The Challenges in the Implementation of Road Policies in Metro Manila

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Abstract: **This paper aims to provide a comprehensive insight on road policies in Metro Manila by identifying the number of policies, distinguishing local policies, national policies, and republic acts, and lastly, determining challenges on road public transport in the area. Most people do not really take road policies as scientific issues, but the implementation of these regulations affects people's lives as much as any other economic factor; that is why it is important to conduct research on how to make these systems better. The findings of this paper significantly contribute to resolving issues of traffic congestion, road accidents, and violations of road policies in the current Philippine transportation system, as well as to the improvement of the country's economic productivity. Urban development assists growth and accessibility of cities towards transit mobility which enables urban areas to seamlessly increase travel within the area. Traffic congestion and long travel hours are unpleasant as it discourages future economic growth. The study observes the current road system in Metro Manila and draws conclusions that can be utilized for the furtherance of today's policies, in a final goal to improve the overall urban development of the country.**

Keywords: **Road transport, urban development, road crash incidents, vehicle sales, road policies, traffic violators, railway commuters.**

1. Introduction

With the emergence of economic development and population growth, demand for travel in cities worldwide has also dramatically increased over the past few decades, hence leading to a series of challenges including traffic congestion (Diao, 2019). To satisfy the growing demand for travel and to mitigate negative externalities that it brings (e.g. road accidents), policy makers as well as researchers have proposed and implemented numerous policies. Transport management policies are crucial for sustainable transport development, it has favoured multiple solutions such as land use changes, institutional reforms and policy transfer (Xu et al., 2017). Public transportation refers to a variety of transport services that are accessible to the general public (Nugrahaini et al., 2019) Mobility in cities and towns in developing countries are extremely reliant on road based public transport modes (Guillen et al., 2013).

The problems on public road transport brought by the rapid urbanization and globalization of the Philippines are evidently becoming more difficult to handle than before. As time moves forward, the number of road accidents (Versoza & Miles, 2016), the congestion rates of traffic (Boquet, 2013), and the cases of drivers who have poor comprehension on traffic regulations (Bañaresa, Caballesa, Serdana, Liggayua, & Bongo, 2018) only increase. The roads have become a melting pot for a kind of transportation that lacks order, and the policies imposed by the lawmakers and local government units are starting to loosen up. Furthermore, a lot of policies that were up for approval faced a huge percentage of getting numerous complaints from the masses who are to be affected by it, and this may happen in more potential policies in the future.

According to Boquet (2013), the urban density of Manila is one of the highest in the world and the rate of motorization far exceeds the street capacity to handle traffic. More people driving around means a bigger problem for the government. They will need to improve the overall capability of the system by introducing and devising new policies, including a possibility for an alternative mode of transportation, or the increase of the roads' current vehicle capacities. With these kinds of problems in the capital, it is only a matter of time before its neighbors—like Pasig City—are dragged down into the pit. For instance, Pasig City is home to some of the most utilized roads for the public; running across its center is the Ortigas Avenue, which, together with Marcos Highway in the north, serves as the main access roads that connects the far east CALABARZON (especially Rizal province) and the urban Metro Manila. Also coming across is the C5 road, which bypasses all the eastern cities throughout the NCR, from Parañaque in the south to Valenzuela in the north. Pasay City holds a lot of inevitable routes going to its abundance of residential areas and landmarks. And day by day, as the population evolves into a more progressive society, these roads become more and more congested and the order needs to be maintained once again.

With the increasing traffic congestion, road accident probability, and violations of road policies in the current Philippine transportation system brought by rapid urbanization, the contributions that this research paper will provide in

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theoretical, practical, and research purposes can greatly aid and support the implementation of future new policies as well as the efficient maintenance of existing laws. By providing an observation on which specific factors may drag policy implementation down and/or decrease its efficiency towards the people, those who keep track of the roads' orderliness can make amends to their system and make an open space for suggestions that can build a better unit of maintenance for all the people who use public roads.

The implementation of public road transport policies will become more of a challenge than it has ever been in the past years. There will be more people to observe obedience with, and more unruly drivers to watch out for. Furthermore, the population size can drastically affect the government's statistics on how much of the cities' road users follow their policies, and also give rise to a possible opposition group to some policies that are to be approved. The objective of this paper is to identify the various challenges faced by the implementation of road public transport policies in Metro Manila.

This research paper can give insights to public road transport officials and researchers on how to make policy implementations easier by providing them an observed perspective on which factors pose a threat to the successful maintenance of road laws. It can also contribute to statisticians in determining the volume and percentage of accidents, traffic congestion, and the abiding of the people to the law. In practical usage, it will make better of the current road situation that the country has and give rise to a potential system that can provide more accessible road usage for the masses.

In the bigger picture, this study contributes to the overall backing of the government's efforts to decrease road issues. The long, dragging traffic on highways and main roads can be lifted to a more convenient situation, and the number of accidents can be decreased as well, along with the probability that it happens again. These changes can greatly help the masses and give them a more comfortable seat while on transport. Furthermore, it will help the country be more productive and efficient by the elimination of a number of factors that hinder a progressive society.

It is very evident that Metro Manila faces numerous road challenges. There are several challenges in the implementation of road public transport policies in terms of Traffic Violators, Road Crash, Vehicle Sales, Railway Commuters and if policy challenges exert significant effects in traffic management. We will also identify management implications that may be drawn from the findings of this study.

In this paper, we will determine the number of road policies in Metro Manila. Along with the existing republic acts. We will distinguish the local and national policies on the road. Lastly, we will identify the main challenges being faced on the road.

2. Literature

Verzosa & Miles (2016) focuses on pedestrian fatalities, specifically those associated with road accidents involving vehicle crashes and/or collisions. The researchers have used the Metro Manila Accident Reporting and Analysis System (MMARAS) data from 2008 to 2011 to analyze and examine the statistical results and other factors that can lead to road accidents like these, and increase the potential for serious injuries or death stated in three cities observed: Makati, Manila, and Quezon, all members of the Metro Manila area. It states a few key occasions in the metropolitan roads that increase the likeliness of a road collision: first, fatalities within pedestrians are more likely to happen when heavy or multiple vehicles are involved, rather than a small car or a single motor. Second, the accidents are more likely to happen in the evening and the midnight time of the day. Third, a troublesome mix of heavy-duty vehicles and pedestrian traffic can have the chances of generating road accidents in the area with the range of high-speed, high-traffic-volume and multi-lane roadways. Finally, and most importantly, the fatality chance heavily increases with the violations of drivers and pedestrians to road policies and traffic laws.

According to Tabuñar (2020) the majority of road traffic crashes in the Philippines are caused by human factors and behaviors, such as drunk driving, over speeding, overtaking, abrupt maneuvers, and bad turns, with drivers' behaviors causing 76.1% of said accidents. The study states that a driver's attitude towards road policies could be associated with driving violations and their awareness of implemented regulations. This study aims to determine the knowledge and attitudes of medical students in the University of the Philippines-College of Medicine (UPCM) towards road traffic regulations, as well as their association and practice in road safety. The data was obtained by utilizing a questionnaire based on national laws on traffic adopted from related literature. After the study is conducted, the researchers conclude that the "Overall safe driving knowledge, attitude and practices of the medical students of UPCM are low" and recommend consistent enforcement of traffic rules must be observed and implemented even more strictly than before.

