prefer private vehicles over public transportation facilities, which are already quite adequate. Therefore, congestion is the main problem faced, and even today, no solution has been found.

The hospital building project was developed in the Citraland area. The congestion that occurs is very influential on the accessibility of hospital visitors, disrupting the comfort of access of visitors. Structuring the accessibility circulation pattern is needed to minimize congestion around the hospital so as not to hinder and interfere with the access of hospital visitors.

Figure 1. Street Situation Around the Entrance Area to the Hospital
Source: Wibowo and Intan, 2023

This study aims to identify the congestion in traffic flow and accessibility to the Orthopedic and Traumatology Hospital of Surabaya, which affects the circulation comfort of hospital visitors. Given that the circulation pattern determines the success or failure of this problem, it can be resolved. More specifically, this study focuses on the circulation of motorized vehicles, where an area's spatial and urban arrangement pattern directly determines the circulation pattern.

2. Method

A stage of the data collection process in research requires a method to guide each stage. This research uses a descriptive qualitative method by doing field observations, direct documentation, and filling out questionnaires with the purposive sampling method. Assessing the problems faced requires real data collection and search. The following are the stages of data collection and discussion carried out by the author:

1. The first stage is to study the literature or theoretical basis related to the discussion of research and problems that exist inside and outside the project environment.
2. The second stage is observation and documentation. At this stage, observations are made by surveying and documenting the factual conditions.
3. The last stage is analyzing by examining the factual conditions in the field and evaluating them to obtain research results and discussions.

Location

This research was conducted at the Surabaya Orthopedic and Traumatology Hospital located at JL. Emerald Mansion TX10 CitraLand Surabaya.

Figure 2. Parking area of Surabaya Orthopedic & Traumatology Hospital
Source: Wibowo and Intan, 2023

The Orthopedic and Traumatology Hospital of Surabaya has three buildings, and building number 3 is still being completed. Before the construction of Building 3 Currently, many of the hospital visitors complain that the hospital lacks inpatient rooms, considering that the hospital's visitors are increasing every year.

Therefore, PT Surabaya Orthopaedic and Traumatology Hospital (PT SOTH), as the owner of this Surabaya Orthopaedic & Traumatology Hospital, plans to build a new building to support visitors by facilitating more inpatient rooms. Building number 3 of the hospital has seven floors with parking areas for cars and motorcycles.

3. Results and Discussion

Hospital activities are human activities that carry out activities within the hospital. Activities include organizing medical services, nursing services, medical support services, administrative and management services, education/training, research, and development. According to the Department of Settlement and Regional Infrastructure, infrastructure and facilities are primary buildings used to support human survival in a limited space so that they can move freely and settle comfortably in all weather; they can live healthily and can interact well between communities (Junianto and Azizah, 2022).

Based on the Ministry of PUPR 2017 rules, the circulation area in the building must consider five basics: essential space size, safety, comfort, convenience, and space function. In addition, health facilities and infrastructure must have high

accessibility because the service area of the health facility is influenced by its accessibility. The location of facilities and infrastructure that are easily accessible will increase the safety level of patients (Rotinsulu and Sembel, 2018).

The circulation of hospital visitors characterizes an indication of hospital activity. These activities are usually supported by the completeness of the most crucial facility, namely parking. Suppose a large parking lot is not provided to help visitors with good circulation and does not make it an obstacle for other road users. In that case, it will affect the capacity of the space concerned, resulting in traffic congestion (Warpani, 2002).

Traffic characteristics are a form of individual movement by drivers interacting with each other on the road space and its environment. Each driver has different abilities, so the behavior of traffic vehicles cannot be generalized. As a result, the behavior will experience differences in local characteristics and habits of the drivers. Therefore, the behavior of one driver will affect and impact the traffic behavior of other drivers (Gujarati and Porter, 2009).

