

## IMPACT OF THE COVID-19 PANDEMIC ON TRAFFIC PERFORMANCE IN KUPANG CITY

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### Abstract

Relationship between transportation and people can also be seen when transportation is affected by major changes in society, such as the COVID-19 pandemic. Kupang City found its first case on April 9, 2020, the government has also implemented social restrictions during the pandemic. Therefore measuring traffic performance is very important for government agencies managing traffic and individuals planning trips, especially when special events occur. The purpose of this study was to obtain a model of changes in traffic movement in Kupang City. The results showed that the social restrictions imposed by the Kupang city government only had an impact on roads with educational facilities, while for others there were no significant changes. Meanwhile, for 2022, which is an endemic period or after the COVID-19 pandemic is over, traffic flows on all roads tend to increase and even exceed traffic flows in 2019 which was the period before the pandemic occurred.

**Keywords:** Capacity, covid-19, PKJI2014, traffic, urban road.

### INTRODUCTION

Transportation plays a very important role in the development of civilization by meeting the travel needs of the community and the transportation needs of goods. In both developed and developing countries, most people travel daily for work, shopping and various social activities [1] [2]. Especially in Indonesia, transportation is facilitated by several modes, such as air, rail, highway, and waterways. Most passenger trips are made by car for shorter distances which means using the road. In traffic engineering, it is known that given the travel demand curve, the cheaper the travel costs, the higher the demand [3] [4]. This effect implies that the induced traffic does not depend on the capacity itself but on the resulting reduction in travel time or cost [5]. As a result, the higher the traffic demand, the higher the road congestion and greenhouse gas emissions [6], and it has also been shown that traffic congestion impacts the economy by slowing down economic growth [7].

The link between transportation and people can also be seen when transportation is affected by major changes in society, such as the COVID-19 pandemic. In Indonesia itself, the first positive case was reported on March 12, 2020, which then continued with the discovery of cases in other provinces. The City of Kupang itself found its first case on April 9, 2020, and until the time this proposal was written, the

Kupang City Government had extended the Implementation of Community Activity Restrictions up to 4 times. Therefore measuring traffic performance is very important for government agencies managing traffic and individuals planning trips, especially when special events occur [8]. The COVID-19 pandemic has significantly affected almost every aspect of daily life, including urban traffic patterns [9]. Therefore, it is important to measure the impact of COVID-19 on transportation to better guide institutions and communities to respond appropriately to changing traffic patterns [10].

In a study in Greece it was proven that the reduced traffic volume due to social restrictions by the government, caused a slight increase in vehicle speed by 6-11% from before the pandemic. [11]. In a study conducted by Jenelius & Cebecauer [12] they analyzed the impact of COVID-19 on daily public transport passengers in Sweden's three most populous regions (Stockholm, Västra Götaland and Skåne) during spring 2020, Decline in public transport transport (40%-60% for cross-regional transport). In research conducted by Du [13] that reducing traffic demand is a very effective method to reduce traffic congestion and air pollution. A 15% reduction in traffic demand for a congested network can result in a 60% reduction in delays.

Based on the above explanation of the current condition of Kupang City and studies

that have been conducted in various places, the main purpose of this study is to show the impact of social distancing in Kupang City regarding COVID-19 on traffic volume in relation to traffic performance in the city of Kupang. The results of this study will be useful for operational and strategic planning of recovery efforts and for dealing with future pandemics [14] [15]. Changes were explored for 4 main roads in Kupang City, namely Timor Raya street, Frans Seda street, Piet A. Tallo street, and Cak Doko street

## RESEARCH METHOD

Analyze the root causes that result in changes in the volume of road traffic and how the air conditions are when implementing restrictions on community activities during the COVID-19 pandemic. Then proceed with how to formulate appropriate policies and recommendations during the recovery period from restrictions on community activities imposed by the government. And also with restrictions on activities carried out during the pandemic, it can be used as a reference in reducing traffic congestion on urban roads if at one time the volume peaks and there is no longer room to develop road infrastructure. This is done starting from the micro to the macro level in a traffic operation system on the highway. So that later we get a transportation model that can be used as a guide in planning the transportation system

