Traffic Impact Analysis of Tajur Bogor Mall Boxies Building on Roads

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ABSTRACT
Traffic congestion that occurs almost evenly throughout the Bogor City area can be caused by several main factors, namely. The narrower roads and the increasing number of motorized vehicles result in congestion. The area of Bogor City, which is only 11,850 ha with a road length of 783,412 km, is already congested to accommodate the number of vehicles that are increasingly exceeding the carrying capacity of the road. In addition, the rapid development of business and trade areas in the city of Bogor spurred changes in traffic intensity. This study aims to create a model of generation and attraction caused by land use such as Educational Buildings, Industrial Estates, Traditional Markets and Supermarkets located in the sub-district. Research data retrieval is carried out using primary and secondary data methods, then the data is processed using (Trip Generation Manual) then modeled with (Software Saturn). The number of generation and towing in the studied area is 491 trips/hour. With Service Levels ranging from C to F. Then the design equation for transportation modeling for the East Bogor sub-district in 2021 is \( Y = 2963.66 + 0.840(X) \) then in 2026, namely \( Y = 2963.66 + 0.840(X) \).

Keywords: congestion; land use; Saturn; generation; attraction.

INTRODUCTION
The city of Bogor has serious problems in the field of transportation, especially traffic. The problem of traffic jams, which conceptually should have been planned and realized by the Department of Transportation of the City of Bogor, but apparently still has not. Traffic jams that occur almost evenly throughout the Bogor City area can be caused by several main factors, namely: The narrower roads and the increasing number of motorized vehicles result in congestion. The area of Bogor City, which is only 11,850 ha with a road length of 783,412 km, is already congested to accommodate the number of vehicles that are increasingly exceeding the carrying capacity of the road. In addition, the rapid development of business and trade areas in the city of Bogor spurred changes in traffic intensity. The development of a certain area has an influence on the traffic around it. Changes in land use, both changes in category and intensity will generate traffic, so small or large will have an influence on the surrounding traffic. With the construction of a new shopping center, it is estimated that it will generate traffic and affect the existing traffic around the new activity center. Through the evaluation of the impact of traffic, it can be calculated how much new trip generation that requires traffic engineering and traffic management to overcome the impact. Traffic impact evaluation is used to predict whether the transportation infrastructure is capable of serving the existing (existing) traffic plus the traffic generated or withdrawn by the new activity center. If the existing infrastructure cannot support the traffic, a study on infrastructure handling and traffic management arrangements must be carried out.

The Boxies Tajur Bogor Mall building owned by PT. Sinar Indonesia Loka which is located on Jl. Raya Tajur No.123, Tajur, East Bogor, Bogor City. Boxies is predicted to be the most luxurious mall in the Bogor City area, which is equipped with recreational facilities and family education in the form of Taman Bunga Nusantara, Petting Zoo Theme Park, Restaurant and Café. This of course will cause changes in traffic characteristics in the form of trip generation and attraction as well as changes in other characteristics. In response to this, it is necessary to analyze the traffic impact of the building in order to predict the possible magnitude of the impact generated as well as to anticipate the impact of the construction of the Boxies Mall Building on the surrounding traffic. Based on this thought, Mall Boxies will have a negative impact on the performance of road...
segments, performance of intersections, so it is necessary to conduct a study in order to anticipate the possibility of decreasing LOS performance of the road network. So that the construction of a new building or area must be carried out with a Traffic Impact Analysis study so that the performance conditions of the surrounding road network are not disturbed.

Transportation travel allows individuals to process travel according to their travel concept. This trip places conditions that best suit the form of a planned trip. A well-planned trip will set a good pattern too (Ganda CF et.al, 2019; Karimah H, Akbardin J, 2022; Syaiful S et.al, 2022; Syaiful S et.al, 2022; Syaiful S, Rusfana H, 2022). So that the provisions in the travel process require general provisions that are in accordance with the appropriate pattern. A person's travel activities adapt to conditions in the field (Syaiful S, Pratama Y, 2019; Syaiful S, Hariyadi D, 2019; Syaiful S et.al, 2020; Syaiful S, Fadly A, 2020). Determine travel patterns according to well-conceptualized steps. Travel activities adjust to the background that places road users according to the steps that have been prepared before traveling (Syaiful S et.al, 2021; Syaiful S et.al, 2023; Syaiful S et.al. 2023).

**Rise and pull**

Generation is the number of movements originating from a land use (zone) while pull is the number of movements that lead to a zone.

Movement generation is a modeling stage that estimates the number of movements originating from a zone or land use and the number of movements attracted to one land use or other zone. Traffic movement is a land use function that produces traffic movement. This traffic generation includes:

- Traffic leaving a location
- Traffic going to or arriving at a location

The output from the calculation of traffic generation and pull is in the form of the number of vehicles, people, or goods transport per unit time, for example vehicles/hour. We can easily count the number of people or vehicles that enter or leave a certain area of land in one day (or one hour) to get the generation and pull of movement.

