Transportation Route Shifts Impacts on The Deterioration of Facades in Kalimas Timur

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Article Info	ABSTRACT
	Historically, Indonesia's strategic location on international trade routes facilitated the development and growth of port cities throughout Indonesia. Historically, rivers were the city's main transportation route, leading to urban settlements along the river banks. Surabaya is one of the cities in Indonesia that relies on waterways as its main transportation route. However, population growth accompanied by the expansion of road transportation modes gradually reduced the role of the river as the main route. The shift has resulted in areas around the river becoming undeveloped and unmaintained. This research uses a space syntax approach to study the impact of the transportation shift in Surabaya from waterway to landline on the condition of facades along Jalan Kalimas Timur. The quantitative method descriptively uses data collected through literature study and field observation. The data obtained was then analysed using DepthMapX software. The results of this study show that the shift in transportation routes impacts the maintenance of facades along Kalimas Timur Street, which tends to be less maintained, making the area that was once the centre of the city now a neglected and damaged area.

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1.   INTRODUCTION

Surabaya is one of the oldest port cities in Indonesia and has been the centre of trade since the Majapahit Kingdom in the 14th century [1]. Surabaya's strategic location is a significant meeting point between maritime and land trade routes. For centuries, water transportation has played a vital role in the economic activity of Surabaya city. Kalimas river is the main transportation route connecting the port with the city centre and surrounding areas [2]. During the Dutch administration, Arabs and Chinese were the drivers of the economy and trade on the east side of the Kalimas River [3]. The activities of loading and unloading goods along the river shaped the physical and social character of the surrounding area, including Kalimas Timur Street. The road network in Surabaya City was built following the Kalimas River and Pegirian

River flow because many people live along the banks of the two rivers. As a result of the winding river, the road development pattern in Surabaya City is irregular [4].

As time passed, land infrastructure development began to shift the role of water transportation. Using roads, bridges, and railways changed goods' distribution and mobility patterns. By the end of the 12th century and the beginning of the 21st century, land transportation was increasingly dominant, resulting in decreased activities on waterways such as the Kalimas River. The road network continues to develop and become the city's main transportation route along with population growth, the distribution of settlements, the distribution of community needs, and the advancement of land transportation [5]. The development of roadways made the river no longer the city's main transportation route and shifted the role of Kalimas River as Surabaya's primary transportation route.

This change from waterway to roadway transportation significantly impacts various aspects of city life, including the maintenance of facades on buildings along roads that were once busy with water activities. The Kalimas Riverfront area, once the centre of the trading city, is now underdeveloped. At that time, Kalimas Timur Street was the centre of the port [1] It was one of the streets affected by various changes in the characteristics of the buildings and the surrounding environment. As a result of reduced water transportation activities, many buildings along Kalimas Timur Street have lost their primary function as warehouses or loading and unloading points for goods. A decrease often follows this decrease in activity in attention to building maintenance, which impacts the physical condition of the facades. In addition, along with the increase in land traffic, buildings on Kalimas Timur Street began to be abandoned, whereas, in the past, this road was passed by many Chinese and Arab traders. Traders would go to the Ampel area, and Chinese traders to the Pabean and Kya-Kya areas [6]. Increased vehicle traffic causes air pollution and vibrations that can accelerate damage to building facades. In addition, infrastructure changes such as the construction of highways and other public facilities affect buildings' aesthetics and maintenance needs.

This study examines the influence of changes in the main transportation route of Surabaya City, from waterways to roadways, on maintaining building facades on Kalimas Timur Street. Based on the dynamics of this change, solutions are expected to be found to maintain and improve the quality of building facades in this area so that they can still contribute to the beauty and historical value of Surabaya City. Surabaya City Government is important in determining the direction of building maintenance and preservation in this area. Policies related to historic building conservation and building facade maintenance regulations are essential factors that influence the physical condition of buildings along Kalimas Timur Street.

2. RESEARCH METHOD

This research uses descriptive quantitative methods. Quantitative research is an approach that answers research hypotheses through numerical data and exact science [7]. This quantitative method is scientific because it fulfils scientific principles, namely concrete, empirical, objective, measurable, rational, and systematic [8]. Descriptive quantitative uses a correlation approach, which is research to find relationships between variables [9]. Descriptive analysis aims to accurately and systematically explain the findings of field and numerical data [10]. Data was collected using the literature study method, observation and field documentation, and document review. The literature study was used to collect maps of Surabaya City. A document review was conducted to collect theoretical data and perform similar studies. Field observation was performed to observe and document Kalimas Timur Street's facade conditions directly.