Moreover, Seva, Flores, Gotohio, and Paras (2013), gathered data from a survey administered to 177 participants in Metro Manila, and the study aims to determine the significant variables in predicting motorcycle accidents in the Philippines, and then compare findings to those in other countries, in order to propose possible government interventions—a making of a new policy, implementation, or the like. According to the study, younger drivers are more likely to be involved in accidents. Committing violations in driving behavior also contributes to a high likelihood of accidents for motorcycle drivers, as well as driving at t- and y-junctions. In the Philippines, a unique set of variables were found to predict motorcycle accidents. At the end of their conclusion, the researchers recommended that government agencies can focus on interventions directed at these three variables.

Additionally, Seva (2017), focuses on Filipino motorcyclists' driving behaviour and the types of injury sustained in their accidents. The researcher's hypothesis was that road policy violations are more likely to predict serious injuries. By administering a survey, the researcher gathered data on the following: the accident experience and its severity, demography, driving experience, and helmet use. The study concludes that significant predictors of serious injury include

drunk driving, non-usage of helmets, and underestimating the speed of oncoming vehicles when overtaking. Results also show that drivers wearing helmets had less severe injuries because they were concentrated in the lower limbs, concluding helmets to be effective safety devices. The researcher recommends that the government consider identifying the factors that contribute to unsafe road behaviour and devise policies on the training of motorcyclists in handling their vehicles for road safety. Additionally, it was also suggested that government institutions help consolidate data on the severity of motorcycle-related injuries and profile these in hospitals for accident researchers to use. Based on the findings of Ibay, De Guzman, Escobar, Nobles, and Oliquino (2019), a total of 42, 877 persons were involved in a road accident in the National Capital Region. 962 persons or 2.24% died. Through the researchers' study mostly men are seen to have a greater risk of death than women. These findings can help the government to monitor road accidents.

As the number of vehicles increase every year in the Philippines, this results in severe traffic congestion on major roads in Metro Manila (Bondoc et al., 2018). Three major roads that are affected by traffic congestion are Circumferential Road 5 (C5 Road), EDSA, and Commonwealth Avenue. According to Ganiron Jr (2015), the rise in the total number of vehicles, travelers and commuters causes the government to have a hard time in the development of transportation. In developing countries like the Philippines, the lack of infrastructure is one of the causes of the rapid increase in motorization. Based on this study, 5.6 million out of 26.8 million registered vehicles are coming from Metro Manila as per the 2011 Department of Transportation and Communication statistical survey.

According to Rith et al. (2019), household vehicle ownership has its negative impact on private vehicle dependency towards a sustainable urban transportation system. Their study used a model in developing integrated household vehicle ownership and energy consumption in determining the factors affecting it, and found out that household income is its main factor. The authors suggest that encouraging urban densification and improvement of road public transport line density can be considered to contribute in lessening private vehicle dependency.

Additionally, Mirandilla and Regidor (2019) evaluated Transportation Network Vehicle Services (TNVS) in Metro Manila from the point of view of the drivers. The researchers included the productivity, impact on traffic, supply and profitability of TNVS in the study. The study concluded that 36,000 vehicles from 8 am to 9 am were operating every weekday. These vehicles generate 370,000 to 590,000 trips per day in Metro Manila. It was seen that while conveying minor productivity than to other modes of transportation, TNVS have the greater influence in the traffic flow.

Guno, Collera, and Agaton (2021) utilizes the application of a political, economic, social, technological, legal, and environmental (PESTLE) analysis to determine how different drivers affect the adoption of electric vehicles (EVs) in the Philippine public transport system. According to the researchers, the electrification of public utility vehicles plays a vital role in the transition towards a more sustainable transport system. However, this adoption faces challenges concerning financing issues, government policies, and public acceptance. Furthermore, results from the study's survey show that the main barriers to the complete adoption of EVs concern mostly the economy and the technological state of the country. On the other hand, the main enabler is the support of the public, backed up by policy and legal drivers. After its conclusions, the study recommends a course of action for the government; that is, to implement policies concerning public transport, including an investment in sustainable sources of energy in order to further develop the public vehicle accessibility and have a more diverse transport sector.

Moreover, the study of Gota (2014) concerns road transport fuel consumption and its correlation to the number of vehicles in the country. According to its abstract, the emissions and energy consumption has been modestly growing at a rate of 0.5% more every year, and is in contrast to the "rapid increase in vehicle numbers, economic activity and in absence of implementation of comprehensive sustainable transport policies and options" (Gota, 2014). With these data in observation, the study aims to find the correlation between fuel consumption with its bottom up qualifications in order to provide quality recommendations in the making of a road policy. In conclusion, the researchers have stated that tricycles, jeepneys and trucks are the "most sensitive modes in terms of fuel consumption" and that the Philippines will need to provide a baseline on the values and data of its fuel efficiency and travel, based on total vehicle sales. They also stated that the travel demand is growing but the country has not yet implemented baseline standards for the fuel economy nor strategies and/or policies that are aggressive.

According to Carpio (2020), some of the injuries that come with the severity of road accidents can be prevented or minimized by skilled traffic enforcers. By administering a survey to a total of 205 respondents composing of 155 commuters and 50 traffic enforcers, the researcher's two objectives were: first, to describe the perception of commuters on the capabilities of traffic enforcers in implementing road policies, and second, assess traffic enforcers in implementing said policies in terms of knowledge, skills, and attitude. The conclusion of the study states that "the commuters perceived traffic enforcers to be knowledgeable, skilled and displaying good attitude in implementing traffic rules" and that the traffic enforcers themselves were assessed to be skilled enough in their job. The researchers recommend that commuters educate themselves on road policies and traffic enforcers update their skills through seminars and training.

While, according to this Lidasan, Espada and Richmund (2011), the rapid urbanization in the Philippines gave rise to undesirable factors such as the increasing traffic congestion, and that it is further supported by "improper planning and inefficient traffic management". The researcher states that local cities do not have enough comprehension on theorizing or devising road policies, and that this job is critical to the capacity of local government units in dealing with said issues. A nationwide survey was administered to 120 cities in the country

in order to examine their needs in dealing with transport and traffic management. The study has concluded that the cities desperately need capacity building, and that even medium-sized cities are already getting affected significantly at early stages of urbanization. The researcher recommends that the government needs to establish an efficient system as quickly as possible while these road problems are still solvable and that includes programs where cities can interact and share problems with each other. The allocation of budget for necessary equipment and facilities in support of transport planning and traffic management is also suggested.

According to Bartolay (2018) even though the Philippines has extensive national laws that address the five major risk factors for safer road users, the lack of effective road policies, along with the strict enforcement that should come with it, hinders the success of the efforts and implementations made for the sake of road safety. It states that Quezon City has enacted a Road Safety Code after it had the highest number of crashes and crash-related fatalities and injuries in Metro Manila, accounting for 33,717 out of 109,322 incidents from 2010 to 2016. The code concerned assessments of road policies, redesigning, and public hearings. Within just four months, Quezon City was able to find a successful, working comprehensive ordinance. The study notes that the cities of Tuguegarao and Ormoc have been making progress on similar road policies on safety regulations after seeing what the ordinances have done for Quezon City. The researcher recommends these kinds of actions to be implemented as soon as possible and adopted at a national level to all localities.

