ANALYSIS IMPACT OF TRAFFIC (ANDALALIN) KAWASAN MALL TRANSMART OF TAJUR ROAD BOGOR

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ABSTRACT
East Bogor District has 6 Village Office with an area of 10.15km². The increase in population growth and development in the area has also increased the movement of traffic flow into and out of the area, causing several problems especially in reducing the performance of road sections that cause traffic congestion on road sections. This study aims to create a model of the generation and attraction generated by land uses such as the Education Building, Industrial Estate, Traditional Markets and Supermarkets. Located in the district. Data processing is carried out with the calculation method of transportation analysis using MKJI 2017. Then it uses (Trip Generation Manual) and then modeled in (Saturn Software). The number of Stitches and Pulls in the area studied was found to be 91.82 trips / hour. With the level of road services with a range of C to F. Then the design equation of transportation modeling for East Bogor sub-district in 2019 is \( Y = 11,790 + 1,098 \times X \) then in 2025, \( Y = 2963.66 + 0.840 \times X \). This proves that if there is no improvement and improvement of road network infrastructure, and efforts to procure an adequate road-based mass public transport system, it will add to the decline in performance of road segments in the region in the future.

Key word: trip generation; trip attraction; MAT; ANDALALIN; transportation.

INTRODUCTION
The development of a certain area has an influence on the traffic around it. This occurs due to changes in land use which result in the movement of traffic flow in and out of the location so that it will affect the pattern of transportation services in the area concerned. With the construction of new apartments, it is estimated that it will generate traffic generation and affect traffic around the new activity center. Through the traffic impact evaluation, it can be calculated how much the new trip generation will require traffic engineering and traffic management to overcome the impact. Traffic impact evaluation is used to predict whether the transportation infrastructure is capable of serving existing (existing) traffic coupled with traffic generated or attracted by new activity centers. If the existing infrastructure cannot support the traffic, a study on the handling of the infrastructure and traffic management arrangements must be carried out (Prasetyo WH, Murtejo T, 2018; Sukirman S, 1999; Tamim OZ, 2000).

The construction of the Tajur Bogor Transmart Mall owned by PT. Dinamika Perkasa Mandiri, which is located on Jl. Raya Tajur No.25, Tajur, Bogor Timur, Bogor City. This Transmart is predicted to be the largest Transmart in Indonesia which is equipped with additional facilities in the form of a Theme Park, Mini Trans Studio, Restaurant and Café, and Cinema. This of course will lead to 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 carry out a traffic impact analysis in order to predict the possible magnitude of the resulting impact and to anticipate the impact of the construction of the Mall Transmart Building on the surrounding traffic.

In Law Number 22 of 2009 concerning Road Transportation Traffic, traffic management and engineering constitute a series of businesses and activities which include planning, procurement, installation, regulation and maintenance of road equipment facilities in the context of realizing, supporting and maintaining security, order, and smooth traffic.

According to the Regulation of the Minister of Transportation of the Republic of Indonesia Number PM 75 of 2015 concerning the Implementation of Traffic Impact Analysis that any plans
for development and/or development of activity centers, settlements and infrastructure that will cause disturbances to security, safety, order and smoothness of traffic and road transportation must be carried out. Traffic Impact Analysis. Based on these thoughts, Mall Transmart will have a negative impact on road performance and intersection performance, so it is necessary to conduct a study in order to anticipate the possibility of decreasing the LOS performance of the road network. So that the construction of a new building or area, a Traffic Impact Analysis study must be carried out so that the performance conditions of the surrounding road network are not disturbed (Niatika U, 2018; Oglesby C, et.al. 1996).

Dwi AP, Murtejo T (2017) said the impact on changes in traffic patterns at each intersection affected the basic concept of traffic. so that it is possible to change the flow and volume of traffic in increasing the burden of the road being passed. The impact of this traffic will increase if this condition is not regulated by traffic engineering.

