

Urban Traffic: Does Renting Eases Up Congestion?

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Chapter 1: Introduction

Background

As citizens of NCR or most commonly called Metro Manila, we know how problematic the daily traffic impacts our convenience, health and performance towards work. Imagine spending a total of 4-6 hours of your time in a day just traveling to work or school, which leaves you with only 18-20 hrs. Assuming you work or study for 9 hrs and your body needs 8 hrs of rest, then you only have 1-3 hrs remaining to be split between family and yourself.

The trouble with traffic congestion is not just the time it takes, but the time it takes away. It is about the minutes wasted, and moments missed. Moments that could have been spent with friends and family. Memories that could have been made. The tragedy of traffic is not the journey delayed, but the life deferred. (Pangalangan, R.A., 2023)

Heavy traffic also means that there are lots of vehicles congesting the road. It occurs when a massive number of motor vehicles are occupying roads that only permit a number of vehicles at a time.

According to a JICA report, the traffic volume in Metro Manila is expected to increase by a factor of 1.46 from 2018 to 2040. The annual growth rate in this case is 1.73%



Fig 1. Metro Manila traffic. From OneNews.ph

Review of Related Literature

Traveling around Metro Manila is not as easy compared to first-world countries such as Canada, USA and Singapore where travel time within the metro can be computed as public transport is seamless. Using online map apps such as Google Maps could also teach you how to go to the destination with corresponding ETA that are 85-90% accurate. It differs so much in the Philippines, even in Metro Manila.

Public Transportation in Manila

According to JICA, the demand for public transit in Manila will likely reach 7.4 million passengers per day by 2030. In comparison with 1996, travel demand within MM showed an increase in the number of trips by car by 15%, whereas trips by public transport declined by 7%. (Korchagina, Y., 2017)

The high increase of car trips can be explained by higher car ownership as well as decline in car occupancy from 2.5 to 1.7 persons per car. Similar decline in vehicle occupancy has been observed in jeepneys (from 15.1 to 10) and buses (from 46.5 to 35.3 passengers). As a result, we have a higher quantity of trips per person and lower vehicle occupancy which affects further deterioration of the situation on the already congested roads. (NEDA, JICA Final Report, 2014)

Main Transport Types

- **Personal Car**

Cars provide flexibility and freedom that people really value and want. It is more convenient and efficient than (if not on traffic) buses or trains, and they provide a level of privacy that is not available when using public transportation.



Fig 2. Usual cars in Metro Manila. From Google

- **Motorcycle**

Motorcycles or popularly called 'single' provides flexibility and mobility which are very important aspects why Filipinos love motorcycles. This form of transportation was accepted by many people because of its ability to take passengers to their door steps, maneuver their way through traffic congestion. Nowadays, there are MC taxis like Angkas and Joyride competing with Grab (equivalent of Uber), making transportation cheaper and easier than before for point to point travel.



Fig 3. Usual type of motorcycles in NCR. Source: Google

- **MRT / LRT**

LRT Line 1 (LRT-1), also called the Green Line (formerly Yellow Line), opened in 1984 and travels a north–south route. MRT Line 2 (MRT-2), the Blue Line (formerly Purple Line), was completed in 2004 and runs east–west. Then came the Line 2 of LRT where MRT became Line 3, and many lines were being constructed like the MRT-7 and the subway, etc.

The electric-powered trains are essential components of the public transportation network in the Philippines. These provide a faster, efficient, and affordable way for commuters to navigate Metro Manila and its surrounding cities.

The issue with these trains is that during rush hour the queue lines go as long as an hour or more before you can ride on it, and what's worse you'll be standing with almost no gaps with other passengers.



Fig 4. MRT and LRT side-by-side. Source: Google

- **Bus**

Bus travel is a cheap and popular way of traveling around the Philippines. It carries a lot of passengers, and it was very fast when there's no traffic during the pre-pandemic as most drivers drive like racers.

Starting 2020, an exclusive lane (with barricade) was given to these city buses to make it express and also to reduce accidents as there are lots of accident cases in EDSA caused by these buses.



Fig 5. City bus in EDSA. Source: Google

- **FX/UV Express**

UV Express which is formerly known as FX, Metered Taxi, and GT Express is a license to operate utility vehicles, particularly vans, as an alternative mode of public transportation in the Philippines. It became a popular term for the public utility vehicles as shown below.

Compared to buses, this is preferable by commuters as it is much safer and more like express but the downside is the queue lines are long during rush hour due to the limited capacity. A new law is being passed down to modernize jeepneys and old uv express vehicles as shown below.



Fig 6. Old UV Express and Fig 7. Modernized UV Express . Source: Google

- **Jeepney**

Jeepneys, usually called jeeps, are minibus-like public utility vehicles, serving as the most popular means of public transportation in the Philippines. It is open and fast, usually 9-10 seaters for the regular jeeps. It is also the cheapest for long distance travel, but the comfort is a bit compromised as there's no air-conditioning and passengers get wet during rainy seasons, and also the very loud sound from the sound system by the young drivers.