The study of Mangahas and Medes (2019) aims to assess the coordination mechanisms and policies of the Metro Manila Development Authority (MMDA) in coordination to the LGUs of cities Mandaluyong, Makati, Taguig, and Quezon City, and then relate the findings to the government unit's traffic management and urban planning mechanisms. By comparing and contrasting the observed significant factors through interviews and utilizing three indicators in the study's framework (socio-legal, socio-technical, and socio psychological), the researchers found "inconsistencies in the traffic ordinances which are reflective to the coordinative mechanism of MMDA with the LGUs". The answers of the sample population interviewed were found varying differently from each other on factors including the presence of traffic enforcers on the major roads and the programs/road policies implemented by the units. The study concludes that the present mechanisms of MMDA in coordination with the cities' LGUs regarding traffic management and urban planning is "effective, however, still presents a weak coordinating mechanism between the two".

Moreover, Olsson (2019) analyzes the effects of road development to rural communities. The researcher has used a theoretical framework consisting of the economic opportunity coming from the road development, and the population's response to it. In observing households and/or household firms, the researcher used time-series data, a road accessibility inventory, and a multi-criteria analysis. The scope of the study was specific; it focused on a rural Philippine fishing community that had difficulties economically brought by poor transport conditions and poor accessibility to major markets. The findings of the study conclude that road improvement is greatly beneficial to the people especially those in communities like the one observed. It will also benefit a great majority of the people in agricultural sectors, specifically the fishing community, in this study. Furthermore, besides helping the people connect with the market in a more convenient way, the study also found indirect effects to the community that can be brought about by road development, namely: "abundance of harvested resource in the community; a potential for technical innovations that increased production and productivity; available investment to support this increased production; abundant demand for this increased production in the market region (the market widened in spatial terms and prices were maintained)".

According to Aydinan (2020), to protect both the lives of drivers and passengers, it is important for drivers to have adequate knowledge of road laws and regulations in order to reduce the accidents and road crashes happening on the road. Using a descriptive research method, the researcher's objective was to gain a better understanding of tricycle drivers' knowledge and level of compliance on traffic rules and regulations in the Philippines. The researcher gathered 100 tricycle driver respondents from Cabanatuan City who were randomly selected from different barangays. The findings of this study was that tricycle drivers were knowledgeable on traffic rules and regulations, however, they are lacking on its compliance. It is suggested in this study that there must be a strict implementation of existing laws and regulations on road traffic management.

Additionally, the study conducted by Ningal & Oños (2021) was to determine how motorcycle riders were educated and trained on road safety. Using a qualitative research design, they were able to choose 20 motorcycle riders to participate in their study. The results of their study showed that the most frequent traffic education they received was the examination being conducted by the Land Transportation Office which focuses on assessing their knowledge on traffic signs and symbols, social media, personal observation, and experiences. Based on their study, they highly suggest that the government should reevaluate the way they conduct traffic education among motorists.

Vardaki & Yanis (2013) focused on considering attitudes as one of the factors that affect a driver's behavior. Moreover, it recognizes the relationship between committing traffic violations and accident involvement. Using a cluster analysis in this research, they wanted to determine how a driver's behavior and attitude is related to committing traffic violations such as speeding, drink-driving, and cell phone use. The researchers were able to gather 601 Greek respondents and were able to divide them into 3 clusters: drivers that commit traffic violations more frequently, drivers who moderately favors traffic violation countermeasures in complying with traffic laws, and drivers who strictly favors traffic violation countermeasures in complying with traffic laws. The findings of the researchers' study indicated that the drivers' age, gender, and area of residence are closely related to their attitude and the

way they behave. It is recommended in this study that the drivers' view on traffic violations may be addressed through informing, educating, and raising awareness to the public.

Zhang, Yau, and Chen (2013) conducted a study about vehicle volume and its association with traffic accidents as the leading cause of death in China. The researchers analyzed the traffic accident data from 2006 to 2010 in Guangdong Province, China with a sample size of less than 7000 per year. They focused on two variables which are traffic violations and accident severity while considering factors such as human, vehicle, road, and environmental risks. The researchers were able to determine that traffic violations are one of the major threats to road safety. They were also able to find other risk factors closely related to traffic violations and accident severity such as different vehicle types and driver groups. Based on the results of their study, the researchers suggest that programs must be conducted for driver groups, there must be strict enforcement on traffic regulations, and there's a need for improvement on road and transportation facilities.

Shell et al. (2015) conducted a study in Nebraska about teens who procured their intermediate level Provisional Operator's Permit (POP) with and without driver education. They tested its relationship with committing traffic violations and road crash involvement through descriptive epidemiological approach wherein 151,880 teens were involved from 2003 to 2010. The result of their study showed that teens with driver education were less likely to be involved in road crashes and commit traffic violations compared to teens who obtained their POP without driver education during their first two years of driving. They concluded that driver education is really important among teens who are first time drivers.

Additionally, Wang, Mu, and Cui (2021) performed a study on how breaking from driving between driver education and car ownership are relatively related to committing traffic violations. They were able to get the data from Wuhan Traffic Management Bureau wherein 356,786 drivers committed a total of 978,855 traffic violations during their first year of driving. The result of their study was that breaking from driving is significantly related to committing traffic violations, however, as time passes, its severity reduces. Their study also found that breaking from driving is also associated with the increase in traffic violations and this was evident in older drivers. Their study supports that driver education is important, however, as time passes, it will fade over time if driving knowledge and skills is not put into practice.

Another study involving the youth was conducted by Joewono & Susilo (2016) in the urban roads of Indonesia about their traffic violation behaviors and the type of traffic violations they committed. The goal of their study was to analyze the relationship between the influencing factors with regards to committing traffic violations, the characteristics of young motorcyclists, and the types of violations. They were able to collate data from three major cities through a questionnaire survey. Their analysis revealed that young motorcyclists were influenced by different influencing factors compared to more mature motorcyclists. Based on the results of their study, they suggest that there is a need to create a specialized behavioral change policy to avoid committing traffic violations among young motorcyclists.

Metro Manila is home to millions of residents and workers who commute daily because of their jobs. Metro Manila comprises only three transit lines which are Light Trail Transit 1, LRT-2, Metro Rail Transit Line 3 or MRT-3, and the PNR or Philippine National Railway. Accordingly, with only three transit lines serving millions of people on a daily basis, the trains are seemingly overused. Due to the over usage of the trains, it resulted to the malfunction and service interruptions among the transit lines, specifically yielding to about 30% up to 40% drop in the transit lines of LRT-1 and MRT-3 in 2015, according to JICA 2018, as cited by Chen, Co Go and Jiang (2021).

Metro Manila is classified as one of the densest cities worldwide, ranking 18th among the most populated cities in the world in accordance with the study done by the United Nations. The city is made up of 13,131,000 people in 2016 and is expected to grow by another 3,000,000 by 2030. As the city comprises three transit lines that work along with other public transportations, the growing population and demand for public transport is yet to be solved. On a daily basis, an average of 18 million trips are made in Metro Manila alone, of which are distributed to 70% trips by public transport –of which 39% are through jeepneys, 14% by bus, and 9% by rail. The remaining 30% are those who travel through private vehicles. This results in congestion and heavy traffic, making the average travel time to 90-150 minutes Dalumpines (2017).