The function of the road is very important in transportation. The road will increase its carrying capacity if the vehicle that is burdening the road passes often stops. Motor vehicles are the highest contributor to the increasing road load. It is hoped that with the increasing number of vehicles, the driver's compliance with traffic signs will also be higher. The hope is that people will be aware of good traffic conditions. This condition will support good and planned traffic management. Awareness of road users in overcoming congestion at a certain point will affect the interests of fellow road users in using existing transportation infrastructure (Gunawan A, 2015; Syaiful S, et.al 2022; Akbar IS, 2021; Nina Z, 2021; Sarwono D, 2015).

Syaiful S (2017) said that in carrying out its function, a road will connect one another so that a node will be formed. This node will receive special treatment as a form of road priority in supporting the smooth flow of traffic so that it will generate new directions in the governance of existing traffic lanes.

To support the function of a good road, it must be managed properly, so that if there is a gap in the regulation of the road pattern, the cause will be quickly identified. The right solution in this management lies with the Road Transport Traffic Service. This related agency will evaluate any new flow-making activities to avoid congestion in the future (Syaiful S, Hariyadi D, 2019; Syaiful S, et al, 2021).

**Generation and attraction**

Awakening is the number of movements originating from a land use (zone) while attraction is the amount of movement towards a zone.

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

1. Traffic leaving a location
2. Traffic to or from a location

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

**The spread of movement**

The aim of moving within an 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 current and future movement patterns.

Understanding patterns can be identified by searching data about the origin and destination of movements, the magnitude of the movements, and when the movements occur.
MAT/Origin Destination Matrix

MAT is a matrix of origin and destination which contains information about the magnitude of movement between zones within a certain area. In this case, the Tid notation states the amount of movement flow (vehicles, passengers, and goods) moving from origin zone i to destination zone d during a certain time interval (Prasetyo WH, Murtejo T, 2018; MKJI. 2017).

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

Public Transportation Problems

During peak hours of peak overcrowding is a common thing in Bogor Regency, especially in areas in the activity centers. These conditions, namely very congested vehicles and irregular schedules, cause passengers to experience delays in their travels, immaterial losses and others.

During the off-peak hour period, services will run irregularly, so that the level of public trust in public transportation decreases, 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 transport services to decline.

RESEARCH METHODS

Time and Place of Research

At this stage the researcher made direct observations in the East Bogor District. by conducting a direct survey on roads in the research location area.

Place of execution

The research location is on the Arterial and Collector roads, and also at the Education Building, Industrial Area, Hospital, Traditional Market and Supermarket. Existing in this research area.

Research time

The research was conducted on May 11, 12 and 13, 2019. The research time was only conducted at the peak hours or the peak hours, which was seen from the daily traffic habits on the Google maps application.

While the implementation is carried out for 3 days, namely Monday which is a work day and study day, and also on Saturdays and Sundays which are weekends.

Materials and tools

Material

The materials needed in this study are primary and secondary data obtained from 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 Kota Bogor).
Tools
1. The tools needed consist of:
2. Traffic Counting questionnaire form
3. Stationery, Road Board, Meter
4. Counting tool,
5. Mobile as a tool for documentation and communication
6. Computers for data processing, and printers, A4 paper as a print out of planning results and reports.

How it Works
The way this research works is described based on the stages that have been designed in the research flow diagram shown in Figure 2 below.

![Figure 2. Flow Chart (Source: Analysis Results)](image)

RESULTS AND DISCUSSION
Existing Conditions

![Figure 3. Location of Traffic Counting and Generation Prediction (Source: Google Earth, 2019)](image)
Table 1 Inventory of Roads

| No | Road name                  | Type   | Road body width (m) | Road function   |
|----|----------------------------|--------|---------------------|-----------------|
| 1  | Raya Tajur 1 Road          | 2/2TT  | 6                   | Arteries        |
| 2  | Raya Tajur 2 Road          | 2/2TT  | 6                   | Arteries        |
| 3  | Raya Pajajaran 1 Road      | 4/2T   | 12                  | Arteries        |
| 4  | Raya Pajajaran 2 Road      | 4/2T   | 12                  | Arteries        |
| 5  | Raya Sukasari Road         | 4/2TT  | 6.5                 | Collector       |
| 6  | Raya Lawanggintung Road    | 4/2TT  | 6                   | Collector       |