### 1. Research design

The research stages start from literature study, data collection, data analysis, until the results are in the form of conclusions and recommendations for handling. Beginning with a literature study, the main roads to be studied were identified as Jalan Timor Raya, Jalan Soeharto, Jalan Sudirman, and Jalan Tom Pello. This stage is carried out to determine the volume of traffic in 2021, namely during the social restrictions imposed by the Kupang City government. At this stage, the concentration points of the study area were also carried out, which in 2019 to 2022 a traffic survey was carried out in order to obtain accurate comparative data. With the scope of the problems to be discussed. The analysis stage is a follow-up after data processing is completed. The purpose of this stage is to understand and analyze the processing results in depth. The analysis was conducted by comparing traffic conditions and air pollution before the COVID-19 pandemic and during the COVID-19 pandemic, namely with the

social restrictions policy by the Kupang City government, with traffic considerations based on the 2014 Indonesian Road Capacity Guide.

### 2. Population and samples

The research was conducted on 4 main roads in Kupang City, namely Timor Raya street, Frans Seda street, Piet A. Tallo street, and Cak Doko street.

### 3. Instruments

All research instruments and procedures are carried out based on the Guidelines for Urban Road Capacity issued by the The Ministry of Public Works and Housing of the Republic of Indonesia in 2014

### 4. Methods of data collection and analysis

#### a. Road Geometric Survey

The collection of road geometric data using the manual method is carried out directly at the survey location by measuring the width of the road, sidewalk width, and parking layout, as well as other data about roads related to this study using a meter.

#### b. Traffic Volume Survey

The survey conducted in this study was a classified volume survey using the manual traffic counts method on 4 main roads in Kupang City, namely Timor Raya street, Frans Seda street, Piet A. Tallo street, and Cak Doko street. The survey was carried out by placing the surveyor at a fixed point. on the side of the road, so that it can clearly observe passing vehicles at the specified point. Data recording is filled in on the survey form according to the vehicle classification that has been determined. The implementation period starts from 06.00 to 20.00 for 7 days.

#### c. Side Friction Survey

This survey was conducted with the aim of obtaining side resistance data which is useful for calculating the capacity of road sections. This survey was conducted by 10 surveyors in 2 survey sessions (Session 1 at 06:00-14:00; Session 2 at 14:00-20:00), where each surveyor conducted a survey of the number of pedestrians (pedestrians). , vehicles stop, vehicles in and out of the side of the road, and slow vehicles on each road segment.

#### d. Analysis

Measuring traffic performance is critical for public bodies managing traffic and individuals planning trips, especially when special events occur.

The COVID-19 pandemic has significantly affected almost every aspect of daily life, including urban traffic patterns [16] [17]. Therefore, it is important to measure the impact of COVID-19 on transportation to better guide institutions and communities to respond appropriately to changing traffic patterns. Therefore, measuring the level of road service in Kupang City during the recovery period from the COVID-19 pandemic is very necessary to determine future steps. The level of road service, the higher the traffic volume on certain roads, the level of road service will decrease. The form of the road service level equation is as follows [18]:

$$LOS = \frac{V}{C} \quad (1)$$

with :

- LOS = traffic performance or so-called v/c ratio
- V = traffic volume
- C = urban road capacity

### DISCUSSION

Traffic performance on roads is measured based on the v/c ratio at peak hour traffic on 4 main roads in Kupang City for 4 years with 2019 being the year traffic has not been affected by the Covid-19 pandemic, while 2020 and 2021 are last year. traffic affected by the Covid-19 pandemic, as well as 2022 which is the year the covid-19 pandemic has ended.[19] [20]. Traffic data such as total traffic volume and point speed are used to generate and calibrate current field conditions [21] [22].