In 2015, the Megatren was proposed in order to suffice the needs and growing demands of commuters. In accordance with the research done by Ganiron (2015), the Metro Rail Transit – 2 can cater 200,000 people on trips daily, which is significantly below its expected capacity ranging from 570,000 to 580,000 average commuters daily. As a result, the Megatren was proposed, with higher passenger capacity, that can cater the growing problem with the daily transport of commuters in the Metro.

The established body of transportation policy research culminated in new policy science approaches and studies against which potential measures for a more sustainable transport system has been of considerable interest to practitioners. Most studies conducted in the Philippines revolve around behaviors of transportation stakeholders (e.g., Seva et al., 2013; Guilllen et al., 2013; Seva, 2017; Tabuñar, 2020; Abad & Fillone; 2020). Relatively little research has taken place into understanding public transport policies in the Philippines and the challenges in its implementation, thus this paper identified challenges in the implementation of public transportation policies in Metro Manila.

Mitigation of road accidents and traffic violators has long been a common core transport policy objective because of its byproduct that impedes the economy. The Philippines lacks effective road policies and strict enforcement. Strict implementation of existing laws should be applied for all ages, may it be new drivers with few experience or expert drivers with already years of experience. There were inconsistencies in the traffic ordinances between MMDA and LGUs that hindered

successful implementation of road safety. Majority of road crash incidents in the Philippines are caused by human behaviors, drunk driving being the most frequent road policy violation. A study from Seva (2017) focused on Filipino motorcyclists and found that significant predictors of serious injury include drunk driving, and identified a helmet as an effective safety device.

Metro Manila has been classified as one of the densest cities worldwide which comprises millions of residents and workers who commute daily. In Metro Manila alone on a daily basis, 9% trips are made by train and considering Metro Manila has only three transit lines, trains are overcrowded and overused. A yearly increase in vehicles in the Philippines, together with travelers and commuters, causes severe traffic congestion in Metro Manila. In addition to that, the increase gives the Philippine government difficulty in the development of transportation.

Communication and coordination among stakeholders (e.g., transport users, providers and regulators) is crucial for an effective regulation as well as the relationship between sustainable transportation, infrastructure planning and implementation (Sand, 2012; Xu et al., 2017). Hence providing effective implementation of transportation policies necessitates a well-functioning and well-integrated urban economy.

3. Method

The research design used was quantitative in nature. Specifically, it was descriptive research utilizing secondary data. The study gathered statistics and quantitative data to make an analysis that described the sample population observed. This design was chosen because like the study *A comprehension-based ergonomic redesign of Philippine road warning signs* by Bañares, Caballesa, Serdana, Liggayua, & Bongo (2018), the researchers believed that the best way to visualize the results concluded from the study would be to describe the sample with the use of numbers and values, just like how the researchers of the cited study concluded that the population needed a much more updated road sign system by observing percentages in drivers who actually comprehended the signs. This was the most efficient design for a study that aims to describe the challenges in the implementation of road public transport policies.

The study focused on the following: (a) commuters or people who are heavily dependent on road-based public transport modes for their mobility (b) motorists (c) public and private vehicle drivers and (d) traffic enforcers. The study ensured equal and enough representation for the whole population. These were people who had first-hand experience of the challenges on road based public transport as well as the challenges in the implementation of road public transport policies.

The study was regional, spanning the perimeter of Metro Manila only. There were no other factors, such as social sectors, that define the locality of the research; it was exclusively a city-wide study. The study covered a period of observation within 12 months. This was significant to the study as the researchers require the information to be as updated and recent as possible.

The researchers aimed to formulate an empirical model that can be used in determining the relationship between road public transport policies and challenges on the road in Metro Manila which are: Vehicle Sales, Railway Commuters, Traffic Violators, and Road Crash Incidents.

The researchers used secondary data from Metro Manila. They used the data from the websites of Metropolitan Manila Development Authority, National QuickStat of the Philippine Statistics Authority, and Department of Transportation.

The study utilized secondary data for its specified independent variables. The data needed such as the Vehicle Sales, Railway Commuters, Traffic Violators, and Road Crash Incidents were requested through the Electric Freedom of Information Digital (eFOI) that could be found in Metropolitan Manila Development Authority's (MMDA) website. The eFOI is an online platform for Filipino citizens and agencies to facilitate requests for Information. The researchers also used datas from the websites of the National Quickstat of the Philippine Statistics Authority (PSA) and Department of Transportation (DOTr). Lastly, the number of monthly road crash incidents was readily available and can be accessed from the MMDA website.

Road policies exist for the sake of the safety of everyone in and off the road which was reinforced by the law. This is a customary practice that has an equivalent fine if not performed. These policies can be about the speed, lighting, traffic signals, or driving of a person. Some of the policies include obedience to traffic signals, no illegal parking/waiting in prohibited areas, no drunk driving, proper seat belts, and right speed in different areas. The effectiveness of these road policies can be measured by getting the data needed which is the number of accidents, offenses, and fatalities in the specific city at a specific month of implementation. After getting the number of these cases, the mean, standard deviation, minimum, and maximum value of the data will be computed and used for the study's analysis.

The researchers used multivariate multiple regression analysis as a method to test the hypotheses of this study. This was used to decide the relationship between their dependent variables and independent variables.

The empirical models proposed by the researchers to determine the relationship between their dependent variables and independent variable are as follows:

$$Vehicle\ Sales = \beta_0 + \beta_1 Traffic\ Violators + \beta_2 Road\ Crash + \varepsilon$$
$$Railway\ Commuters = \beta_0 + \beta_1 Traffic\ Violators + \beta_2 Road\ Crash + \varepsilon\backslash$$

4. Results and Discussion

The correlation between Vehicle Sales and traffic violators is 0.8001 meaning the variables have a fairly strong positive relationship. While the correlation between road crash and vehicle at 0.3898 and the correlation between Road crash and traffic violators is at 0.1683, they both have a weak positive relationship.

Table 1
Correlation coefficients, using the observations 2018:02 - 2020:12
5% critical value (two-tailed) = 0.3338 for n = 35

Vehicle Sales	Traffic Violators	d_Road Crash	
1.0000	0.8001	0.3898	Vehicle Sales
	1.0000	0.1683	Traffic Violators
		1.0000	d_Road Crash

The OLS output is significant since statistically, both constant and traffic violators are significant to Vehicle Sales at .01 alpha. As the number of traffic violators increases, Vehicle sales also increases by 50.2%. The first difference of road crash is also significant to Vehicle sales at .05 alpha. As road crashes increase, vehicle sales also increase by 19.5%. The Durbin-Watson is at 1.017302 which means there is no autocorrelation error therefore we proceed.