(Source: Analysis Results)

Traffic Counting Data Calculation

Table 2. Flow of Vehicle Volume by Urban Road Classification at Jln. Raya Tajur 1

| No | Raya Tajur 1 Road Period | West | Road type 2/2TT | Road type 2/2TT | SMP/Hours | Amount |
|----|--------------------------|------|-----------------|-----------------|-----------|--------|
|    |                          | SM   | KR              | KB              |           |        |
| 1  | 06.00 – 07.00            | 652  | 642             | 14              | 1.308     | 3.260  |
| 2  | 07.00 – 08.00            | 444  | 613             | 8               | 1.065     | 2.395  |
| 3  | 11.00 – 12.00            | 413  | 558             | 6               | 977       | 2.216  |
| 4  | 12.00 – 13.00            | 660  | 722             | 23              | 1.404     | 3.379  |
| 5  | 16.00 – 17.00            | 469  | 439             | 10              | 917       | 2.322  |
| 6  | 17.00 – 18.00            | 376  | 389             | 12              | 777       | 1.901  |

(Source: Analysis Results)

Table 3. Flow of Vehicle Volume by Urban Road Classification at Jln. Raya Tajur 2

| No | Raya Tajur 2 Road Period | EAST | Road type 2/2TT | Road type 2/2TT | SMP/Hours | Amount |
|----|--------------------------|------|-----------------|-----------------|-----------|--------|
|    |                          | SM   | KR              | KB              |           |        |
| 1  | 06.00 – 07.00            | 343  | 882             | 14              | 1.240     | 2.267  |
| 2  | 07.00 – 08.00            | 364  | 720             | 10              | 1.093     | 2.182  |
| 3  | 11.00 – 12.00            | 375  | 558             | 10              | 973       | 2.098  |
| 4  | 12.00 – 13.00            | 482  | 908             | 19              | 1.409     | 2.851  |
| 5  | 16.00 – 17.00            | 404  | 929             | 4               | 1.337     | 2.549  |
| 6  | 17.00 – 18.00            | 347  | 625             | 6               | 978       | 2.016  |

(Source: Analysis Results)

Table 4. Vehicle Volume Flow with Urban Road Classification at Jln. Raya Padjajaran 1

| No | Raya Pajajaran 1 Road Period | EAST | Road type 4/2T | Road type 4/2T | SMP/Hours | Amount |
|----|-------------------------------|------|----------------|----------------|-----------|--------|
|    |                               | SM   | KR             | KB             |           |        |
| 1  | 06.00 – 07.00                 | 690  | 1.092          | 11             | 1.793     | 3.862  |
| 2  | 07.00 – 08.00                 | 661  | 994            | 11             | 1.666     | 3.648  |
| 3  | 11.00 – 12.00                 | 691  | 1.016          | 7              | 1.714     | 3.784  |
| 4  | 12.00 – 13.00                 | 811  | 1.242          | 24             | 2.077     | 4.504  |
| 5  | 16.00 – 17.00                 | 659  | 1.025          | 10             | 1.694     | 3.669  |
| 6  | 17.00 – 18.00                 | 632  | 920            | 10             | 1.561     | 3.454  |

(Source: Analysis Results)

Table 5. Flow of Vehicle Volume by Urban Road Classification at Jln. Raya Padjajaran 2

| No | Raya Pajajaran 2 Road Period | EAST | Road type 4/2T | Road type 4/2T | SMP/Hours | Amount |
|----|-------------------------------|------|----------------|----------------|-----------|--------|
|    |                               | SM   | KR             | KB             |           |        |
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Table 6. Flow of Vehicle Volume by Urban Road Classification at Jln. Sukasari

| No | Raya Sukasari Road | EAST | Road type 4/2TT | Road type 4/2TT | SMP/Hours | Amount |
|----|--------------------|------|-----------------|-----------------|-----------|--------|
|    | Period             | SM   | KR   | KB       |           |        |
| 1  | 06.00 – 07.00      | 320  | 389  | 4        | 712       | 1.671  |
| 2  | 07.00 – 08.00      | 286  | 355  | 5        | 645       | 1.501  |
| 3  | 07.00 – 08.00      | 300  | 273  | 2        | 575       | 2.110  |
| 4  | 12.00 – 13.00      | 397  | 515  | 10       | 921       | 4.504  |
| 5  | 16.00 – 17.00      | 291  | 405  | 4        | 699       | 1.570  |
| 6  | 17.00 – 18.00      | 262  | 366  | 4        | 631       | 1.415  |