The differences in traffic characteristics affect the behavior and habits of these drivers, and there may be positive and negative impacts. One of the negative impacts that is very visible and felt by drivers is the emergence of congestion. According to *Manual Kapasitas Jalan Indonesia*, from Kusnandar, congestion is a condition where the intensity on the road exceeds the planned road capacity, causing free speed in certain road sections (Kusnandar, 2009).

According to Hakim, a public space and landscape designer practitioner, comfort is determined by several elements in the design, such as circulation, climate, noise, shape, aroma, cleanliness, beauty, security, and lighting. Comfort can be reduced due to poor circulation, such as unclear road or traffic flow, no clear division of space between pedestrians and motorists, or no circulation division between one space and another (Hakim, 2012).
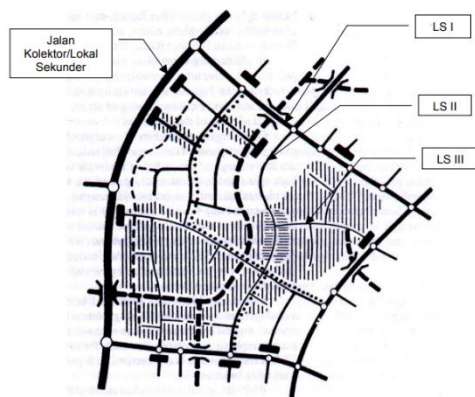

Figure 3. Illustration of Grid-Type Residential Road Network
Source: SNI 03-6967-2003 tahun 2003

The aspects of comfort in traffic circulation are determined by the provisions and standards that have been set according to the Indonesian National Standard (SNI), including:

Table 2. SNI Data on Traffic Comfort

No	Comfort Aspects	Indonesia National Standard
1	**Road Width** SNI 03-6967-2003	**Lokal Sekunder I (LS I)** Plan speed is at least 30 km/h, and road width is not <8m **Lokal Sekunder II (LS II)** Plan speed is at least 20 km/h, and road width is not <7m **Lokal Sekunder III (LS III)** A minimum plan speed of 10 km/h and a width of road not <5m
2	**Number of Vehicles** SNI 03-6967-2003	**Lokal Sekunder I (LS I)** Capacity 800-2000 vehicles/day **Lokal Sekunder II (LS II)** Capacity 200-1000 vehicles/day **Lokal Sekunder III (LS III)** Capacity <350 vehicles/day
3	**Road Median** SNI 03-2442-1991 SNI 03-2444-2002	Raised medians are installed when the width of the land for median placement is <5m, with the median height from the road surface between 18cm & 25cm.
4	**Vegetation** SNI 7645:2010	The width of the plantable median should be 0.80m. The ideal width is 4-6m
5	**Access Road Distance Between Intersections** SNI 03-6967-2003	**Lokal Sekunder I (LS I)** >200 meters **Lokal Sekunder II (LS II)** 100-200 meters **Lokal Sekunder III (LS III)** 50-100 meters

Source: SNI Persyaratan Umum Sistem Jaringan dan Geometrik Jalan, 2023 dan SNI Klasifikasi Penutup Lahan, 2010

An elite residential area in the CitraLand area is on the road flow to the west of the hospital. In the flow of roads to the south are residential areas, rows of kiosks, and several boarding houses or homestays. The flow of roads to the east enters the Surabaya State University campus area and the access area to the hospital, which

aligns with the flow of roads to the north.

Figure 4. Intersection 4 of Jl. Emerald Mansion TX10
Source: Google Street View, 2022

Congestion often occurs on this section of the road at intersection 4. The main contributing factors are the density of private vehicle users, the duration of traffic lights, and the narrow size of roads. Other factors include the inefficient circulation of U-turns and the density of kiosks and small traders that occupy the vehicular access road.

Based on the analysis of field observations, the factors that support the occurrence of congestion are the inefficiency of urban planning and good circulation and the inefficient setting of the duration of traffic lights at intersection 4 of the Citraland Area.