Table 2
Model 9: OLS, using observations 2018:02-2020:12 (T = 35)
Dependent variable: Vehicle Sales

	Coefficient	Std. Error	t-ratio	p-value	
Const.	10718.3	2291.08	4.678	<0.0001	***
Traffic Violators	0.501635	0.0644008	7.789	<0.0001	***
d_Road Crash	1.95367	0.722224	2.705	0.0109	**

Mean dependent var	27127.69	S.D. dependent var	8650.846
Sum squared resid	7.45e+08	S.E. of regression	4825.473
R-squared	0.707158	Adjusted R-squared	0.688855
F(2, 32)	38.63692	P-value(F)	2.93e-09
Log-likelihood	−344.9529	Akaike criterion	695.9058
Schwarz criterion	700.5718	Hannan-Quinn	697.5165
rho	0.487677	Durbin-Watson	1.017302

The Heteroskedasticity is at 0.300398 which is superior to .05 alpha, we then accept the null hypothesis that there is no heteroskedasticity.

```
   coefficient      std. error      t-ratio    p-value
  --------------------------------------------------------
  const            3.57474e+07     2.39419e+07   1.493    0.1462
  TrafficViolators    79.2854      1769.73       0.04480  0.9646
  d_RoadCrash      17327.8        12034.4        1.440    0.1606
  sq_TrafficViolat~   -0.0153978   0.0320593    -0.4803   0.6346
  X2_X3               -0.373624    0.360586     -1.036    0.3087
  sq_d_RoadCrash       2.77438     3.05877       0.9070   0.3719

  Unadjusted R-squared = 0.173151

  Test statistic: TR^2 = 6.060275,
  with p-value = P(Chi-square(5) > 6.060275) = 0.300398
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The p value of Normality of Residuals is 0.381727, we accept the null hypothesis which means residuals are normally distributed.

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    interval        midpt   frequency    rel.     cum.

       < -7983.6   -9747.8      1       2.86%    2.86% *
  -7983.6 - -4455.2 -6219.4     5      14.29%   17.14% *****
  -4455.2 - -926.78 -2691.0     8      22.86%   40.00% *******
  -926.78 - 2601.6   837.43    13      37.14%   77.14% *************
   2601.6 - 6130.0  4365.8      6      17.14%   94.29% ******
   6130.0 - 9658.5  7894.2      0       0.00%   94.29%
        >= 9658.5  11423.       2       5.71%  100.00% **

Test for null hypothesis of normal distribution:
     Chi-square(2) = 1.926 with p-value 0.38173
```
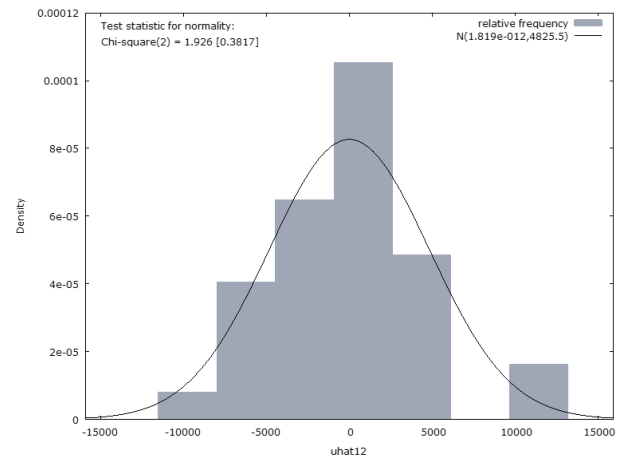

Fig. 1. Test statistic for normality

For the Structural stability test, p value is 0.2036 which is greater than alpha. We accept the null hypothesis indicating there is no breakpoint from 2018-2020.

```
Augmented regression for Chow test
OLS, using observations 2018:02-2020:12 (T = 35)
Dependent variable: VehicleSales

                  coefficient   std. error   t-ratio   p-value
  -------------------------------------------------------------
  const            24096.7      9172.65       2.627    0.0136  **
  TrafficViolators   0.151685   0.227727      0.6661   0.5106
  d_RoadCrash        2.78074    1.76017       1.580    0.1250
  splitdum        -15217.2      9475.47      -1.606    0.1191
  sd_TrafficViolat~  0.435971   0.240631      1.812    0.0804  *
  sd_d_RoadCrash    -1.22564    1.92359      -0.6372   0.5290

  Mean dependent var  27127.69   S.D. dependent var   8650.846
  Sum squared resid   6.38e+08   S.E. of regression   4688.598
  R-squared           0.749454   Adjusted R-squared   0.706256
  F(5, 29)           17.34942    P-value(F)            6.05e-08
  Log-likelihood   -342.2230     Akaike criterion    696.4461
  Schwarz criterion 705.7782     Hannan-Quinn        699.6675
  rho                 0.456802   Durbin-Watson         1.061448

Chow test for structural break at observation 2019:07
  F(3, 29) = 1.63188 with p-value 0.2036
```

Lastly, the Specification error for squares and cubes is at 0.109 which is greater than alpha indicating there is no specification error and the specification of the model is correct. The specification error for squares only is at 0.038 and for cubes only at 0.0341 which is less both than the alpha indicating a specification error.

```
RESET test for specification (squares and cubes)
Test statistic: F = 2.392099,
with p-value = P(F(2,30) > 2.3921) = 0.109

RESET test for specification (squares only)
Test statistic: F = 4.695514,
with p-value = P(F(1,31) > 4.69551) = 0.038

RESET test for specification (cubes only)
Test statistic: F = 4.912130,
with p-value = P(F(1,31) > 4.91213) = 0.0341
```

During the twentieth century, private vehicle ownership had a significant increase, making most in Metro Manila struggle with traffic that led to negative effects such as increased frustration, tardiness, stress and most especially road traffic accidents (Ganiron, 2015). According to Pan, F., Yang, Y., Zhang, L., Ma, C., Yang, J., & Zhang, X., 2020; Agustin, I. W.,

Table 3
Number of traffic accident, casualties, and material losses, 2015-2019

Description	2015	2016	2017	2018	2019	Annually Increase (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Number of accident (Case)	96 233	106 644	104 327	109 215	166 411	4,87
Killed (Person)	24 275	31 262	30 694	29 472	25 671	1,41
Seriously injured (person)	22 454	20 075	14 559	13 315	12 475	-13,67
Slight injured (person)	107 743	120 532	121 575	130 571	137 342	6,26
Material loss (million rupiahs)	215 892	229 137	217 031	213 866	254 779	4,23

Source: Indonesia State Police

2019; Suhardi, B., Ishartomo, F., & Mohd Rohani, J., 2021, the increase in vehicles is related to the increase in the number of violations which are the beginning of traffic accidents. Like the Philippines, Indonesia is one of the emerging market economies of the world. The city of Surabaya located in Indonesia is considered one of the cities with increasing motorized vehicle users every year. With the large number of vehicles also comes with a large number of accidents, since 2015 to 2019 it has been recorded to have an annually increasing number of accidents by 4.87% (Agustin, I. W., 2019; Suhardi, B., Ishartomo, F., & Mohd Rohani, J., 2021).