(Source: Analysis Results)

Table 7. Flow of Vehicle Volume by Urban Road Classification at Jln. Lawanggintung

| No | Raya Lawanggintung Road | EAST | Road type 4/2TT | Road type 4/2TT | SMP/Hours | Amount |
|----|-------------------------|------|-----------------|-----------------|-----------|--------|
|    | Period                  | SM   | KR   | KB       |           |        |
| 1  | 06.00 – 07.00           | 324  | 467  | 4        | 795       | 1.766  |
| 2  | 07.00 – 08.00           | 318  | 587  | 2        | 907       | 1.860  |
| 3  | 11.00 – 12.00           | 306  | 493  | 6        | 805       | 1.720  |
| 4  | 12.00 – 13.00           | 375  | 707  | 11       | 1.093     | 2.217  |
| 5  | 16.00 – 17.00           | 333  | 794  | 7        | 1.134     | 2.130  |
| 6  | 17.00 – 18.00           | 328  | 704  | 8        | 1.040     | 2.022  |

(Source: Analysis Results)

Calculation of Average Speed of Roads

VB = (VBD + VBL). FVBHS. FVBUK

Table 7. Average Speed of Urban Road Classification Section

| No  | Road name                  | VBD km/hours | VBL km/hours | FVBHS L Be (m) | FVBUK | VB  |
|-----|----------------------------|--------------|--------------|----------------|-------|-----|
| 1   | Raya Tajur 1 Road          | 55           | -4           | 0.95           | 1.00  | 48.45 |
| 2   | Raya Tajur 2 Road          | 55           | -4           | 0.95           | 1.00  | 48.45 |
| 3   | Raya Pajajaran 1 Road      | 55           | 0            | 0.95           | 1.00  | 52.25 |
| 4   | Raya Pajajaran 2 Road      | 55           | 0            | 0.95           | 1.00  | 52.25 |
| 5   | Raya Sukasari Road         | 55           | 7            | 0.95           | 1.00  | 58.90 |
| 6   | Raya Lawanggintung Road    | 55           | 7            | 0.95           | 1.00  | 58.90 |

(Source: Survey Results and Analysis)

VB = (VBD + FVB). FVBHS.FVBUK-FJ

Road Section Capacity Calculation

The calculation of road capacity based on the MKJI 2017 is stated in the following table:

C = C0 x FCLj x FCPA x FCHS x FCUK

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Table 9. Urban Road Capacity

| No | Road name         | C₀   | FC₁₀ | FC₆₅ | FC₁₅ | FC₂₀ | C   |
|----|-------------------|------|------|------|------|------|-----|
| 1  | Raya Tajur 1 Road | 1650 | 3300 | 0.92 | 1.00 | 0.98 | 2.975 |
| 2  | Raya Tajur 2 Road | 1650 | 3300 | 0.92 | 1.00 | 0.98 | 2.975 |
| 3  | Raya Pajajaran 1 Road | 1650 | 3300 | 1.00 | 1.00 | 0.95 | 3.135 |
| 4  | Raya Pajajaran 2 Road | 1650 | 3300 | 1.00 | 1.00 | 0.95 | 3.135 |
| 5  | Raya Sukasari Road | 2900 | 5800 | 0.87 | 1.00 | 0.94 | 4.743 |
| 6  | Raya Lawanggintung Road | 2900 | 5800 | 0.87 | 1.00 | 0.94 | 4.743 |

(Source: Survey Results and Analysis)