**Movement Spread**

The purpose of moving in one area will cause problems such as congestion, air pollution, noise, delays and so on. One way to be able to find solutions to these problems is to understand the movement patterns that occur in the present and in the future.

Understanding the pattern can be known by searching for data about the origin and destination of the movement, the magnitude of the movement, and when the movement occurred.

**MAT**

MAT is an origin-destination matrix that contains information about the magnitude of movement between zones within a certain area. In this case, the Tid notation states the magnitude of the flow of movement (vehicles, passengers, and goods) moving from the origin zone i to the destination zone during a certain time interval (Hadi W.P: 2018).

Almost all transportation problem solving techniques and methods (both urban and regional) require MAT information as the basic and most important information in representing the need for movement.

**Public Transportation Problems**

During peak hours, overcrowding is a common occurrence in the city of Bogor, especially in the areas of activity centers. This condition, which is very dense vehicles and irregular schedules, causes passengers to experience delays in their journey, immaterial losses and others.

During the off peak hour period, services will run irregularly, so that the level of public confidence in public transportation will be reduced, which in turn causes them to switch to using private
vehicles to fulfill their mobility. As a result, we can predict that the level of congestion is getting higher, which in turn causes the level of public transportation services to decrease.

RESEARCH METHODS
Research Time and Place
At this stage the researchers conducted direct observations in the District of East Bogor, by conducting direct surveys on existing roads in the research location area.

Place of execution
The research locations are on the Arterial and Collector roads, as well as in Education Buildings, Industrial Estates, Hospitals, Traditional Markets and Supermarkets that exist in this research area.

Figure 1. Study Location. Source: Google Maps/Earth Analysis)

Research time
The research was carried out on 11 to 19 May 2021. The research time was only carried out at peak hours or the busiest hours, as seen from daily traffic habits on the Google maps application.

While the implementation is carried out for 8 days, namely Monday which is a working day and study day, and also on Saturday and Sunday which is a weekend.

Materials and tools
a) Material
The materials needed in this research are Primary and Secondary data obtained from the results of the analysis and related agencies in the form of Bogor City growth data, Bogor City existing conditions, and Bogor City Spatial Planning Map data (RTRW Bogor City).

b) Tool
The tools needed consist of:
• Traffic Counting questionnaire form
• Stationery, Road Board, Meter
• Counting Tool,
• Mobile as a tool for Documentation and Communication
• Computer to process data, and Printer, A4 Paper as Print Out result of planning and report.

c) How it Works
The workings of this research are described based on the stages that have been designed in the research flow chart shown in Figure 2 below.
RESULTS AND DISCUSSION
Existing Condition
Figure 4. Inventory of Roads. Source: Analysis Results, 2021

Traffic Counting Data Calculation

<table>
<thead>
<tr>
<th>No.</th>
<th>Nama Jalan</th>
<th>Type</th>
<th>Lebar Badan Jalan (m)</th>
<th>Fungsi Jalan</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jln. Raya Tajur 1</td>
<td>2/2 TT</td>
<td>6</td>
<td>Arteri</td>
</tr>
<tr>
<td>2</td>
<td>Jln. Raya Tajur 2</td>
<td>2/2 TT</td>
<td>6</td>
<td>Arteri</td>
</tr>
<tr>
<td>3</td>
<td>Jln. Raya Padjajaran 1</td>
<td>4/2 T</td>
<td>12</td>
<td>Arteri</td>
</tr>
<tr>
<td>4</td>
<td>Jln. Raya Padjajaran 2</td>
<td>4/2 T</td>
<td>12</td>
<td>Arteri</td>
</tr>
<tr>
<td>5</td>
<td>Jln. Sukasari</td>
<td>4/2 TT</td>
<td>6.5</td>
<td>Kolakor</td>
</tr>
<tr>
<td>6</td>
<td>Jln. Lembang</td>
<td>4/2 TT</td>
<td>6</td>
<td>Kolakor</td>
</tr>
</tbody>
</table>

Figure 5. Vehicle Volume Flow With Urban Road Classification on Jln. Raya Tajur 1. Source: Analysis Results, 2021.

Figure 6. Vehicle Volume Flow With Urban Road Classification on Jln. Raya Tajur 2. Source: Analysis Results, 2021.

Figure 7. Vehicle Volume Flow With Urban Road Classification on Jln. Raya Padjajaran 1. Source: Analysis Results, 2021.