The object of this research is Kalimas Street in Surabaya City. This research used maps of Surabaya City in 1943 and 2024. The 1943 map of Surabaya City was drawn using Autocad software in dxf format, while the 2024 map was taken from the Cadmapper website. Surabaya City road network map was created in 1943 to represent the condition of waterways and landlines used as Surabaya City transportation routes, and the road network map in 2024 represents the condition of only roadways used as Surabaya City's main transportation routes.

The simulation process is done with DepthMapX and uses maps in dxf format to determine the connectivity, integration, visibility, and RRA values. The connectivity value is a dimension for measuring local properties that count the number of inner spaces directly connected to other spaces in the configuration [11]. The integration value is a dimension to measure global properties in the form of the relative position of each space to other spaces in a space configuration [11]. The more spaces that receive the most motion and intersect with other spaces, the greater the integration value in that space is [10]. The visibility value is the visibility of an object in a system from a certain point [12]. A high visibility value means a space is visible,

making it easier for humans to use space [12]. If a space has a low RRA value, then the space tends to have a high integrity value compared to other spaces [13].
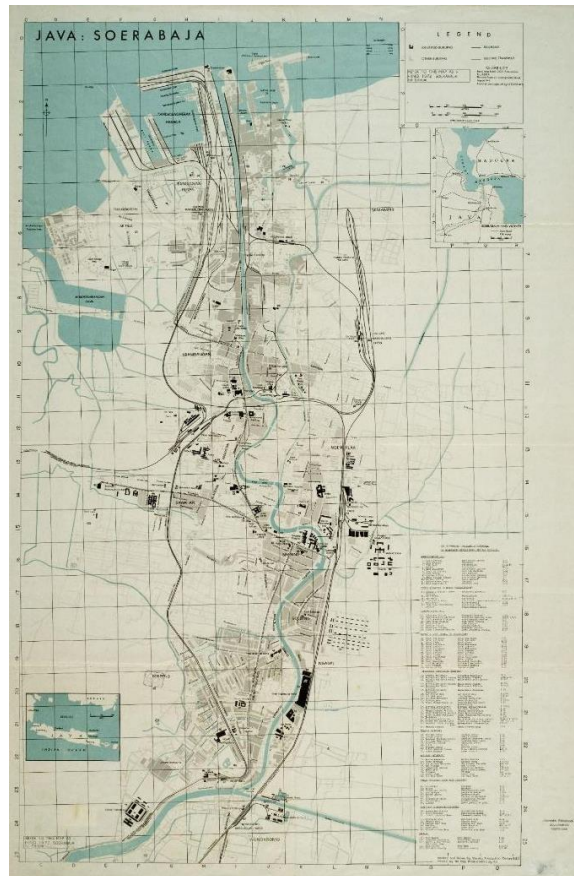
Figure 1. The map of Surabaya City in 1943

The colour range will equalise the simulation results of the 1943 map and the 2024 colour, and the results of connectivity, integration and visibility will be tabulated and categorised based on changes in colour colours. The colour arrangement is dark blue at the lowest, then light blue, green, yellow, and or orange until the highest is red. The range of colours from the DepthMapX analysis of the 1943 and 2024 maps must be the same to determine the level of change. The level of change is categorised into five levels: decreasing, insignificantly decreasing, increasing, insignificantly increasing, and no change. The outcome of the simulation process using DepthMapX is discussed, including the maintainability of the building facades on Kalimas Timur Street.