The collinearity with a condition index of 24.304 indicates we can proceed with the rest of the tests.

```
Belsley-Kuh-Welsch collinearity diagnostics:

  variance proportions

  lambda     cond     const RailwayC~ TrafficV~ RoadCrash
   3.862    1.000     0.003    0.001    0.002     0.001
   0.114    5.814     0.281    0.055    0.008     0.000
   0.017   14.946     0.057    0.270    0.961     0.027
   0.007   24.304     0.659    0.673    0.029     0.972

lambda = eigenvalues of inverse covariance matrix (smallest is 0.00653822)
cond   = condition index
note: variance proportions columns sum to 1.0

According to BKW, cond >= 30 indicates "strong" near linear dependence,
and cond between 10 and 30 "moderately strong".  Parameter estimates whose
variance is mostly associated with problematic cond values may themselves
be considered problematic.

Count of condition indices >= 30: 0

Count of condition indices >= 10: 2
Variance proportions >= 0.5 associated with cond >= 10:

    const RailwayC~ TrafficV~ RoadCrash
    0.716     0.943    0.991     0.999
```

The correlation between railway commuters and traffic violators is 0.8896 which means they have a fairly strong positive relationship. The correlation of road crash and railway commuters is 0.9410 meaning a fairly strong positive relationship. The correlation between road crash and traffic violators also shows a fairly strong positive relationship at 0.8880.

Table 4
Correlation coefficients, using the observations 2018:01 - 2020:12
5% critical value (two-tailed) = 0.3291 for n = 36

Railway Commuters	Traffic Violators	Road Crash	
1.0000	0.8896	0.9410	Railway Commuters
	1.0000	0.8880	TrafficViolators
		1.0000	RoadCrash

Moving onto the OLS output, statistically both constant and road crash are significant to railway commuters at .01 alpha. While traffic violators are significant to railway commuters at .05 alpha. For every increase in the number of traffic violators,

railway commuters also increase by 103.724. On the other hand, as road crashes increase, railway commuters also increase by 1683.77. This indicates that growth in traffic violators and road accidents discourage commuters to take vehicular mobility and instead increase railway transportation. The p-value of Durbin-Watson is 1.035964 indicating no autocorrelation error thus we proceed.

Table 5
Model 14: OLS, using observations 2018:01-2020:12 (T = 36)
Dependent variable: Railway Commuters

	Coefficient	Std. Error	t-ratio	p-value	
const	−4.92797e+06	956476	−5.152	<0.0001	***
Traffic Violators	103.724	48.7680	2.127	0.0410	**
Road Crash	1683.77	283.365	5.942	<0.0001	***

Mean dependent var	10199397	S.D. dependent var	5225713
Sum squared resid	9.63e+13	S.E. of regression	1708437
R-squared	0.899225	Adjusted R-squared	0.893117
F(2, 33)	147.2311	P-value(F)	3.59e-17
Log-likelihood	−566.1548	Akaike criterion	1138.310
Schwarz criterion	1143.060	Hannan-Quinn	1139.968
rho	0.419213	Durbin-Watson	1.035964

The p-value of Heteroskedasticity is 0.406466 which is greater than alpha, we accept the null hypothesis that there is no heteroskedasticity.

```
White's test for heteroskedasticity
OLS, using observations 2018:01-2020:12 (T = 36)
Dependent variable: uhat^2

                  coefficient     std. error    t-ratio  p-value
  ------------------------------------------------------------------
  const            1.17384e+013   5.07206e+012   2.314   0.0277  **
  TrafficViolators 3.35504e+08    3.89234e+08    0.8620  0.3955
  RoadCrash       -4.28746e+09    3.31072e+09   -1.295   0.2052
  sq_TrafficViolat~ -7266.06      13187.4       -0.5510  0.5857
  X2_X3            26532.9        121094         0.2191  0.8280
  sq_RoadCrash     226043         406738         0.5557  0.5825

  Unadjusted R-squared = 0.141048

Test statistic: TR^2 = 5.077744,
with p-value = P(Chi-square(5) > 5.077744) = 0.406466
```

The normality of residuals is 0.669736, we accept the null hypothesis that the residuals are normally distributed.

```
Frequency distribution for uhat14, obs 1-36
number of bins = 7, mean = 7.76102e-010, sd = 1.70844e+006

   interval          midpt    frequency   rel.    cum.

        < -2.702e+006  -3.263e+006    2     5.56%    5.56% *
  -2.702e+006 - -1.580e+006  -2.141e+006    4    11.11%   16.67% ***
  -1.580e+006 - -4.577e+005  -1.019e+006    8    22.22%   38.89% *******
  -4.577e+005 -  6.642e+005   1.033e+005   11    30.56%   69.44% ***********
   6.642e+005 -  1.786e+006   1.225e+006    5    13.89%   83.33% *****
   1.786e+006 -  2.908e+006   2.347e+006    4    11.11%   94.44% ***
        >=  2.908e+006   3.469e+006    2     5.56%  100.00% *

Test for null hypothesis of normal distribution:

Chi-square(2) = 0.802 with p-value 0.66974
```
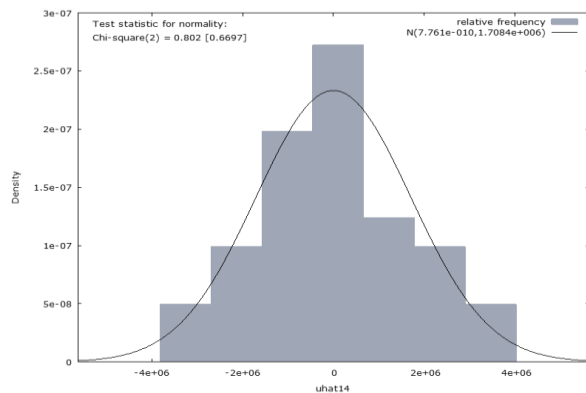
Fig. 2. Test statistic for normality

For the structural stability test, the p-value is 0.0068 which is less than the alpha. We reject the null hypothesis, there is a structural break that exists in the data.

```
Augmented regression for Chow test
OLS, using observations 2018:01-2020:12 (T = 36)
Dependent variable: RailwayCommuters

                   coefficient    std. error    t-ratio  p-value
  ---------------------------------------------------------------
  const             3.04687e+06   7.16574e+06    0.4252   0.6737
  TrafficViolators  72.8498       71.6158        1.017    0.3172
  RoadCrash         959.484       881.378        1.089    0.2850
  splitdum         -7.26179e+06   7.21732e+06   -1.006    0.3224
  sd_TrafficViolat~ 21.4055       88.8006        0.2411   0.8112
  sd_RoadCrash      520.227       930.433        0.5591   0.5802

Mean dependent var  10199397    S.D. dependent var   5225713
Sum squared resid   6.46e+13    S.E. of regression   1467723
R-squared           0.932384    Adjusted R-squared   0.921115
F(5, 30)            82.73627    P-value(F)           1.26e-16
Log-likelihood     -558.9720    Akaike criterion     1129.944
Schwarz criterion   1139.445    Hannan-Quinn         1133.260
rho                 0.309211    Durbin-Watson        1.300169

Chow test for structural break at observation 2019:06
  F(3, 30) = 4.90399 with p-value 0.0068
```

Lastly, the specification error for squares and cubes is 0.000217 indicating a specification error for it is less than the alpha. The p-value for squares only is 0.085 and for cubes only is 0.453 indicating both have no specification error since both p-value is greater than alpha.

```
RESET test for specification (squares and cubes)
Test statistic: F = 11.212865,
with p-value = P(F(2,31) > 11.2129) = 0.000217

RESET test for specification (squares only)
Test statistic: F = 3.159887,
with p-value = P(F(1,32) > 3.15989) = 0.085

RESET test for specification (cubes only)
Test statistic: F = 0.576929,
with p-value = P(F(1,32) > 0.576929) = 0.453
```