C₀ = C₀ x FC₁₀ x FC₆₅ x FC₁₅

Service Level (Existing)

Table 10. Road Traffic Service Levels in East Bogor District

| No | Road name         | Type | To      | Road body width (m) | C   | V  | VCR | LOS |
|----|-------------------|------|---------|---------------------|-----|----|-----|-----|
| 1  | Raya Tajur 1 Road | 2/2TT| Raya Pajajaran | 6     | 2.975 | 1404.3 | 0.47 | C   |
| 2  | Raya Tajur 2 Road | 2/2TT| Raya Pajajaran | 6     | 2.975 | 1408.95 | 0.47 | C   |
| 3  | Raya Pajajaran 1 Road | 4/2T | Raya Tajur     | 12    | 3.135 | 2076.5 | 0.66 | C   |
| 4  | Raya Pajajaran 2 Road | 4/2T| Raya Sukasari  | 12    | 3.135 | 2170.15 | 0.69 | C   |
| 5  | Raya Sukasari Road | 4/2TT|Raya Tajur      | 6.5   | 4.743 | 921.35  | 0.19 | A   |
| 6  | Raya Lawanggintung Road | 4/2TT| Raya Pajajaran | 6     | 4.743 | 1133.7 | 0.24 | B   |

(Source: Analysis Results, 2019)

Table 11. Road Traffic Service Levels in East Bogor District in 2019 and 2025

| No | Road name         | Type | VCR (2019) | LOS | VCR (2025) | LOS |
|----|-------------------|------|------------|-----|------------|-----|
| 1  | Raya Tajur 1 Road | 2/2TT| 0.47 | C       | 0.50 | C   |
| 2  | Raya Tajur 2 Road | 2/2TT| 0.47 | C       | 0.50 | C   |
| 3  | Raya Pajajaran 1 Road | 4/2T | 0.66 | C       | 0.70 | C   |
| 4  | Raya Pajajaran 2 Road | 4/2T| 0.69 | C       | 0.73 | C   |
| 5  | Raya Sukasari Road | 4/2TT| 0.19 | A       | 0.21 | B   |
| 6  | Raya Lawanggintung Road | 4/2TT| 0.24 | B       | 0.24 | B   |

(Source: Analysis Results, 2019)

Prediction of Generation Calculation Using ITE (Institute Transportation Engineers)
Figure 4. Manual trip Generation (Source: Trip Generation Manual, 9th Edition)

Table 12. Calculation of Generation and Withdrawal in the Transmart Tajur Mall, Bogor

| No | Location     | Facilities   | Area Sqm | Units of measure | ITE coefficient | ITE generation (trips/hour) |
|----|--------------|--------------|----------|------------------|-----------------|-----------------------------|
| 1  | Low cost Apt | 16.380       | 545      | 0.58             | 316             |
| 2  | TRANSMART   | 2.864        | 30.83    | 6.82             | 210             |
| 3  | Park and ride | 4.200       | 605      | 0.62             | 375             |
|    | Total        | 23.444       | 1.181    |                  | 901             |

(Source: Analysis Results, 2019)

Table 13. Generation of Transmart Tajur

| Sqm  | Sqt | Koeficient | Trips/hour |
|------|-----|------------|------------|
| 4.810| 52  | 9.48       | 491        |

(Source: Analysis Results, 2019)

Study Zone Conditions and MAT 2019

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

Table 14. Zoning of the Study Area

| Zona | Kelurahan   | Sub-district |
|------|-------------|--------------|
| 1    | Baranangsiang | Bogor Timur |
| 2    | Katulampa   | Bogor Timur |
| 3    | Sindangrasa | Bogor Timur |
| 4    | Sukasari    | Bogor Timur |
| 5    | Tajur       | Bogor Timur |
| 6    | Sindagsari  | Bogor Timur |

(Source: Analysis Results)