The facade is the most important architectural element because it speaks the meaning and function of a building [14]. The maintainability criterion is one of the criteria used to assess whether the study object is kayaking [15]. Measures of the level of damage include the level of maintainability, the percentage of damage and the cleanliness of the building [15]. Facade maintainability will be used to assess the quality of building facades on Kalimas Timur Street. The maintainability of buildings in the area will be classified into poor, fair, reasonable, and excellent [16]. This classification consists of the following criteria [16]:

a. The building is in poor condition.
    - The building originality : 0% - 24%
    - Building elements are damaged, missing, and even destroyed
    - Wall paint faded, dull, full of mould and rotten frames
b. The building is in fair condition.
    - The building originality: 25% - 49%
    - Material condition of the building: some have been replaced and less harmonised
    - Wall paint is peeling, dull, and filled with fungus

c. The building is in good condition
   -   The building originality: 50% - 74%
   -   Some building materials have been replaced but are in good condition and still in harmony
   -   Wall paint is starting to fade and dull but is still in good condition
d. The building is in excellent condition
   -   The building originality: 75% - 100%
   -   The building materials are in good condition
   -   The colour of the wall paint is new, not dull and looks well-maintained

3.   RESULTS AND DISCUSSION

This research analyses the road network based on the Surabaya City Map in 1943 and 2024 using DepthMapX software. The analysis was conducted on road network maps in different years to determine the pattern of changes due to the change in Surabaya City's transportation routes from waterways to roadways. The Map in 1943 represents the condition of Surabaya City when waterways and roadways were used as the main transportation routes, while the Map in 2024 represents the situation where only roadways are the main transportation routes in Surabaya City. The axial line analysis on Surabaya City's road network map using DepthMapX software was conducted to find the level of connectivity and integration on Kalimas Timur Street. The visibility value can be seen from the value on the grid analysed in the DepthMapX software. This figure is a graphical image of the DepthMapX analysis results.
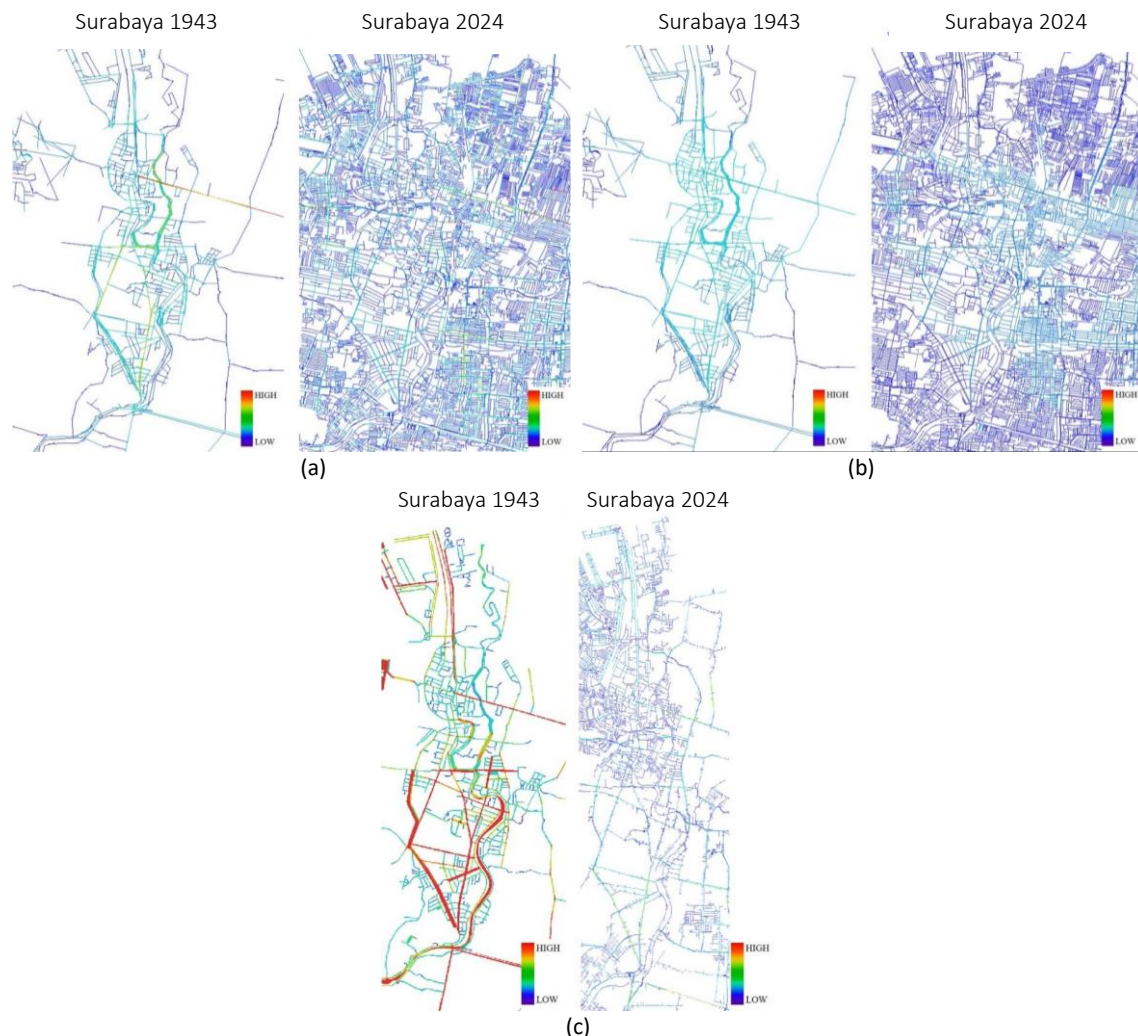
Figure 2. *(a) Connectivity, (b) Integration,* and *(c) Visibility* in Surabaya City

