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## The Effects of Odd-Even Traffic Restriction Policy during Asian Games 2018 in Jakarta

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### Abstract

In 2014, Jakarta was chosen to be the host city for Asian Games 2018. Improvements were taken place everywhere, from renovating sport venues to building a completely new apartment complex to serve as an Athlete Village. The city, which is infamously known for its bad traffic, faced an enormous challenge when it came to fulfilling the traffic requirement. Extensive traffic management measures need to be carried out throughout the city. It was then decided to implement Odd-Even Traffic Restriction Policy in most of the primary road in Jakarta during the Asian Games 2018. This study will explain about the implementation process of Odd-Even Policy in Jakarta and its effects on improving traffic condition of Jakarta. Parameters to be compared before and after the implementation of the policy are Volume and VC Ratio, Average Speed, and Public Transport Ridership. By implementing Odd-Even Policy in Jakarta, the VC Ratio of roads with Odd-Even Policy could be reduced by 19.95% while also increasing the speed by up to 46.26%. The attractiveness of public transport was also increased during this period, shown by an increase of public transport ridership by up to 74.34%. It was also managed to reduce the travel time needed to travel between the Athlete Village and each venues to be under 30 minute marks. Looking at these data, it could be concluded that the Odd-Even Policy that was implemented during Asian Games 2018 successfully improved the traffic condition of Jakarta.

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## 1. Introduction

### 1.1. Background

Jakarta is the capital city of Indonesia, the world's 4th most populous country in the world. As the capital city, Jakarta is the center of government and economic activities of Indonesia. In the latest census, Jakarta has a population of 9,607,787 people and still sees a steady increase for 1.41% each year (BPS, 2010). Due to its importance in Indonesia economic activity, 8 other municipalities surrounding Jakarta city developed mainly as the residential area for people working in Jakarta, which makes up the Greater Jakarta Area or better known as Jabodetabek. The population within the Greater Jakarta Area nearly reached 30 million people (BPS, 2010), with Jakarta being the center of it. There are approximately 47.5 million trips per day inside Greater Jakarta based on Presidential Decree No. 55 of 2018 about Greater Jakarta Transportation Masterplan. This makes Jakarta being one of the most congested cities in the world. Recent report suggests that Jakarta is the 12th most congested cities in the world, more congested than other big cities such as Istanbul in Turkey, Mexico City in Mexico, and Rio de Janeiro in Brazil (INRIX, 2017).

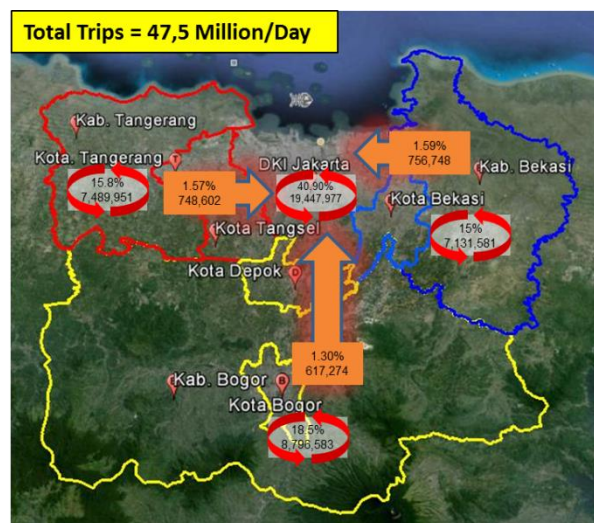


Fig. 1. Movement in Greater Jakarta Area.

Despite its bad traffic reputation, Jakarta still managed to gain trust from organizations worldwide to host major international events. One of them came from Olympic Council of Asia (OCA) in 2014 with the appointment of Jakarta to be the host city of Asian Games 2018 (Sasongko, 2014). Jakarta then started to improve the city by renovating the venues to be used (Hidayat, 2016) and building new athlete village to accommodate all the athletes and officials during the upcoming Asian Games 2018 (The Jakarta Post, 2016).

Despite its effort in improving its sport facilities, the OCA still had concerns about the traffic problems in Jakarta (Agence France-Presse, 2017). This concern was then proved to be true in February 2018 when the Test Event for Asian Games 2018 was held. In the Test Event, the travel time from Athlete Village to Gelora Bung Karno Sports Complex, where most of the Asian Games events would be held, reached 70 minutes during the afternoon peak hours. The distance between those two was only 22Km, which means the average speed was only about 18Kph. This was really concerning for every parties involved in, considering that those figures was reached even when police escort was already taken place. In fact, the trip back to athlete village took much longer time, which was 90 minutes.