Rail travel appears to be convenient and sustainable compared to other alternative travel modes as well as an appropriate solution to relieve traffic congestion (Li, L., Wang, S., Li, M., & Tan, J., 2018; Irawan, M. Z., Putri, M. K., Belgiawan, P. F., & Dwitasari, R., 2017; More, S. S., Pathak, G., Panchal, S., & Patil, M., 2021). According to Ganiron (2015), the primary reason for usage of MRT 2 in Metro Manila is due to its considerably faster transportation than public utility

vehicles and it takes less time for commuters to get to their destination since they can avoid traffic jams and obstacles below the ground. Since traffic congestion can affect the occurrence of road accidents (Retallack, A. E., & Ostendorf, B., 2019), the mass rail system encourages commuters into their mode of transportation for a safer travel.
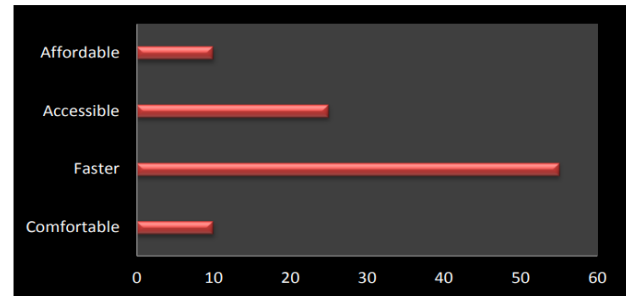

Fig. 3. Reasons for commuting MRT
Source: Ganiron Jr, T. U. (2015). The Influence of Megatren System on Ridership in Metro Manila

5. Conclusion and Recommendation

This research aims to identify various challenges faced by the implementation of road policies in Metro Manila. Using the secondary data provided by Philippine government agencies such as the Metropolitan Manila Development Authority (MMDA), National QuicksStat of the Philippine Statistics Authority (PSA), and Department of Transportation (DOTr), and using a multivariate multiple regression analysis approach to run the data collated, this research found that there is a significant relationship between the challenges on the road and transport policies.

The following are challenges on the road and in the implementation of road laws and regulations, these were identified using the dependent (vehicle sales and railway commuters) and independent variables (traffic violators and road crash). Drivers don't have adequate knowledge of road laws and regulations, and even if they had, they do not comply with it. A study found inconsistencies with traffic ordinances of MMDA and LGUs, this implies there is a lack of integrated and coordinated transport network. Lacking a safe transport system wherein there are inadequate safe roadsides, safe speeds, safe vehicles so that addressing it can reduce fatal crashes and serious injuries. Transport supply doesn't meet the growing demand of commuters most especially railway commuters. With only three transit lines in Metro Manila, it does not meet all of the needs of daily commuters. Lastly, there is limited investment in transport infrastructure and equipment which can greatly help in the further development of infrastructure as well as in acquiring data.
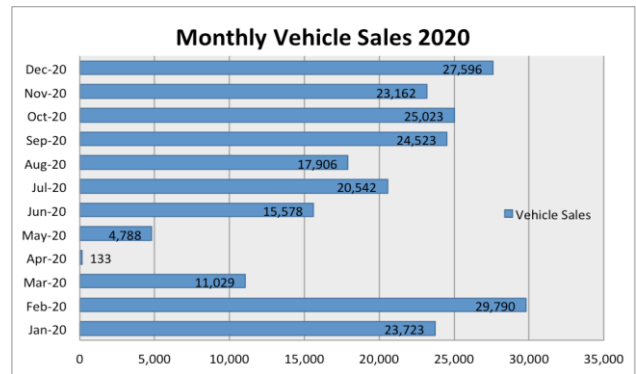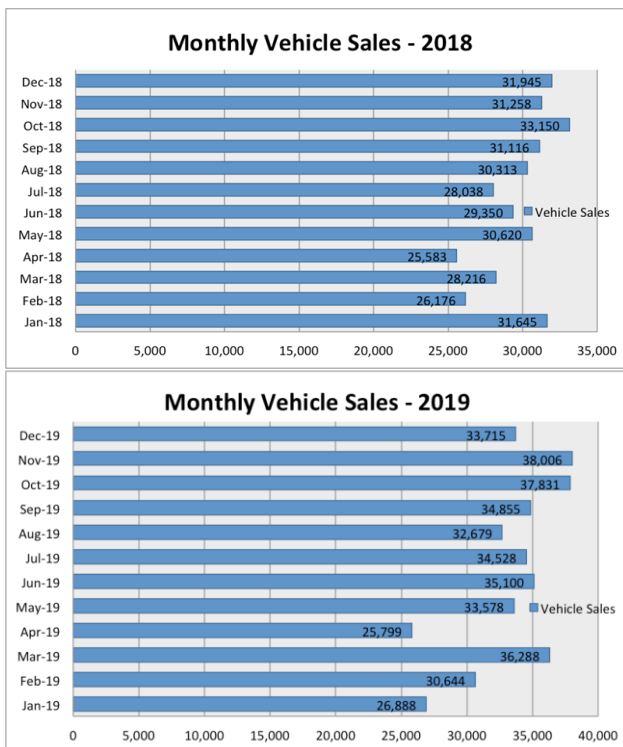
As a study that aims to contribute to resolving real-world issues, the findings and conclusions of this study shall be available for utilization by government individuals and future researchers alike to assist in solving current problems on road policy implementation. Socio Economic issues that can be cleared up include, first and foremost, the initiative of the public to follow such policies. As a result of flawed road policy implementation, many events arise that make impacts not only

socially but also economically. One of these is the overall productivity of the Filipino public. As roads become clogged or as the traffic crisis remains as bothersome as it is today, more and more people get higher probabilities to turn up late to work or to school. Many people also consider the amount of traffic in their daily itineraries, reducing the number of duties to be done in a day when compared to a situation where road policies are correctly implemented and followed. The flawed road policy implementation also affects social norms as it slowly becomes a normal situation for everyone, whilst successfully staying to be the unsolved obstacle it truly is. While enforcers stay lax and people stay undisciplined, implementing more road policies would not do anything to contribute to the issue at all.