Figure 2 is the result of DepthMapX analysis based on the Surabaya City map in 1943 and 2024. Figure 2(a) is the result of connectivity analysis, Figure 2(b) is the result of integration analysis, while Figure 2(c) is the result of visibility analysis. Axial images on the results of DepthMapX analysis of the Surabaya City Map in 1943 are dominated by light blue, green, yellow, and red colours. Different things can be seen on the Surabaya City Map 2024, dominated by light and dark blue colours. Changes in colour categories indicate the dominance of a decrease in the level of connectivity, integration and visibility of the Surabaya City road network. As a result, the change in Surabaya City's transportation route from the waterway to the roadway affects the decrease in the value of connectivity, integration and visibility on the Surabaya City road network. Kalimas Timur Street is one of the roads in Surabaya City close to the waterway, namely the Kalimas River. The following is an image of the DepthMapX analysis results on Kalimas Timur Street.

Connectivity   Integration   Visibility

(a)

Connectivity   Integration   Visibility

(b)
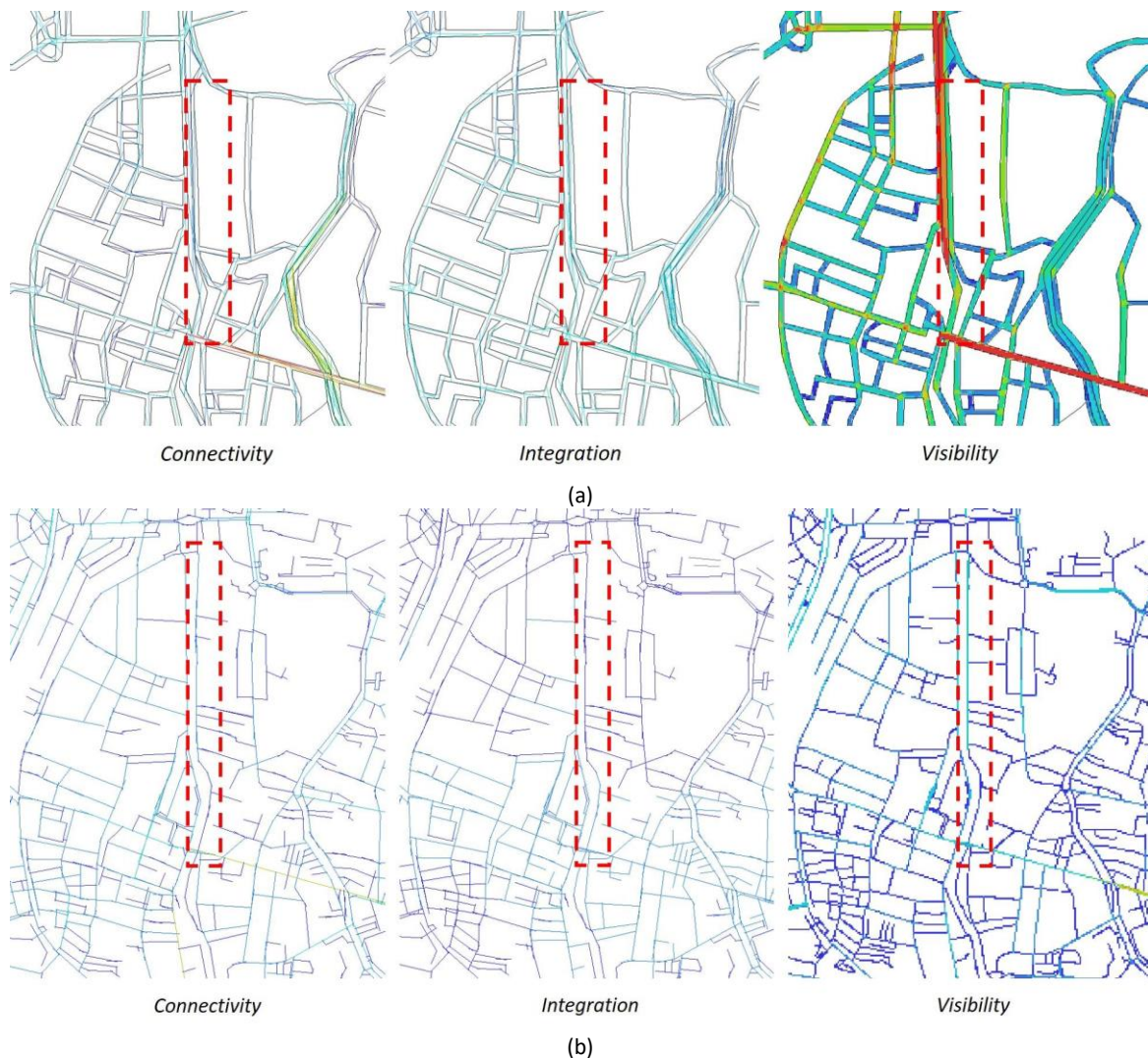
Figure 3. DepthMapX analysis of Kalimas Timur Street on (a) Surabaya Map 1943 and (b) Surabaya Map 2024.