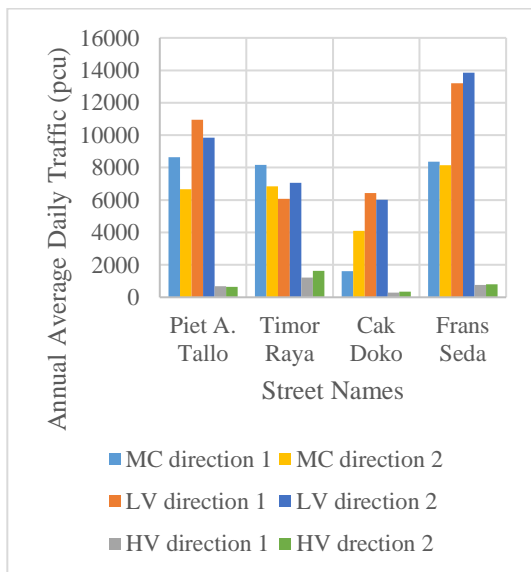


Figure 1. Annual Average Daily Traffic (pcu)

Based on Figure 1, the highest average daily traffic occurs on the Frans Seda street in direction 2 with a total of 13862 light vehicles, while the lowest average daily traffic occurs on the Cak Doko street in direction 2 with a total of 355 heavy vehicles. This shows that the traffic flow on the Frans Seda street, which contains the medical center area, is still busy with traffic, while on other roads, especially on the Cak Doko road which is the education center area, it is not crowded with road users. The same goes for research [23] [24] which reveals that traffic volume depends on the type of road environment.

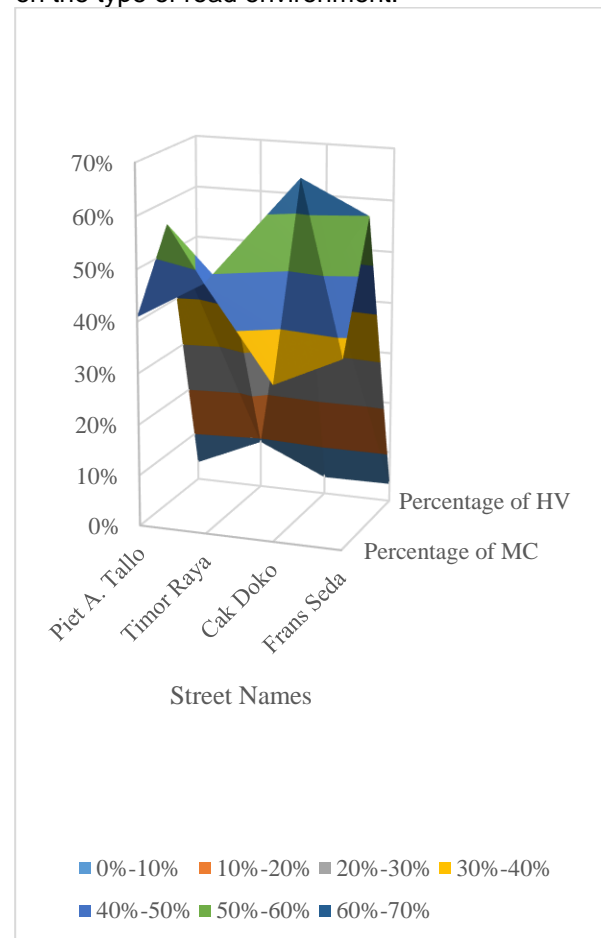
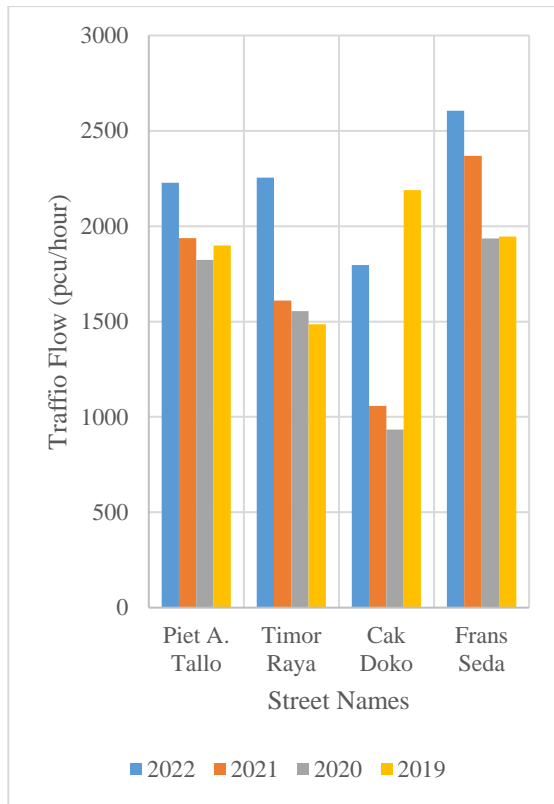