Table 3. Estimated time of traffic light

Description Road	Color	Time
Jl. Emerald Mansion TX10	🔴	41 seconds
	🟢	77 seconds
Jl. Lontar (east side of hospital building)	🔴	104 seconds
	🟢	13 seconds
Jl. Lontar Lidah Kulon	🔴	97 seconds
	🟢	22 seconds
Jl. Raya Unesa Campus	🔴	30 seconds
	🟢	80 seconds

Source: Wibowo and Intan, 2023

The Aspect of Traffic Circulation Comfort

Having distributed questionnaires using the purposive sampling method to complete the research report data, the authors obtained a total of 30 respondents who participated in answering the questions asked in the questionnaire. The question was divided into six categories based on the aspects that consider traffic circulation comfort indicators, as mentioned before, including the width of the road, type of vehicles, road median, vegetation provided, distance road between intersections, duration of traffic lights, and other informal factors, such as street vendors and illegal parking. The results of the questionnaire data are presented in the following diagram.
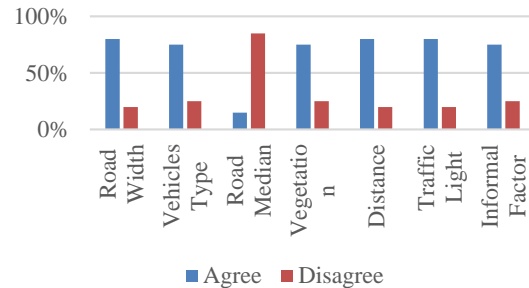
Figure 5. Indicators of Traffic Circulation Comfort Indicators
Source: Wibowo and Intan, 2023

Most respondents said traffic jams often occur at the intersection of four roads, Jl. Emerald Mansion TX10, Jl. Lontar Lidah Kulon, Jl. Raya Kampus Unesa, and Jl. Lontar (east side of hospital building). It is the result of the dimensions of the road not complying with SNI standards, the lack of proportionate vehicle capacity, and the duration of the traffic lights needing to be more balanced between red and green lights. As a result, many motorists feel uncomfortable, predominantly as circulation to hospital visitors is disrupted.

Analysis of Traffic Circulation Comfort

The results of the distribution of questionnaires based on the perceptions of respondents who have experience passing through the intersection four road section with schematic analysis, as follows:

(1) Analysis of JL. Lontar Lidah Kulon

According to the perception of respondents' answers, a percentage of 93.8% said that traffic congestion on JL. Lontar Lidah Kulon occurs due to the size of the road needing to be commensurate with the capacity of the road itself and the volume of vehicles that exist every day.

Figure 6. The Dimension of Jl. Lontar Lidah Kulon
Source: Google Street View, 2023

The saturation of the road with vehicles parked on the side and the large number of vendors and kiosks that need more parking space add to the congestion.

Figure 1. Condition of Jl. Lontar Lidah Kulon
Source: Google Street View, 2023

A percentage of 75% said that they felt uncomfortable when crossing the road section at JL. Lontar Lidah Kulon. The arrangement of traffic lights is often a problem felt by the community because the length of the green light differs from the red light.

Figure 2. Duration of traffic signal lights at Jl. Lontar Lidah Kulon
Source: Wibowo and Intan, 2023

(2) Analysis of JL. Emerald Mansion TX10

The level of congestion on JL. Emerald Mansion TX10 is of low value because this road section is the main road; to regulate the duration of the green traffic signal lights, it is said to have a long duration of around 40-80 seconds. Congestion that occurs on this road section is very rare. One of the causes of congestion will depend on how smooth the road is on the UNESA Campus.

Figure 9. Condition of Jl. Emerald Mansion TX10
Source: Google Street View, 2023

(3) Analysis of JL. Lontar (East Side Road of Hospital Building)

Depending on the respondents' perception, a percentage of 100% agree on the inefficiency of circulation on this road section due to the flow of U-turns that complicate hospital visitors and disturb other road users.