Figure 3 is an image of the results of the DepthMapX analysis of Kalimas Timur Street and the surrounding streets. Kalimas Timur Street is within the area marked with a red box. Figure 3(a) is the DepthMapX analysis result of Kalimas Timur Street in 1943, and Figure 3(b) is the analysis result in 2024. Figures 3(a) and 3(b) are compared, and it can be seen that there is a change in the colour category of integration and visibility values on Kalimas Timur Street. The colour of the axial integration line on Jalan Kalimas Timur has changed from light blue to dark blue, while the visibility on Jalan Kalimas Timur has changed from green to light blue. The results show that Kalimas Timur Street tends to experience a decrease in the level of integration and visibility based on the colour category. A different thing happens to the

connectivity value where there is no change in the colour category, as the colour that appears remains light blue. The table below details the colour categories, connectivity, integration, visibility, and RRA values of Kalimas Timur Street in 1943 and 2024.

Table 1. Connectivity, Integration, and Visibility Value of Kalimas Timur Street

Variable	Surabaya 1943		Surabaya 2024		Level of Change
	Colour Range	Value	Colour Range	Value	
Connectivity	Light Blue	9	Light Blue	4	Insignificantly decreasing
Integration	Light Blue	0.72	Dark Blue	0.46	Decreasing
Visibility	Green	211	Light Blue	119	Decreasing
RRA	-	1.26	-	1.98	Decreasing

Table 1 shows the result of the analysis of Kalimas Timur Street using DepthMapX. Based on Table 1, the connectivity level on Kalimas Timur Street has decreased but not significantly. It was because Kalimas Timur Street did not experience a change in the colour category, which remained in light blue, but the connectivity value decreased from 9 to 4. The change in transportation routes from the waterway to the roadway impacted the decrease in connectivity value, meaning that the number of other roads directly connected to Kalimas Timur Street decreased. The integration and visibility levels have declined based on colour and value categories. The change of transportation route from waterway to roadway impacts the decrease of integration value on Kalimas Timur Street from light blue to dark blue. In addition, the visibility value also decreased from the category of green colour to light blue. Kalimas Timur Street experienced a decrease in RRA value, which can be seen from the change in RRA value from 1.26 to 1.98. The reduction in RRA value indicates that Kalimas Timur Street has a low integrity value. The transportation route change from waterway to roadway affects the reduction of connectivity, integration, visibility, and RRA values on Kalimas Timur Street.