After reviewing this Test Event, the OCA decided to put a limit of maximum 30 minute for the travel time between Athlete Village and each venue to be used in the Asian Games. To achieve this requirement, a comprehensive traffic measures need to be taken place in Jakarta. Ministry of Transportation through Greater Jakarta Transport Authority, Jakarta Provincial Government through its Department of Transportation, and

Indonesian National Police through the National Traffic Corps and Jakarta Traffic Corps were then discussing about the suitable traffic measures to be implemented.

One of the proposed traffic measures which came up during the discussions was the Odd-Even Traffic Restriction Policy. Odd-Even Policy is a policy which allows cars with Odd-Numbered plate to be used on Odd-Dated days and cars with Even-Numbered plate would be allowed to be used on Even-Dated days. This policy actually had been implemented in other cities in the world, such as Beijing in China (Hooker, 2008) and Delhi in India (BBC, 2017). Despite the reason behind the implementation of Odd-Even Policy in those two cities were more to the environmental issues, Odd-Even Policy was believed by policy makers in Jakarta to be effective to reduce traffic in Jakarta during Asian Games 2018. This was due to the fact that it requires rather small amount of money to implement and the fact that the familiarity of people living in Jakarta with Odd-Even Policy as it had been implemented in several main roads in Jakarta during peak hours since 2016 (Azis, 2016). The Odd-Even Policy was then decided to be implemented in 3 toll roads connecting Jakarta with its neighboring cities and also in 10 major roads inside the city of Jakarta.

This study is conducted to report the implementation process of Odd-Even Policy in Jakarta during Asian Games 2018 and to see how Odd-Even Policy influenced traffic performance in Jakarta.

### *1.2. Aim and Objectives*

The aim of this study is to learn the effect of the implementation of Odd-Even Policy in improving Jakarta traffic condition in order to fulfill the requirement needed to be a good host for the Asian Games 2018.

### *1.3. Outline*

This report will follow the outline as following:

- **Introduction**

This chapter will explain about the background of Odd-Even Policy implementation during Asian Games 2018. This chapter will also cover the aim of the study and the outline on how the study will be reported.

- **Methodology**

This chapter will explain about the implementation process of Odd-Even Policy implementation during Asian Games 2018 and the data collection methods used to gather necessary information to be used in evaluating the Odd-Even Policy.

- **Data Analysis**

This chapter will explain about the data collected before and during the implementation of Odd-Even Policy.

- **Conclusion**

This chapter will summarise all information discussed on previous chapters and will also include the recommendation for future Odd-Even Policy implementation.

## **2. Methodology**

### *2.1. Description of Implementation Process*

As the Odd-Even Policy that will be implemented covers most of the main roads used by people in Greater Jakarta Area, many stakeholders with different perspective were involved during the implementation process. This section will explain about the process that would eventually enable Odd-Even Policy to be successfully implemented during Asian Games 2018. There are two parts in this section. The first one being the implementation process of Odd-Even Policy in 3 toll roads connecting Jakarta with its neighboring cities, namely Jakarta-Cikampek Toll Road, Jagorawi Toll Road, and Jakarta-Tangerang Toll Road. The second part is about the implementation process of Odd-Even Policy in 10 main arterial roads in Jakarta, namely Benyamin Sueb Road, M.H. Thamrin Road, Jend. Sudirman Road, Gatot Subroto Road, Ahmad Yani Road, D.I. Panjaitan Road, S. Parman Road, Rasuna Said

Road, MT Haryono Road, and Metro Pondok Indah Road. On general terms, the implementation process of Odd-Even Policy that had been done by Greater Jakarta Transport Authority followed the following flowchart:

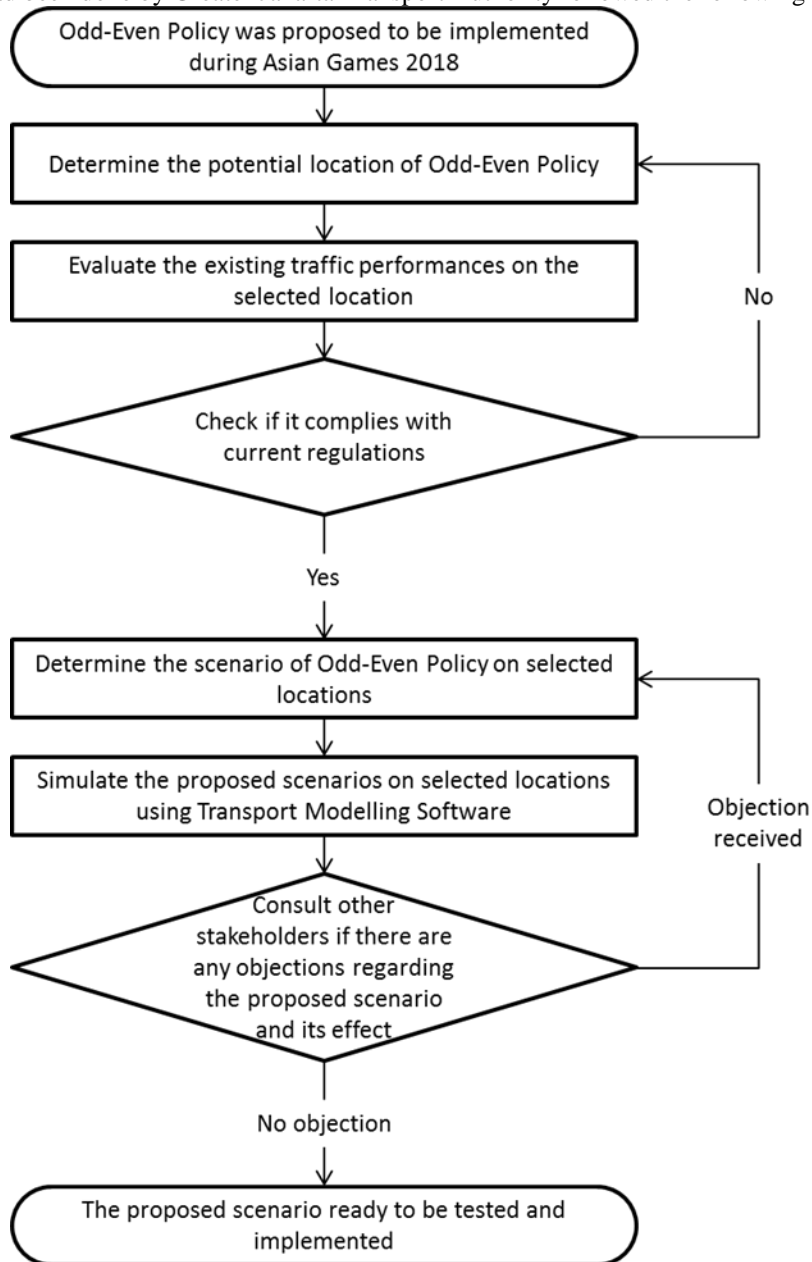


Fig. 2. Implementation Process of Odd-Even Policy in Jakarta.

### Toll Roads

Odd-Even Policy in toll road is the first proposed solution during the discussion of possible traffic measures to be taken during Asian Games 2018. It came up first because of the condition of Jakarta-Cikampek Toll Road was really crowded due to the ongoing constructions which took place on both side of the roads. Jakarta-Cikampek Toll Road is actually one of the most important roads in Indonesia due to the fact that it connects the capital city to residential area such as Bekasi, industrial area such as Karawang and Cikarang, and also part of the network that connects

Jakarta to other big cities in Java Island such as Surabaya and Semarang which are the capital city of East Java and Central Java Province respectively.

To see if it was possible to implement the Odd-Even Policy in Jakarta-Cikampek Toll Road, several regulations were consulted. One of which is the Government Regulation No. 32 of 2011 about Management and Engineering, Impact Analysis, and Traffic Demand Management. It was stated there that the minimum requirements for a road section to be implemented a plate number based traffic restriction policy are as following:

1. VCR on peak hour is more than 0.7
2. Average travel speed on peak hour is less than 30Kph
3. Public Transport service is available on selected route

The next step was to determine the scenario of Odd-Even Policy in Toll Road. It was decided that the Odd-Even screening would not be taken place inside the toll road. Instead, the screening would be taken place in some of the Toll Gates along the toll road, so that people with unsuitable plate number would still have access to divert their route accordingly. To minimize the number of officer needed to supervise the toll gate, it was decided to implement the Odd-Even Policy on some of the toll gates with the highest number of user along the toll road.

After the location of Odd-Even Policy in Jakarta-Cikampek Toll Road had been decided, there are some opinions emerged on meetings with other stakeholders. One of them was about the social issue that might happen if Odd-Even Policy was implemented, due to the fact that the Odd-Even Policy was planned only for cars. Therefore, it was then decided to put a package of policy that covers all type of users in Jakarta-Cikampek Toll Road. The content of the policy package is as following:

1. Odd-Even Policy on Bekasi Barat and Bekasi Timur Toll Gate (Jakarta bound only) from 06.00 to 09.00 WIB on weekdays
2. Restricted access for freight vehicles type 3, 4, and 5 on both directions from 06.00 to 09.00 WIB on weekdays
3. Provision of Public Transport Lane from Bekasi Timur (Jakarta bound only) and TransJabodetabek Premium services from 06.00 to 09.00 WIB on weekdays

Due to the fact that more types of vehicle would be restricted to access the toll road during certain period of time, a more extensive study of cost benefit analysis was done to convince all the related stakeholders. It was then discussed up until the Coordinating Ministry level and involved several high officials of the country. After it was decided that the benefit would exceed all the cost emerged from implementing the policy package, the Minister of Transportation sign the Ministerial Regulation No. 18 of 2018. Using the same momentum, similar traffic measures was also implemented in other two toll roads connecting Jakarta with surrounding cities, which are Jagorawi Toll Road and Jakarta-Tangerang Toll Road. An exception was given to freight vehicle in Jagorawi Toll Road as there was not much of freight traffic taken place on that road section.