Figure 2. Composition of Traffic by Vehicle Type

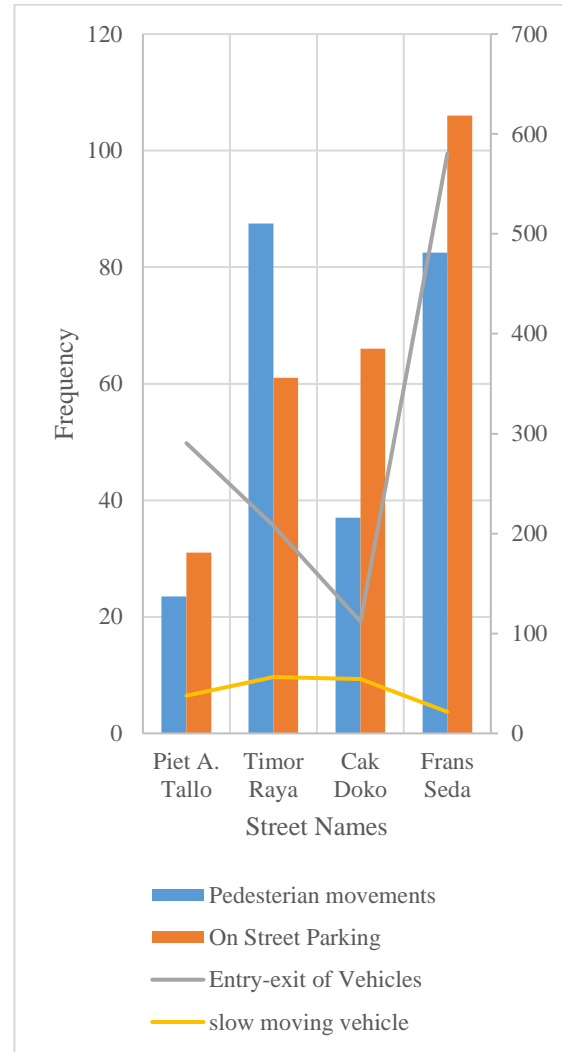
Based on Figure 2, the composition of vehicles that mostly cross the main roads in Kupang City is light vehicles with a percentage of 66.22% on the Cak Doko street. Meanwhile, the type of vehicle with the lowest percentage is the type of heavy vehicle with a percentage of 3.37% which occurs on the Cak Doko street. This shows that during the COVID-19 pandemic, people used light vehicles more than motorcycles and heavy vehicles. Things like this also happened in Africa during 2020 the use of private vehicles increased and public

transportation decreased drastically due to the fear of people gathering together due to the COVID-19 pandemic [25] [26].