Figure 4. Section of Kalimas Timur Street to analyse the Condition of Facade Maintainability

Figure 4 is a key plan of the Kalimas Timur Street segment section for a detailed explanation of facade maintenance on each building. Kalimas Timur Street is divided into ten segments consisting of A. The segments are divided based on the gap between building facades. Each facade is discussed for its integrity, building elements and surface condition to assess the level of maintenance of each building. Below is a table that explains the level of maintenance of each building on Kalimas Timur Street.

Table 2. Level of Maintainability of Building Facades on Kalimas Timur Street

Segment	No.	Building Facade	Description	Maintainability Level
A	A1		• Building integrity: 45% • Building elements: The windows and doors are missing, but the main building remains intact. • Building surface: The Wall Paint colour is dull, and some spots are mouldy, dirty, and begin to rot	Fair
	A2		• Building integrity: 24% • Building elements: Many windows and doors are missing, and only temporary covers are needed. Walls and ceilings are peeling and crumbling. • Building surfaces: The wall paint is unmaintained, dirty, dull, mouldy and weathered •	Poor
	A3		• Building integrity: 60% • Building elements: Windows and doors are still intact. A small shop in front of the facade • Building surface: Wall paint is not maintained, is dull, and some spots are mouldy	Fair
	A4		• Building integrity: 60% • Building elements: The building is not destroyed • Building surfaces: Wall paint is faded, dull, and mouldy	Fair
	A5		• Building integrity: 65% • Building elements: Building elements are still in fair condition • Building surfaces: The wall paint is faded and dull. But the surface of the building is still in good condition	Good
B	B1		• Building integrity: 30% • Building elements: The building is not destroyed • Building surface: Wall paint has faded, is dirty, started to grow wild plants, dull and mouldy	Fair
	B2		• Building integrity: 90% • Building elements: The building is in good condition • Building surfaces: The wall paint colour is good, not dull and maintained	Excellent
	B3		• Building integrity: 20% • Building elements: Damaged building • Building surfaces: The wall paint colour has faded, dominated by dirty, dull, weathered, and mouldy conditions.	Poor
C	C1		• Building integrity: 65% • Building elements: Building elements are still in reasonably good condition • Building surface: The wall paint is starting to fade and dull, but still quite good	Good

C2		• Building integrity: 20% • Building elements: Damaged building • Building surfaces: The wall paint colour is not visible, dominated by dirty, dull, weathered, and mouldy conditions	Poor
C3		• Building integrity: 30% • Building elements: Missing building windows covered with zinc cladding • Building surfaces: The wall paint colour is faded and dull, and some spots are mouldy	Fair
C4		• Building integrity: 30% • Building elements: Incomplete door and window parts • Building surface: Wall paint peeling and fading, dull, and some mouldy spots	Fair
C5		• Building integrity: 60% • Building elements: Windows, doors and buildings still exist • Building surface: The wall paint colour is starting to fade and dull, but still good	Good
C6		• Building integrity: 30% • Building elements: building windows are in a state of disrepair • Building surfaces: Wall paint peeling and fading, dull and mouldy	Fair
C7		• Building integrity: 60% • Building elements: Windows, doors and buildings still exist • Building surface: The wall paint colour is starting to fade and dull, but it is still good	Good
C8		• Building integrity: 20% • Building elements: The shape of the building is irregular; some parts of the building are damaged, and the front area of the building is used for selling. • Building surfaces: Wall paint is peeling and fading, dull, and mouldy	Poor

D	D1		• Building integrity: 60% • Building elements: Windows, doors, and buildings are still in place • Building surface: The wall paint colour is faded and dull but still looks good	Good
	D2		• Building integrity: 20% • Building elements: building windows are damaged and missing. • Building surfaces: Wall paint is no longer visible, dull, mouldy and weathered	Poor
	D3		• Building integrity: 30% • Building elements: incomplete doors and windows • Building surface: Wall paint peeling and fading, dull, and some mouldy spots	Fair
	D4		• Building integrity: 95% • Building elements: Building in good condition • Building surfaces: The wall paint colour is in good condition, not dull and maintained	Excellent
E	E1		• Building integrity: 30% • Building elements: incomplete doors and windows • Building surface: Wall paint peeling and fading, dull, and some mouldy spots	Fair
	E2		• Building integrity: 75% • Building elements: the building is in good condition • Building surface: The wall paint colour is in good condition and not dull.	Excellent
	E3		• Building integrity: 24% • Building elements: The shape of the building is intact, but some points are damaged, and the front area of the building is used for selling. • Building surface: Wall paint is peeling, fading, dull, and mouldy.	Fair
	E4		• Building integrity: 85% • Building elements: Building shape is in good condition • Building surface: The wall paint colour is in good condition and not dull	Excellent
	E5		• Building integrity: 75% • Building elements: Building shape is in good condition • Building surface: The wall paint colour is in good condition and not dull	Excellent
F	F1		• Building integrity: 85% • Building elements: Building shape is in good condition • Building surface: The wall paint colour is in good condition and not dull	Excellent