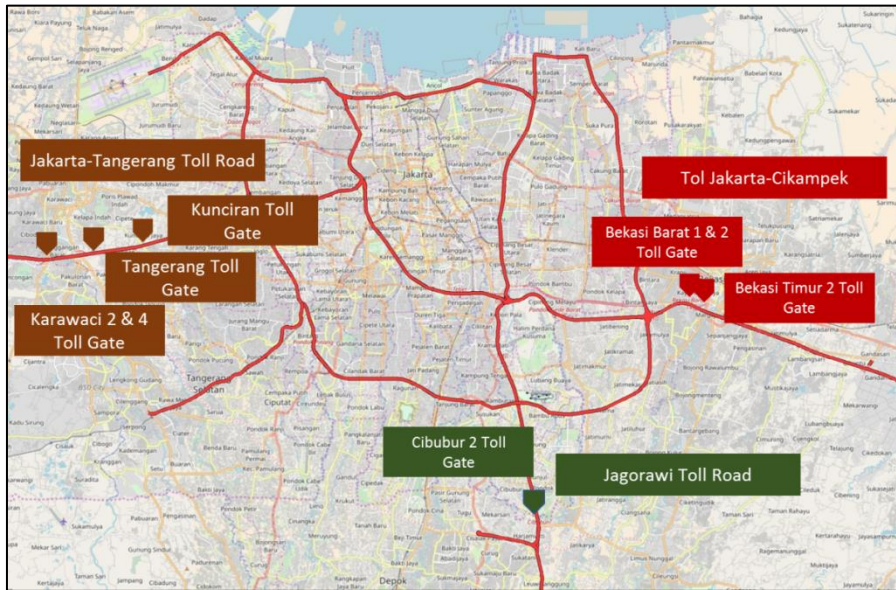


Fig. 3. Toll Gates with Odd-Even Policy.

Arterial Roads

Using the same set of methods of Odd-Even Policy implementation process in toll roads, the first thing to do is to determine the location of Odd-Even Policy in arterial roads in Jakarta. 10 road sections were proposed to be implemented the Odd-Even Policy concerning their existing traffic performance and due to the fact that they would serve as the main roads for athlete movements during Asian Games 2018. Several regulations were then consulted, such as Jakarta Local Regulation No. 1 of 2012 about Land Use Planning of 2030 which stated road sections that possible to be implemented some Traffic Demand Management measures.

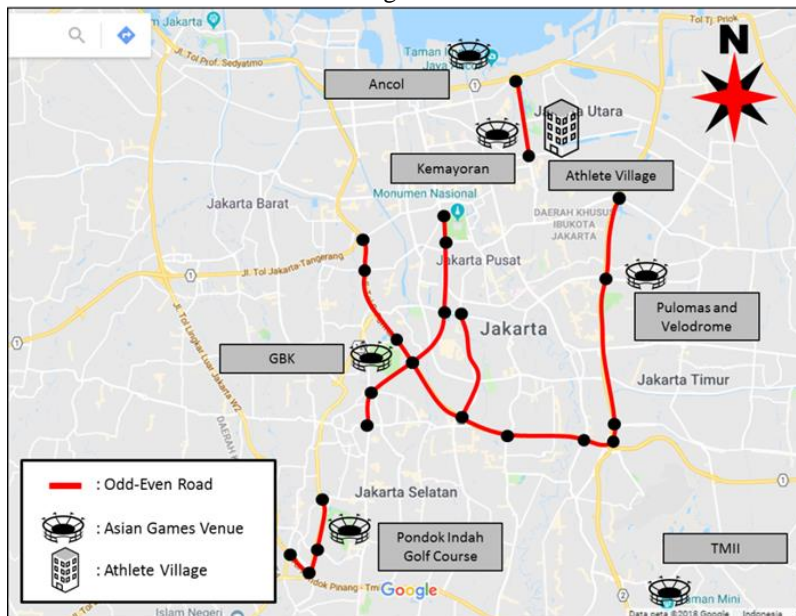


Fig. 4. Arterial Roads with Odd-Even Policy.