Figure 8. Vehicle Volume Flow With Urban Road Classification on Jln. Raya Padjajaran 2. Source: Analysis Results, 2021.
Figure 9. Vehicle Volume Flow With Urban Road Classification on Jln. Sukasari. Source: Analysis Results, 2021

Figure 10. Vehicle Volume Flow With Urban Road Classification on Jln. Lawanggintung. Source: Analysis Results, 2021

Calculation of the Average Speed of Roads

\[ \text{VB} = (\text{VB}_D + \text{VB}_L) \cdot \text{FV}_{\text{BHS}} \cdot \text{FV}_{\text{BUK}} \]

Figure 11. Average Speed of Urban Road Classification Section. Source: Analysis Results, 2021

Calculation of Road Segment Capacity

The calculation of road capacity based on MKJI 2017 is stated in table 9 below:

\[ C = C_0 \times F_{C_{LJ}} \times F_{C_{PA}} \times F_{C_{HS}} \times F_{C_{UK}} \]

Figure 12. Urban Road Capacity. Source: Analysis Results, 2021

C = C0 x FC_{LJ} x FC_{PA} x FC_{HS}
Service Level (Existing)

<table>
<thead>
<tr>
<th>No</th>
<th>Nama Jalan</th>
<th>Type</th>
<th>Asah Massa</th>
<th>Lebar Jalan (m)</th>
<th>C</th>
<th>V</th>
<th>C R</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jin. Jaya Tajur 1 (Depan Boxen Mall - Lippo Plaza)</td>
<td>2/2</td>
<td>TT</td>
<td>6</td>
<td>29</td>
<td>55</td>
<td>4.40</td>
<td>0.4</td>
</tr>
<tr>
<td>2</td>
<td>Jin. Jaya Tajur 2 (Transmart - Lippo Plaza)</td>
<td>2/2</td>
<td>TT</td>
<td>6</td>
<td>29</td>
<td>55</td>
<td>4.40</td>
<td>0.4</td>
</tr>
<tr>
<td>3</td>
<td>Jin. Jaya Padujajaran 1 (Jl. Padujajaran - Jl. Raya Tajur)</td>
<td>4/2</td>
<td>T</td>
<td>12</td>
<td>71</td>
<td>15</td>
<td>207</td>
<td>6.6</td>
</tr>
<tr>
<td>4</td>
<td>Jin. Raya Padujajaran 2 (Jl. Sukamti - Jl. Padujajaran)</td>
<td>4/2</td>
<td>T</td>
<td>12</td>
<td>31</td>
<td>15</td>
<td>217</td>
<td>6.15</td>
</tr>
<tr>
<td>5</td>
<td>Jin. Sukamti</td>
<td>4/2</td>
<td>TT</td>
<td>6,5</td>
<td>47</td>
<td>43</td>
<td>521</td>
<td>61</td>
</tr>
<tr>
<td>6</td>
<td>Jln. Lawangsenteng</td>
<td>4/2</td>
<td>TT</td>
<td>6</td>
<td>43</td>
<td>43</td>
<td>3,7</td>
<td>6,2</td>
</tr>
</tbody>
</table>

Figure 13. Level of Road Traffic Service in East Bogor District. Source: Analysis Results, 2021

<table>
<thead>
<tr>
<th>No</th>
<th>Nama Jalan</th>
<th>Type</th>
<th>VCR 2021</th>
<th>LOS</th>
<th>VCR 2026</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jin. Raya Tajur 1 (Depan Boxen Mall - Jln. Raya Tajur)</td>
<td>2/2</td>
<td>TT</td>
<td>0.47</td>
<td>C</td>
<td>0.50</td>
</tr>
<tr>
<td>2</td>
<td>Jin. Raya Tajur 2 (Transmart-Lippo Plaza)</td>
<td>2/2</td>
<td>TT</td>
<td>0.47</td>
<td>C</td>
<td>0.50</td>
</tr>
<tr>
<td>3</td>
<td>Jin. Raya Padujajaran 1 (Jln. Padujajaran-Jln. Raya Tajur)</td>
<td>4/2</td>
<td>T</td>
<td>0.66</td>
<td>C</td>
<td>0.70</td>
</tr>
<tr>
<td>4</td>
<td>Jin. Raya Padujajaran 2 (Jln. Sukamti-Jln. Padujajaran)</td>
<td>4/2</td>
<td>TT</td>
<td>0.66</td>
<td>C</td>
<td>0.73</td>
</tr>
<tr>
<td>5</td>
<td>Jln. Sukamti</td>
<td>4/2</td>
<td>TT</td>
<td>0.19</td>
<td>A</td>
<td>0.21</td>
</tr>
<tr>
<td>6</td>
<td>Jln. Lawangsenteng</td>
<td>4/2</td>
<td>TT</td>
<td>0.21</td>
<td>B</td>
<td>0.24</td>
</tr>
</tbody>
</table>

Figure 14. Road Traffic Service Levels in East Bogor District in 2021 and 2026. Source: Analysis Results, 2021