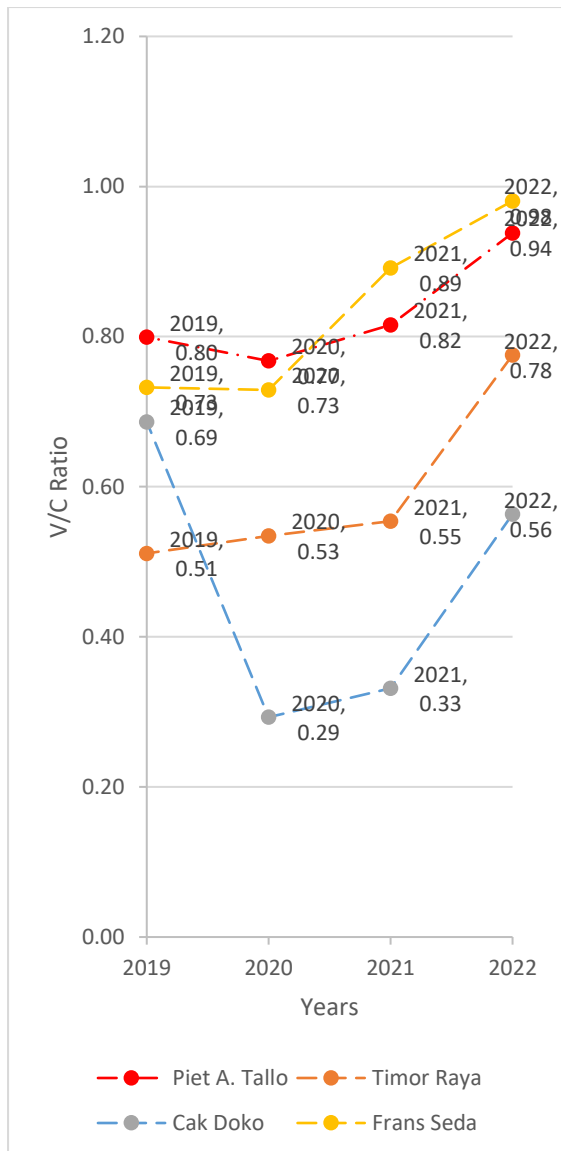
**Figure 3. Peak Traffic Volume**

Based on Figure 3, the highest peak hour traffic flow on the 4 main roads in Kupang City from 2019 to 2022 is on the Frans Seda street in 2022, which is 2605 pcu/hour. Meanwhile, the lowest traffic flow is on the Cak Doko street in 2020 with 934 pcu/hour. From Figure 3 it can also be seen that the traffic flow in 2020 on the four roads tends to be the lowest compared to 2019, 2021 and 2022. Meanwhile, in 2022 the traffic flow on the four roads tends to be the highest when compared to 2019, 2020, and 2021. This shows that 2020 with too high cases of covid-19 and social restrictions implemented by the government greatly affect the decrease in traffic flow on the four main roads in Kupang City. The same thing happened in a study conducted by Jenelius & Cebecauer [27] [28] there was a decline in the use of public transportation in education and office areas by 40% -60% for cross-regional transportation in 2020.



**Figure 4. Side Friction Frequency**

Based on Figure 4, the side friction category during peak hours on the main street in Kupang city is the low category for Cak Doko street with a weight frequency of 269, the medium category for Piet A. Tallo street and Timor Raya street with a frequency of occurrence weight as much as 383 and 413, and the high category is for Frans Seda street with a frequency of occurrence weight as much as 790. With this data it can be seen that the Frans Seda street section which has health facilities in the form of a hospital has the largest roadside activity when compared to other roads, especially on the Cak Doko street. which are in Education facilities which are the roads with the lowest roadside activities. As discussed by Daniel Miravet, the education and office areas are the least active [29] [30].



**Figure 5.** v/c Ratio from 2019 to 2022

Based on Figure 5, traffic performance on the main street in Kupang City from 2019 to 2022 tends to experience a decrease in the v/c ratio in 2020 and 2021 and increase in 2022. The v/c ratio in 2020 is the lowest with 0.77, 0.53, 0.29, 0.73 respectively for Piet A. Tallo street, Timor Raya street, Cak Doko street and Frans Seda street. While the v/c ratio in 2022 is the highest with 0.94, 0.78, 0.56, 0.98 respectively for Piet A. Tallo street, Timor Raya street, Cak Doko street and Frans Seda street. This shows that the Covid-19 pandemic which began to have an impact in 2020, the start of the implementation of social restrictions by the government had an effect on better road traffic performance when compared to before the pandemic, namely in 2019 and after the pandemic in 2022. This is the same as research in the United States, Switzerland and Japan, in general there is a decrease in traffic

volume by 30% -50 during a pandemic, especially when social restrictions are imposed by the government[31] [32] [33].

## CONCLUSION

From the results and discussion, it can be concluded that the COVID-19 pandemic only affects roads with educational facilities, while other roads do not have much effect, especially on roads with health facilities without significant changes. This can be seen on the Frans Seda road where there are health facilities in the form of a hospital, there is no change in the v/c ratio, namely in 2019 and 2020 it remains 0.73. Meanwhile, in 2022, which is the endemic period for COVID-19, all roads will experience an increase in traffic flow, even higher than in 2019 before the Covid-19 pandemic

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