Origin Destination Matrix

MAT is a two-dimensional matrix that contains information about the amount of movement between zones within a certain area. The row represents the zone of origin and the column represents the destination zone, so that each matrix cell represents the magnitude of the movement flow that moves from the origin zone i to the destination zone.
Table 15. Existing MAT in 2019

| Year 2019 | Zona No | 1   | 2   | 3   | 4   | 5   | 6   | OI   |
|----------|---------|-----|-----|-----|-----|-----|-----|------|
|          |         |     |     |     |     |     |     |      |
| TRANSSMART | 2      | 2.044 | 0   | 151 | 16  | 582 | 39  | 2.832 |
|          | 3      | 1.561 | 1.088 | 0   | 12  | 51  | 75  | 2.787 |
|          | 4      | 1.617 | 2.841 | 302 | 0   | 53  | 42  | 4.855 |
| TRANSSMART | 5      | 1.099 | 562  | 205 | 16  | 0   | 134 | 2.016 |
|          | 6      | 2.324 | 1.619 | 234 | 25  | 30  | 0   | 4.232 |
| DD       | 9.645  | 6.720 | 957  | 74  | 737 | 313 | 1   |      |

(Source: Analysis Results)

Table 16. Existing MAT in 2025

| Year 2025 | Zona No | 1   | 2   | 3   | 4   | 5   | 6   | OI   |
|-----------|---------|-----|-----|-----|-----|-----|-----|------|
|           |         |     |     |     |     |     |     |      |
| TRANSSMART | 2      | 2169.75 | 0   | 160.29 | 16.98 | 617.80 | 41.40 | 3006  |
|          | 3      | 1    | 1154.93 | 0   | 12.74 | 54.14 | 79.61 | 2958  |
|          | 4      | 1716.48 | 3015.78 | 320.58 | 0   | 56.26 | 44.58 | 5154  |
| TRANSSMART | 5      | 1166.61 | 596.57 | 217.61 | 16.98 | 0   | 142.24 | 2140  |
|          | 6      | 2466.97 | 1718.60 | 248.40 | 26.34 | 31.85 | 0   | 4492  |
| DD       | 9177   | 7133 | 1016 | 79  | 782 | 332 | 1   |      |

(Source: Analysis Results, 2019)

Road Network in the Study Area

Road network modeling in the study location is shown in Figure 5 below.

Figure 5. Road network modeling (Source: Analysis Results, 2019)

The following is presented in Figure 3 in the form of the road loading (VCR Variable Intensity) of the study location.

Figure 6. VCR Variable Intensity and MAT 2019 (Source: Analysis Results, 2019)
There is also a Generation and Pull Movement Pattern at the Study site using the origin-destination matrix modeled on the SATURN application as shown in Figure 8 below.

**Figure 7.** VCR Variable Intensity and MAT 2025 (Source: Analysis Results, 2019)

**Figure 8.** The Pattern of Generation and Withdrawal of the Existing Study Location 2019 (Source: Analysis Results, 2019)

**Figure 9.** The Pattern of Generation and Withdrawal of the Existing Study Sites in 2025 (Source: Analysis Results, 2019)
Results of Network Calibration and Transportation Modeling Equation Design

\[ Y = 11,719 + 1,098. \text{(X)} \]

(Source: Analysis Results, 2019)

**Figure 10.** Results of Network Calibration in East Bogor District 2019 Y = 11,719 + 1,098. (X)

**CONCLUSION**

Based on the results of the analysis and discussion, the following conclusions can be drawn:

Existing conditions of the primary arterial and primary collector road networks in the study area, it is found that LOS in the range B to E. several roads that are quite congested due to the desire to be close to capacity, and the lack of traffic control for vehicles that stop carelessly, less orderly street vendors and so on. The construction of the Tajur Transmart Mall in East Bogor District in 2019 with an generated value of 9,074 pcu/hour and an attraction of 491 trips/hour. Then in 2025 with a generation value of 12717 pcu/hour and an attraction of 491 trips/hour. Traffic problems Jl. Raya Tajur 1 and Jl. Raya Tajur 2 is the high level of travel which is indicated by the high value of the VCR. Especially during the peak hours of the afternoon (16.00 -17.00) for the direction of entering and leaving the study area and the peak hours of the daytime (12.00 - 13.00). this is due to these roads.

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