Generation Calculation Prediction Using ITE (Institute Transportation Engineers)
Traffic Impact Analysis of Tajur Bogor Mall Boxies Building on Roads


<table>
<thead>
<tr>
<th>Location</th>
<th>Facilities</th>
<th>Uses Sqm</th>
<th>Unit of Measurement</th>
<th>Coefficient</th>
<th>ITE Bangkok (trip/jam)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boxies Mall</td>
<td>Low Cost Apt</td>
<td>16,380</td>
<td>545</td>
<td>6.58</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>Conventional</td>
<td>2,864</td>
<td>30,45</td>
<td>6.82</td>
<td>21.9</td>
</tr>
<tr>
<td></td>
<td>Park and Ride</td>
<td>4,209</td>
<td>002</td>
<td>6.02</td>
<td>372</td>
</tr>
<tr>
<td>Total</td>
<td>23,454</td>
<td>1,181</td>
<td>901</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 16. Generating and Attractive Calculations in the Transmart Mall Tajur Bogor Area. Source: Analysis Results

Condition of Study Zone and MAT 2021

Six zones in one study sub-district were observed based on the administrative division of the kelurahan.

Table 1. Study Area Zone Division

<table>
<thead>
<tr>
<th>Zone</th>
<th>Kelurahan</th>
<th>Subdistrict</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baranangsiang</td>
<td>Bogor Timur</td>
</tr>
<tr>
<td>2</td>
<td>Katulampa</td>
<td>Bogor Timur</td>
</tr>
<tr>
<td>3</td>
<td>Sindangrasa</td>
<td>Bogor Timur</td>
</tr>
<tr>
<td>4</td>
<td>Sukasari</td>
<td>Bogor Timur</td>
</tr>
<tr>
<td>5</td>
<td>Tajur</td>
<td>Bogor Timur</td>
</tr>
<tr>
<td>6</td>
<td>Sindagsari</td>
<td>Bogor Timur</td>
</tr>
</tbody>
</table>

(Source: Analysis Results)

Origin Destination Matrix

MAT is a two-dimensional matrix that contains information about the magnitude of movement between zones within a certain area. The row represents the origin zone and the column represents the destination zone, so that each cell of the matrix represents the magnitude of the movement current that moves from the origin zone i to the destination zone.

Figure 17. Existing MAT in 2021. Source: Analysis Results
Figure 19. Existing MAT in 2026 Source: Analysis Results

Road Network in Study Area

The road network modeling at the study site is shown in Figure 20 below.

Figure 20. Road Network Modeling at the study site (Source: Analysis Results, 2021)

In the following, figure 21 and figure 22 are presented in the form of road loading (VCR Variable Intensity) at the study site.

Figure 21. VCR Variable Intensity and MAT 2021 (Source: Analysis Results, 2026)
There is also the Pattern of Generating and Attractive Movements at the study site using the origin-destination matrix modeled on the SATURN application, which is shown in figure 23, figure 24 and figure 25 below.

Figure 22. Variable Intensity VCR and MAT 2026 (Source: Analysis Results, 2021)

Figure 23. Generating and Attractive Patterns of Existing 2021 Study Locations (Source: Analysis Results, 2026)

Figure 24. Generating and Attractive Patterns of Existing Study Locations in 2026. Source: Analysis Results, 2021
Network Calibration Results and Transport Modeling Equation Design

Figure 25. Results of Network Calibration in East Bogor District 2019 Y = 11,719 + 1,098 (X).

Source: Analysis Results, 2026

CONCLUSION

The construction and development of various types of land use, in essence, will directly or indirectly cause traffic impacts. The construction of the Boxies Mall in Tajur Bogor is predicted to cause a number of trips and trips that can have a negative impact on traffic flow performance on the surrounding roads. Based on the calculation results. The negative impacts that arise as a result of the increase in the number of course need to be anticipated by conducting an analysis of the resulting impacts and the steps needed to anticipate these impacts. Based on the results of the studies that have been carried out, there are several conclusions as follows, the existing condition of the Primary Arterial and Primary Collector road network in the study area obtained LOS in the range B to E. East Bogor District has a fairly good road network condition with an average LoS of C. there are several roads that are quite congested because the desire is approaching capacity, and the lack of traffic control for vehicles that stop carelessly, street vendors who are less orderly and so on. Boxies Tajur Mall building in East Bogor District in 2021 with a generation value of 9,074 smphour and a pull of 491 trips/hour. Then in 2026 with a rise value of 12717 smphour and a pull of 491 trips/hour. Traffic problems Jl. Raya Tajur 1 and Jl. Raya Tajur 2 is the high rate of travel which is indicated by the high value of the VCR. Especially in the afternoon peak hours (16.00 - 17.00) for directions to enter and exit the study area and peak hours during the day (12.00 – 13.00). This is because the road is a way out or in from the development.

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