By addressing the numerous problems and challenges faced by the implementations of road policies, the findings of this study shall provide an educated analysis that can help many officials in the country. This can fix the current issues that the Filipino public face today, not only on the road itself but also all other external factors that the people may not even realize to be related to the amount of inefficiency within the current road systems. The research findings can and may support any existing policy or project of the government that concerns road policies, and how the people follow such policies. It may also support the implementation of any future road policies. The findings of the study have the purpose of contributing for the action and implementation plans of the officials so that existing and succeeding policies alike can be enforced better, and thus encourage the public to pursue a more diligent metropolitan system.
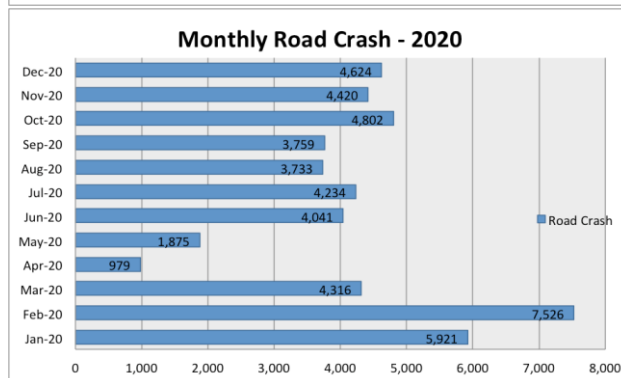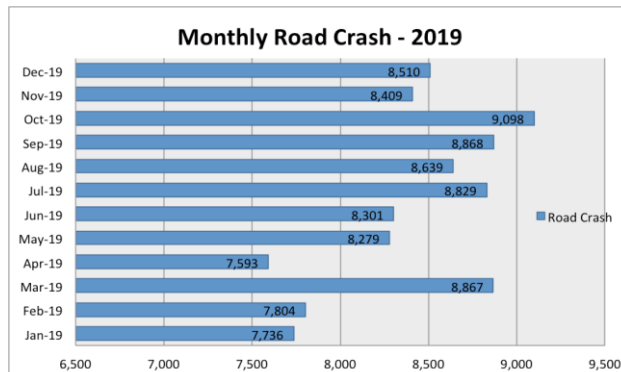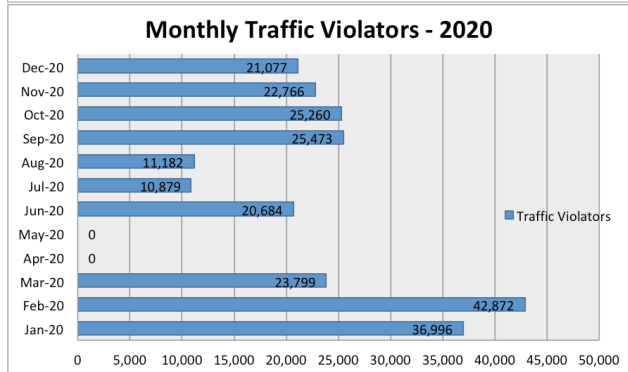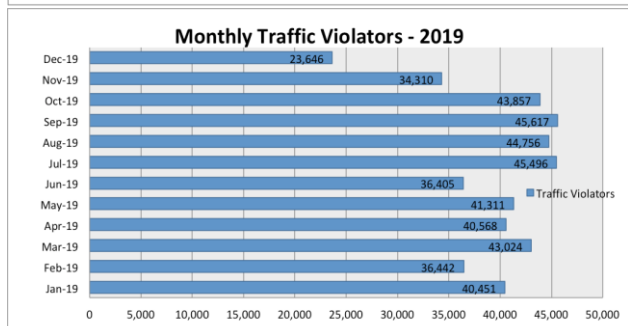
APPENDIX

Appendix A

Monthly Vehicle Sales - 2018

Monthly Vehicle Sales - 2019

Monthly Vehicle Sales 2020

Appendix B

Monthly Railway Commuters - 2018

Monthly Railway Commuters - 2019

Monthly Railway Commuters - 2020
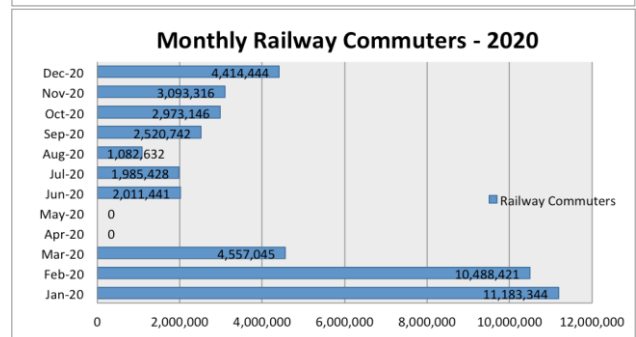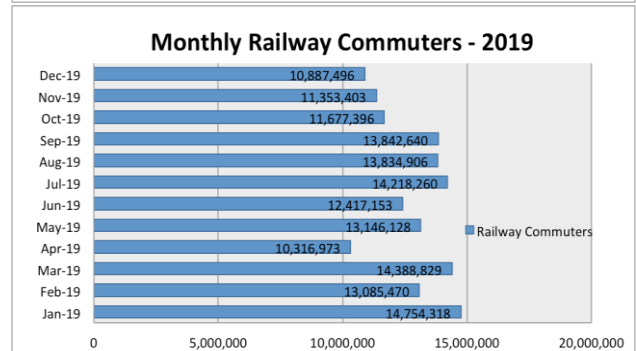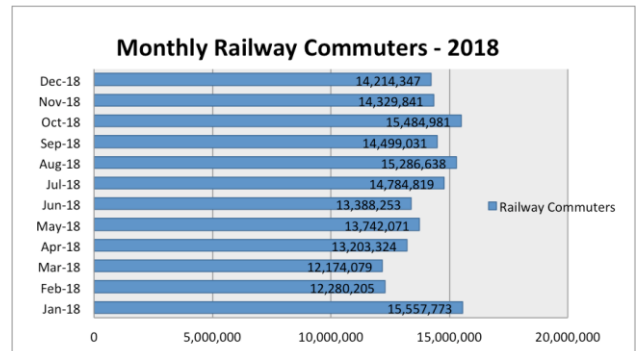
National QuickStat - Philippine Statistics Authority (PSA) & Department of Transportation (DOTr)

Appendix C

Monthly Traffic Violators - 2018

Monthly Traffic Violators - 2019

Monthly Traffic Violators - 2020

Appendix D

Monthly Road Crash - 2018

Monthly Road Crash - 2019
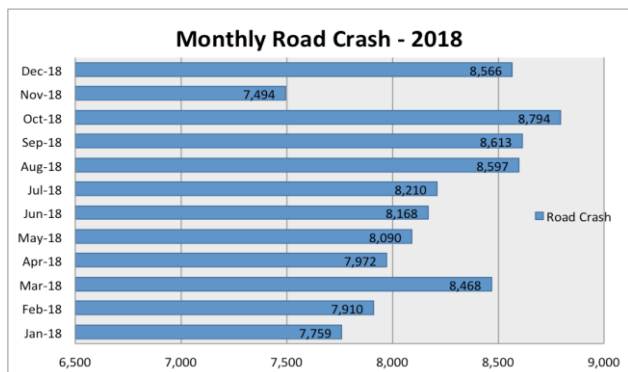

Monthly Road Crash - 2020
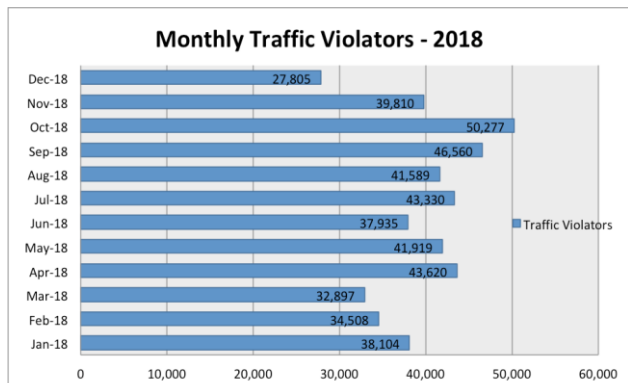
Freedom of Information (eFOI) - Metropolitan Manila Development Authority (MMDA)

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