Figure 10. Condition of Jl. Lontar East Side of Hospital Surabaya Building
Source: Google Street View, 2023

Figure 11. Schematic Analysis of Turn Around Flow Circulation
Source: Wibowo and Intan, 2023

Plus, the size of the road needs to be wider to be used as a place for U-turns due to vehicles experiencing clashes, especially between public motorists and motorists who are visitors to the hospital itself.

(4) Analysis of Unesa Campus Highway

Based on the perception of the respondent's answers with a percentage of 75%, they said that the traffic conditions on the Jalan Raya UNESA Campus section were comparable to those on the Jalan Emerald Mansion TX10 section. Congestion on this road section is rare, and congestion occurs due to significant events in the UNESA Campus Area, such as graduations, festivals, or other formal and informal events. The rest of the road will feel quiet without any accumulation of vehicles.

Figure 12. Condition on the East Side of the Hospital Building
Source: Google Street View, 2023

The result from previous questionnaire shows that the road section at intersection 4 of the Citraland area is often congested due to the following factors:

a. The high volume of vehicles needs to be commensurate with the capacity of the road, which is too narrow for two flows at once.
b. The density of small traders selling their commodities on the roadside and kiosks with minimal parking space.
c. The duration of time the red light is on compared to the green light is different.
d. The circulation path in the U-turn flow makes it difficult for motorists, hinders travel, and disrupts the circulation of hospital visitors to the parking lot.

4. Conclusion

This study identifies the congestion problem around the Orthopedic and Traumatology Hospital of Surabaya, which affects the circulation comfort of hospital visitors. The result shows that circulation at intersection 4 of the Citraland Area still needs to be more efficient because congestion is still a significant problem the Citraland area faces. Improper circulation in the U-turn flow on the east side of the hospital building is still one of the congestion factors in the Citraland Area and disturbing visitors to the Orthopedic and Traumatology Hospital of Surabaya itself.

According to the questionnaire fillers' opinions, the traffic lights problem still needs to be solved. The density of vehicles when crossing narrow roads and the number of small traders and kiosks with minimal land is different from the capacity of the road section, adding to the congestion that occurs.

References

B. SNI, "Persyaratan Umum Sistem Jaringan dan Geometrik Jalan Perumahan. SNI 03-6967-2003," 2003. [Online].

B. SNI, "Klasifikasi Penutup Lahan," 2010. [Online].

B. SNI, "Klasifikasi Penutup Lahan. SNI 7645-2010," 2010. [Online].

Gujarati, Damodar., Dawn, C, Porter. (2009). Basic Econometric 5th Edition 1993. New York: McGraw-Hill Oglesby.

Hakim, R. (2012). Komponen Perancangan Arsitektur Lansekap. Jakarta: Bumi Aksara, 2012.

Institut Kesehatan dan Bisnis Surabaya. (2023). Tentang Surabaya. [Online]. Available: https://ikbis.ac.id/tentang-surabaya/.

Junianto, Kurniawan Dwi., Azizah, Ronim. (2022). Identidikasi Kemacetan Di Depan Jalan Masuk Pasar Klewer Berdasarkan Persepsi Pengunjung. *Jurnal SIAR-III,* pp. 226-231.

Kusnandar, E. (2009). Pengkinian Manual Kapasitas Jalan Indonesia 1997. *Jurnal Jalan dan Jembatan,* Vol. 26, No.2, pp. 1-11.

Rotinsulu, F.A., Franklin, P. J., and Sembel,A. (2018). Analisis Ketersediaan dan Kebutuhan Sarana Permukiman di Kecamatan Kalawat. *Jurnal Spasial Universitas Sam Ratulangi*, Vol. 4, No. 3, pp. 42-51

Warpani, S.P. (2002). Pengelolaan Lalu Lintas dan Angkutan Jalan Bandung. Bandung: ITB Press.