|				
	F2		• Building integrity: 20% • Building elements: Many facade elements are damaged and missing • Building surface: Wall paint is faded, dirty, dull, and mouldy	Poor
	F3		• Building integrity: 30% • Building elements: Doors and windows on the building are incomplete • Building surface: The wall paint is peeling, fading, and dull, and some spots are mouldy.	Fair
	F4		• Building integrity: 30% • Building elements: Doors and windows on the building are incomplete • Building surface: The wall paint is peeling, fading, and dull, and some spots are mouldy	Fair
G	G1		• Building integrity: 20% • Building elements: Many facade elements are damaged and missing • Building surface: Wall paint is faded, dirty, dull, and mouldy.	Poor
	G2		• Building integrity: 30% • Building elements: Doors and windows on the building are incomplete • Building surface: Wall paint is peeling, fading, and dull, and some spots are mouldy	Fair
	G3		• Building integrity: 60% • Building elements: Windows, doors, and buildings are still in place • Building surface: The wall paint colour is starting to fade and dull, but still good	Good
	G4		• Building integrity: 10% • Building elements: Doors and windows on the building are incomplete • Building surfaces: Wall paint peeling, faded, dull, dirty and mouldy	Poor
H	H1		• Building integrity: 60% • Building elements: Windows, doors, and buildings are still in place • Building surface: The wall paint colour is in good condition, but some spots are starting to mould.	Good
	H2		• Building integrity: 30% • Building elements: Doors and windows on the building are incomplete • Building surface: The wall paint is peeling, fading, and dull, and some spots are mouldy	Fair
	H3		• Building integrity: 30% • Building elements: The main form of the building is still intact but damaged at some points. The front area of the building is used for selling. • Building surface: Wall paint is peeling, fading, dull, and dirty, and some spots are mouldy	Fair
I	I1		• Building integrity: 15% • Building elements: Doors and windows on the building are incomplete • Building surfaces: Wall paint peeling, faded, dull, dirty and mouldy	Poor

	I2		• Building integrity: 15% • Building elements: Doors and windows on the building are incomplete • Building surfaces: Wall paint peeling, faded, dull, dirty and mouldy	Poor
J	J1		• Building integrity: 85% • Building elements: The shape of the building looks good • Building surface: The wall paint colour is in good condition and not dull	Excellent
	J2		• Building integrity: 35% • Building elements: Many facade elements are damaged and missing. • Building surface: The paint is faded, dirty, and dull.	Fair
	J3		• Building integrity: 90% • Building elements: The building shape is still good • Building surface: The wall paint colour is good and not dull	Excellent
	J4		• Building integrity: 35% • Building elements: Many elements of the building facade have been damaged and missing • Building surface: Wall paint has faded, dirty, and dull	Fair
	J5		• Building integrity: 35% • Building elements: Many facade elements are damaged and missing • Building surface: Paint has faded, dirty, dull	Fair
	J6		• Building integrity: 65% • Building elements: Building elements are in fair condition • Building surface: The wall paint is starting to fade and dull, but still quite good	Good
	J7		• Building integrity: 35% • Building elements: The shape of the building is complete, but some points are damaged. The front area of the building is used for selling. • Building surface: The wall paint is peeling and fading, dull, and some spots are mouldy.	Fair
	J8		• Building integrity: 35% • Building elements: The building shape is complete, but some points are damaged • Building surface: Wall paint is peeling and fading, dull, and some spots are mouldy	Fair
	J9		• Building integrity: 35% • Building elements: Doors and windows on the building are incomplete • Building surface: The wall paint is peeling, fading, and dull, and some spots are mouldy.	Fair

Table 2 shows the condition of each facade on the buildings along Kalimas Timur Street. The old buildings found along Jalan Kalimas Timur mean that the area was an important area in the past, where water transportation was the main transportation route for the city. The data details in Table 2 are then processed and tabulated to get the percentage of the number of facades based on the level of maintenance. The classification is divided into four types: excellent, good, fair, and poor.