The scenario of Odd-Even Policy on those roads was then discussed. One of the discussions was about the implementation period of the Odd-Even Policy. Given that the sport events during Asian Games would be held all day long, and on Saturday and Sunday as well, the Odd-Even Policy on arterial roads was adjusted accordingly. It was then decided that the Odd-Even Policy would be from 06.00 to 21.00 WIB, 7 days a week. To accommodate all road users during the implementation of Odd-Even Policy, a policy package was also issued by the government. The policy package, as regulated by Governor's Regulation No. 77 of 2018 and Ministerial Regulation No. 78 of 2018, is as following:

1. Traffic management measures by the implementation of Odd-Even Policy and Toll Gate Closure with police discretion
2. Provision of public transport as compensation of Odd-Even Policy and to accommodate all tourist during Asian Games 2018
3. Restricted access for freight vehicle type 3, 4, and 5 on Pluit-Tg.Priok, Tg.Priok-Cawang, Cawang-TMII, and Cawang-Cikunir toll road from 06.00 to 19.00 WIB and Cawang-Tomang-Pluit and Tomang-Kembangan toll road from 05.00 to 22.00 WIB during Asian Games 2018



Fig. 5. Route Restriction for Freight Vehicles.

## 2.2. Evaluation Methods

To be able to see the effect of Odd-Even Policy that would be implemented, there need to be a traffic evaluation method before and after the implementation. The parameters to be compared are Average VC Ratio, Average Speed, and Number of Passenger on public transport.

Average VC Ratio could be obtained ideally by doing traffic counting on each of the Odd-Even Policy location during the implementation period. On Jakarta-Cikampek, Jagorawi, and Jakarta-Tangerang Toll Road, the traffic counting was done according to the implementation period, which was from 06.00 to 09.00 WIB on weekdays, only on toll gate that implemented Odd-Even Policy. Therefore, the data obtained is only on traffic volume data. VC Ratio data from traffic counting on the actual toll road section were also available. However, because of there are other policies included in the policy package, such as the restriction for freight vehicle, the VC Ratio data of after implementation is directly affected by other policies than Odd-Even Policy. Therefore we could not use those data to study the effect of Odd-Even Policy on toll roads. On arterial roads of Jakarta, due to the fact that the locations were spread widely across Jakarta, and the implementation period was considerably longer (06.00 to 21.00 WIB), samples were taken to evaluate the Odd-Even Policy. From 10 arterial roads that were implemented Odd-Even Policy, only 3

were chosen because of the provision of CCTV cameras on each chosen road. The period of traffic counting was also cut to only 15 minutes sample of Morning traffic, 15 minutes of Afternoon traffic, and 15 minutes of Evening traffic. However, we could also do the traffic count for some of the parallel roads to roads that were implemented Odd-Even Policy. As many as 7 road sections around the Odd-Even roads were evaluated to see how Odd-Even Policy influenced the alternative routes. Unlike traffic counting in the toll roads, the traffic counting on arterial roads resulted in VC Ratio data.

Evaluating the Average Speed before and after the implementation was rather simpler than evaluating the Average VC Ratio. Google Maps were used to obtain average travel time from one end to another end of a road section at a certain time, which could easily converted into average speed by calculating it with distance measured in Google Maps as well. By doing this, we could retrieve average speed of toll roads on every 15 minutes, while on arterial roads the frequency of retrieving data was every 1 hour. The number of roads surrounding Odd-Even Road that could be observed was also more extensive, which were 20 road sections.

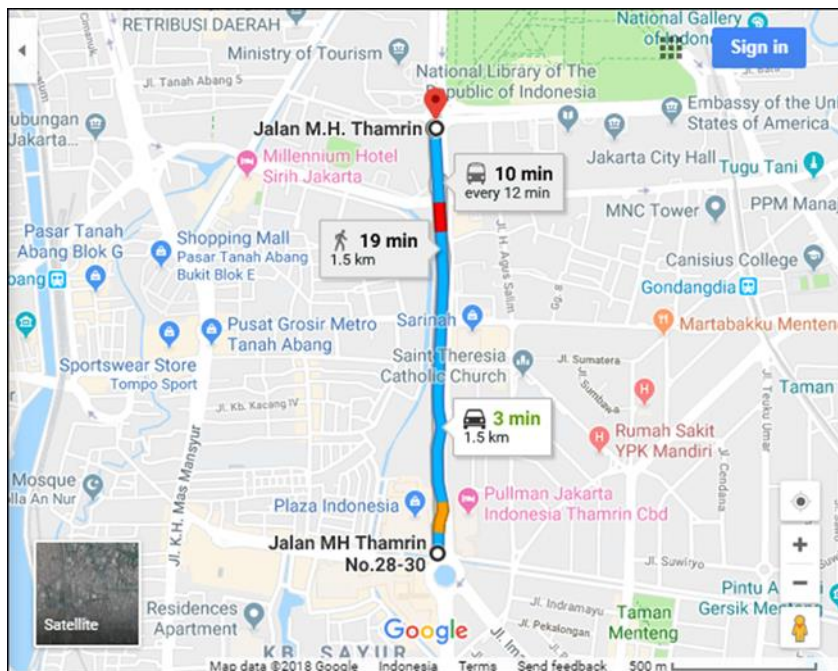


Fig. 6. Example of Average Speed Evaluation Method on M.H. Thamrin Road.

The last parameter to be evaluated is the number of passenger on public transport. This was done to see if Odd-Even Policy successfully moves private car users to use public transport. This was done by consulting each company that operates public transport in Jakarta, such as TransJakarta, Commuter Lines, and TransJabodetabek.

We also need to evaluate the travel time between each venue that will be used during Asian Games 2018 and the Athlete Village to see if the requirement set by the OCA could be fulfilled.

### 3. Results and Discussion

#### 3.1. Toll Roads

##### Volume

Here is the car volume obtained before and after the implementation of Odd-Even Policy on toll gates of the respective 3 Toll Roads where the Odd-Even Policy was taken place:



Table 1. Car Volume Before and After the Implementation of Odd-Even Policy on Toll Road.

Toll Road	Car Volume (PCU/Hour)		Change (%)
	Before	After	
Jakarta-Cikampek	8,206	5,547	-32.41%
Jagorawi	7,701	5,582	-27.51%
Jakarta-Tangerang	6,737	5,066	-24.81%
Average	7,548.00	5,938.16	-28.48%

The car volume data before the implementation of Odd-Even Policy were retrieved between March and April 2018, while the data of after the implementation of Odd-Even Policy were retrieved between April and May 2018.

From the [Table 1](#) above we could see that the average volume on toll gates that were implemented Odd-Even Policy on those 3 toll roads reduced by 28.48%. From this data we could see that the volume reduction produced by Odd-Even Policy did not reach 50%, as many would have hoped. This might be because of there are some exception to some type of vehicles, such as President and Vice President vehicles, emergency vehicles, public office operational vehicles, etc. This could also because of there are people who have two vehicles with Odd and Even plate number so that they still could access the toll gate using different vehicles on different days.

#### Average Speed

Here is the Average Speed obtained before and after the implementation of Odd-Even Policy on 3 Toll Roads where the Odd-Even Policy was taken place:

Table 2. Average Speed Before and After the Implementation of Odd-Even Policy on Toll Road.

Toll Road	Speed (Kph)		Change (%)
	Before	After	
Jakarta-Cikampek	23.13	32.95	42.45%
Jagorawi	31.65	43.22	36.57%
Jakarta-Tangerang	22.09	28.11	27.23%
Average	25.62	34.76	35.66%

The speed data before the implementation of Odd-Even Policy were retrieved between March and April 2018, while the data of after the implementation of Odd-Even Policy were retrieved between April and May 2018.

From the [Table 2](#) above we could see that the average speed on those 3 toll roads increased by 31.38%. From this data we could see that the speed was improved by the implementation of Odd-Even Policy. However, we should also consider that the data resulted on Jakarta-Cikampek and Jakarta-Tangerang Toll Road was not purely because of Odd-Even Policy. Other policies implemented such as freight vehicles restriction might also behind the reason on why the speed had gone up. But if we look only at Jagorawi toll road, where there are no freight vehicles restriction taken place, the speed also increased by similar figure, which is 32.80%.

#### Public Transport

Here is the average number of monthly passenger of public transport service obtained before and after the implementation of Odd-Even Policy that operates along the 3 Toll Roads where the Odd-Even Policy was taken place:

Table 3. Public Transport Ridership Before and After the Implementation of Odd-Even Policy on Toll Road.

Public Transport Service	Number of Passenger (Passenger/Month)		Change (%)
	Before	After	
TransJabodetabek Premium Jakarta-Cikampek	24,171	71,424	195.49%

TransJabodetabek Premium Jagorawi	26,051	31,025	19.09%
TransJabodetabek Premium Jakarta-Tangerang	34,413	45,104	31.07%
Average	28,211.67	49,184.33	74.34%

The data regarding the number of passenger before the implementation of Odd-Even Policy were retrieved on April 2018, while the data of after the implementation of Odd-Even Policy were retrieved on September 2018.

From the [Table 3](#) above we could see that the average monthly passengers on those 3 routes increased by 74.34%. From this data we could see that the Odd-Even Policy implemented on those 3 toll roads successfully increase the attractiveness of public transport on the corresponding route. This might also because of the priority given to public bus on those routes which was also included in the policy package. The provision of Park and Ride service on the area near Bekasi Barat Toll Gate, which is one of the toll gates restricted by Odd-Even Policy, might also be the reason why the number of passenger went up after the implementation of Odd-Even Policy. However, further study might be needed to prove if there are any other factors than the implementation of Odd-Even Policy that influences the ridership, such as population growth, public transport frequency adjustment, and so on.

### 3.2. Arterial Roads

#### Average VC Ratio

Here is the average VC ratio obtained before and after the implementation of Odd-Even Policy on arterial roads where the Odd-Even Policy was taken place and on surrounding arterial roads which might have served as alternative roads for the Odd-Even road:

Table 4. VC Ratio on Odd-Even Roads Before and After the Implementation of Odd-Even Policy on Arterial Road.