Table 3. Percentage of Facades by Maintenance Level Classification on Kalimas Timur Street

Building Facade	Excellent	Good	Fair	Poor	Number of Facades
Amount	8	8	21	10	47
Percentage (%)	17%	17%	45%	21%	100%

Percentage of Facades by Maintenance
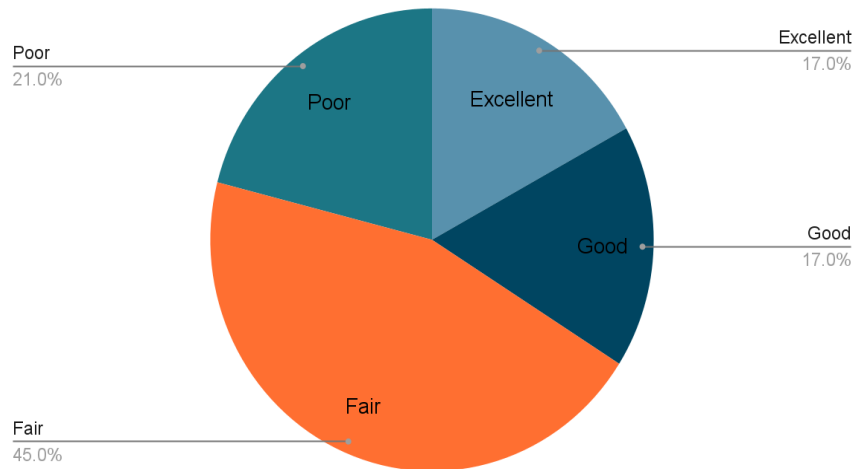
Figure 5. Percentage of Facades by Maintenance Level Classification on Kalimas Timur Street

Based on Table 3, the condition of the facades on Kalimas Timur Street is maintained at 45%. Reasonably maintained and poorly maintained facades account for 66% more than goodly maintained and excellently maintained facades, which account for only 34%. Poorly maintained buildings are dominated by former warehouses, where, in the past, the area was used as a trade transportation route via waterways. The location of Kalimas Timur Street, which is on the side of Kalimas River, has been affected by the change in the main transportation route of Surabaya City from waterways to roadways. As a result, Kalimas Timur Street, which used to be an important area of the city, has now become an underdeveloped area. The change in transportation routes affects the facades of buildings near the waterway, which tend to be shabby and poorly maintained.

4.   CONCLUSION

The location of Jalan Kalimas Timur on the side of the Kalimas River is influenced by changes in the main transportation route of Surabaya City, from waterways to roadways. The change in the main transportation route of Surabaya City from waterways to roadways impacts the decrease in the value of connectivity, integration, visibility, and RRA of Jalan Kalimas Timur. The waterway is no longer used as the city's main transportation route, causing Jalan Kalimas Timur, which used to be an important area in the city of Surabaya, to become a less developed area. This decline in development can be seen from the condition of building facade maintenance on Jalan Kalimas Timur, which is quite well maintained at 45% and less well maintained at 21%.

This research provides in-depth insight into the impact of changes in the waterway to roadway transportation on the maintainability of building facades on Kalimas Timur Street. It can be used to revitalise the Kalimas Timur Street area. The recommendations below are expected to help revitalise and develop the Kalimas Timur area.
   a.   Infrastructure revitalisation will be done by improving the quality of roads and public facilities on Kalimas Timur Street.
   b.   Local economic development can be achieved by encouraging the presence of financial activities such as organising local markets or festivals on Kalimas Timur Street.
   c.   Incentivise owners to maintain their facades and buildings to improve building quality.
   d.   Empowerment of local communities in the process of planning and implementing revitalisation.
   If the above recommendations can be implemented, Jalan Kalimas Timur can again become a vibrant and attractive area and tourist destination for Surabaya's old town.

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