Arterial Road with Odd-Even Policy	VC Ratio		Change (%)
	Before	After	
M.H. Thamrin Road	0.76	0.59	-21.67%
Rasuna Said Road	0.69	0.56	-19.46%
S. Parman Road	0.80	0.65	-18.76%
Average	0.75	0.60	-19.95%

Table 5. VC Ratio on Alternative Roads Before and After the Implementation of Odd-Even Policy on Arterial Road.

Alternative Road	VC Ratio		Change (%)
	Before	After	
Perintis Kemerdekaan Road	0.63	0.76	20.46%
Letjen Suprpto Road	0.58	0.61	5.35%
Salemba Raya Road	0.61	0.65	7.55%
Pejaten Raya Road	0.70	0.74	4.77%
Gunung Sahari Road	0.55	0.57	4.33%
Dewi Sartika Road	0.65	0.69	6.42%
Mayjen Sutoyo Road	0.67	0.70	4.83%
Average	0.63	0.67	7.70%

The VC ratio data before the implementation of Odd-Even Policy were retrieved on June 2018, while the data of after the implementation of Odd-Even Policy were retrieved on August 2018.

From the [Table 4](#) above we could see that the average VC ratio on arterial roads with Odd-Even Policy reduced by 19.95%. This data is actually aligned with the reduction of volume in toll gate with Odd-Even Policy in [Table 1](#)

where the reduction is less than 50%. This might also because of the same reason, such as vehicles that were excluded and some people actually have two or more cars.

From the [Table 5](#) above we could see that the average VC ratio on alternative roads increased by 7.70%. This data shows us that people still look for alternative roads when they were not allowed to access some part of the road network. However, the increase of VC ratio on alternative roads still below the reduction of VC ratio on Odd-Even roads that might indicate the benefit caused by Odd-Even Policy exceeds the extra cost that came with it.

### Average Speed

Here is the average speed obtained before and after the implementation of Odd-Even Policy on arterial roads where the Odd-Even Policy was taken place and on surrounding arterial roads which might have served as alternative roads for the Odd-Even road:

Table 6. Average Speed on Odd-Even Roads Before and After the Implementation of Odd-Even Policy on Arterial Road.

Arterial Road with Odd-Even Policy	Speed (Kph)		Change (%)
	Before	After	
Gatot Subroto Road	24.30	48.00	97.56%
Jend. Sudirman Road	22.26	33.90	52.31%
M.H. Thamrin Road	20.84	30.13	44.60%
Rasuna Said Road	29.42	30.71	4.37%
S. Parman Road	22.41	30.88	37.82%
MT Haryono Road	29.43	55.90	89.91%
D.I. Panjaitan Road	23.76	32.81	38.10%
Ahmad Yani Road	28.52	33.59	17.79%
Benyamin Sueb Road	23.92	37.14	55.31%
Metro Pondok Indah Road	26.93	35.18	30.62%
Average	25.18	36.83	46.26%

Table 7. Average Speed on Alternative Roads Before and After the Implementation of Odd-Even Policy on Arterial Road.

Alternative Road	Speed (Kph)		Change (%)
	Before	After	
Perintis Kemerdekaan Road	35.53	28.87	-18.75%
Letjen Suprpto Road	30.30	30.49	0.61%
Salemba Raya Road	24.27	23.99	-1.16%
Matraman Road	27.12	24.92	-8.12%
Kalibata Road	22.76	23.76	4.37%
Pasar Minggu Road	21.85	21.87	0.08%
Soepomo Road	22.90	20.09	-12.27%
Saharjo Road	29.29	21.90	-25.21%
Casablanca Road	22.39	23.24	3.81%
K.H. Mas Mansyur Road	20.21	21.36	5.68%
Warung Jati Barat Road	15.62	17.29	10.69%
Pejaten Raya Road	17.57	17.23	-1.97%
R.E. Martadinata Road	33.90	31.85	-6.05%
Danau Sunter Barat Road	27.71	24.17	-12.78%
HBR Motik Road	36.13	28.57	-20.92%

Gunung Sahari Road	21.11	20.34	-3.66%
R.A. Kartini Road	28.09	27.42	-2.39%
Ciputat Raya Road	22.72	21.75	-4.31%
Mayjen Sutoyo Road	23.47	22.52	-4.05%
Dewi Sartika Road	17.66	17.68	0.13%
Average	25.03	23.46	-6.26%

The speed data before the implementation of Odd-Even Policy were retrieved on June 2018, while the data of after the implementation of Odd-Even Policy were retrieved on August 2018.

From the [Table 6](#) above we could see that the average speed on Odd-Even roads increased by 46.26%. This data indicates that the implementation of Odd-Even Policy did well in relieving traffic congestion in the implementation location itself. But as we can see from [Table 7](#), the average speed on alternative roads were reduced by 6.26%, aligned with the increasing VC ratio on alternative roads that could be seen on [Table 5](#). However, the increase of average speed on Odd-Even road far exceeds the reduction of speed on alternative roads, which might also indicates that the benefit caused by the implementation of Odd-Even Policy far exceeds the cost that resulted as a side effect.

### Public Transport

Here is the average number of weekly passenger of public transport service obtained before and after the implementation of Odd-Even Policy that operates in Greater Jakarta area:

Table 8. Public Transport Ridership Before and After the Implementation of Odd-Even Policy on Arterial Road.

Public Transport Service	Number of Passenger (Passenger/Week)		Change (%)
	Before	After	
TransJakarta	1,342,811.40	1,882,700.40	40.21%
Commuter Line	4,654,738.00	4,939,961.00	6.13%
Average	2,998,774.70	3,411,330.70	13.76%

The data regarding the number of passenger before the implementation of Odd-Even Policy were retrieved on June 2018, while the data of after the implementation of Odd-Even Policy were retrieved on August 2018.

From the [Table 8](#) above we could see that the number of weekly passenger of main public transports in Greater Jakarta Area, namely TransJakarta and Commuter Line, increased by 13.76%. This data proved that the implementation Odd-Even Policy would increase the attractiveness of public transport as they were one of the vehicles that were excluded from the policy. However, further study might still be needed to see if the additional passenger came from private vehicle users or other sources. In fact, 204 additional buses were in operation during Asian Games 2018 which could be one of the reasons why the number of passenger went up in August 2018.

### 3.3. Athlete Routes

Here is the travel time obtained before and after the implementation of Odd-Even Policy on routes between each venue and the Athlete Village that will be used for Asian Games 2018:

Table 9. Travel Time between Athlete Village and Each Venues Before and After the Implementation of Odd-Even Policy on Arterial Road.

Venue	Athlete Route	Travel Time (Minute)		Change (%)
		Before	After	
1	Athlete Village – GBK	70	27	-61.43%
	GBK – Athlete Village	58	25	-56.90%
2	Athlete Village – Kemayoran	10	7	-30.00%

	Kemayoran – Athlete Village	5	4	-20.00%
3	Athlete Village – Ancol	16	11	-31.25%
	Ancol – Athlete Village	11	8	-27.27%
4	Athlete Village – Pulomas	37	24	-35.14%
	Pulomas – Athlete Village	33	22	-33.33%
5	Athlete Village – Velodrome	44	26	-40.91%
	Velodrome – Athlete Village	35	24	-31.43%
6	Athlete Village – TMII	55	28	-49.09%
	TMII – Athlete Village	49	26	-46.94%
7	Athlete Village – Pondok Indah	50	38	-24.00%
	Pondok Indah – Athlete Village	45	33	-26.67%
8	Athlete Village – Cibubur	75	30	-60.00%
	Cibubur – Athlete Village	64	29	-54.69%

From the [Table 9](#) above we could see that almost all the athlete route reached the requirement set by the OCA, which is less than 30 minute of travel time, except for Pondok Indah Venue. However this was approved by the OCA given that Pondok Indah is a venue for golf where the athletes would start their journey early in the morning when the road is still empty.

## 4. Conclusion

### 4.1. Conclusion

The Odd-Even Policy that was implemented during Asian Games 2018 has managed to reach the goals that have been set before. The travel time between each venue to the Athlete Village reduced to less than 30 minutes which would enables athletes to arrive at each venues without being distressed by the traffic. The Odd-Even Policy also brings benefit to the city as it managed to reduce car volume on toll roads by 28.48%, reduce VC ratio on arterial roads by 19.95%, increase speed on toll roads by 31.38%, and increase speed on arterial roads by 46.26% on the location of the implementation. Although it also increased the VC ratio of alternative roads by 7.70% and reduced the speed by 6.26%, the advantages resulted from Odd-Even Policy was exceeding the disadvantages that came with it. It also managed to improve the attractiveness of public transport which shown by the increase of 74.34% ridership on public transport service along the toll road and 13.76% increase on public transport that have extended network in the city of Jakarta. Therefore, Odd-Even Policy could be permanently implemented considering the results reported in this study

### 4.2. Recommendation for Future Studies

There are several recommendations for future studies that would complement the data resulted in this study. The first recommendation is to conduct study to trace where the additional passengers who use the public transport after the implementation of Odd-Even Policy came from. By doing this study, the effect of Odd-Even Policy on increasing public transport attractiveness or decreasing private vehicle attractiveness could be found out.

The next recommendation is to conduct the same study using parameters from sectors other than traffic performances. This could be in form of economic activity, fuel consumption, etc. With this study, a more comprehensive cost and benefit analysis of Odd-Even Policy could be produced so that it might be adopted in other cities as well.

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