Fig 8. Traditional jeepney. Source: Google

- **Walking**

Walking is becoming more and more of a means of transportation which has both direct and indirect benefits to your health. This only applies to short-distance like less than a kilometer. Usually, office workers rent an apartment or condominiums and just walk to work.

Just 30 minutes every day can increase cardiovascular fitness, strengthen bones, reduce excess body fat, and boost muscle power and endurance. It can also reduce your risk of developing conditions such as heart disease, type 2 diabetes, osteoporosis and some cancers.

Boarding / House Rentals

Boarding houses provide accommodation for a fee. Usually a resident only has a right to occupy a room and share other facilities such as a kitchen and bathroom, they do not have the same rights as tenants.

These days, lots of apartments and condominiums are for rent, and you get to occupy the whole place without limitations. Of course, the price differs from bed spaces and boarding houses as you are renting the whole place.

For convenience, people buy or rent condos or townhouses instead of going back and forth, especially those who do not live in the city.

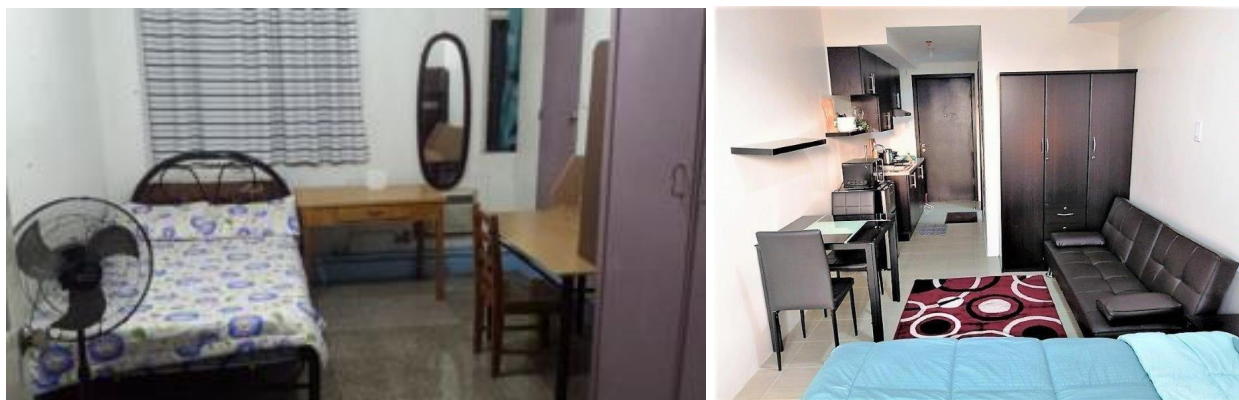


Fig 9. Boarding House and Fig 10. Studio-type Condo . Source: Google

UVVRP

The Unified Vehicular Volume Reduction Program (UVVRP), more commonly known as the 'number coding' scheme was originally developed as a short-term travel demand management measure for Metro Manila in light of on-going construction of transportation infrastructure projects in the 1990's. (Regidor, J., 2012)

Table 1 – Evolution of the UVVRP

Year	Evolution of the scheme
1995	Odd-Even Scheme – for private vehicles with less than 3 passengers; major roads only; <u>7:00-9:00 AM and 5:00 – 7:00 PM</u> (Odd – banned T, Th, Sa; Even – banned M, W, F)
FEB 1996	Modified Odd-Even Scheme – included public transport and trucks (Banned: M-1,2; T-3,4; W-5,6; Th-7,8; F-9,0)
JUN 1996	UVVRP – all roads, <u>7:00 A.M. – 7:00 P.M.</u> but not including public transport (Banned: M-1,2; T-3,4; W-5,6; Th-7,8; F-9,0)
2003	Modified UVVRP – <u>window = 10:00 A.M. – 3:00 P.M.</u> (Banned: M-1,2; T-3,4; W-5,6; Th-7,8; F-9,0)
2010	Modified UVVRP including public transport vehicles

Source: Tiglao, Regidor and Teodoro (2007)

Nowadays, the UVVRP is being utilized to control traffic congestion as it is reducing private vehicles and some public vehicles. Although, despite having the UVVRP, traffic congestion during rush hour is inevitable probably due to the inflated population in the Metro.

During the pandemic, number coding was suspended on March 2020 and was restored 3 months later.

NCR Population

The population of NCR denotes a positive growth rate of 0.97% annually from 2015 to 2020. It is the most populous region in the Philippines, the 7th most populous metropolitan area in Asia, and the 3rd most populous urban area in the world. (DTI)

Several reasons why the NCR population has been bloating year by year, and largely because high levels of rural poverty are pushing people into the cities.

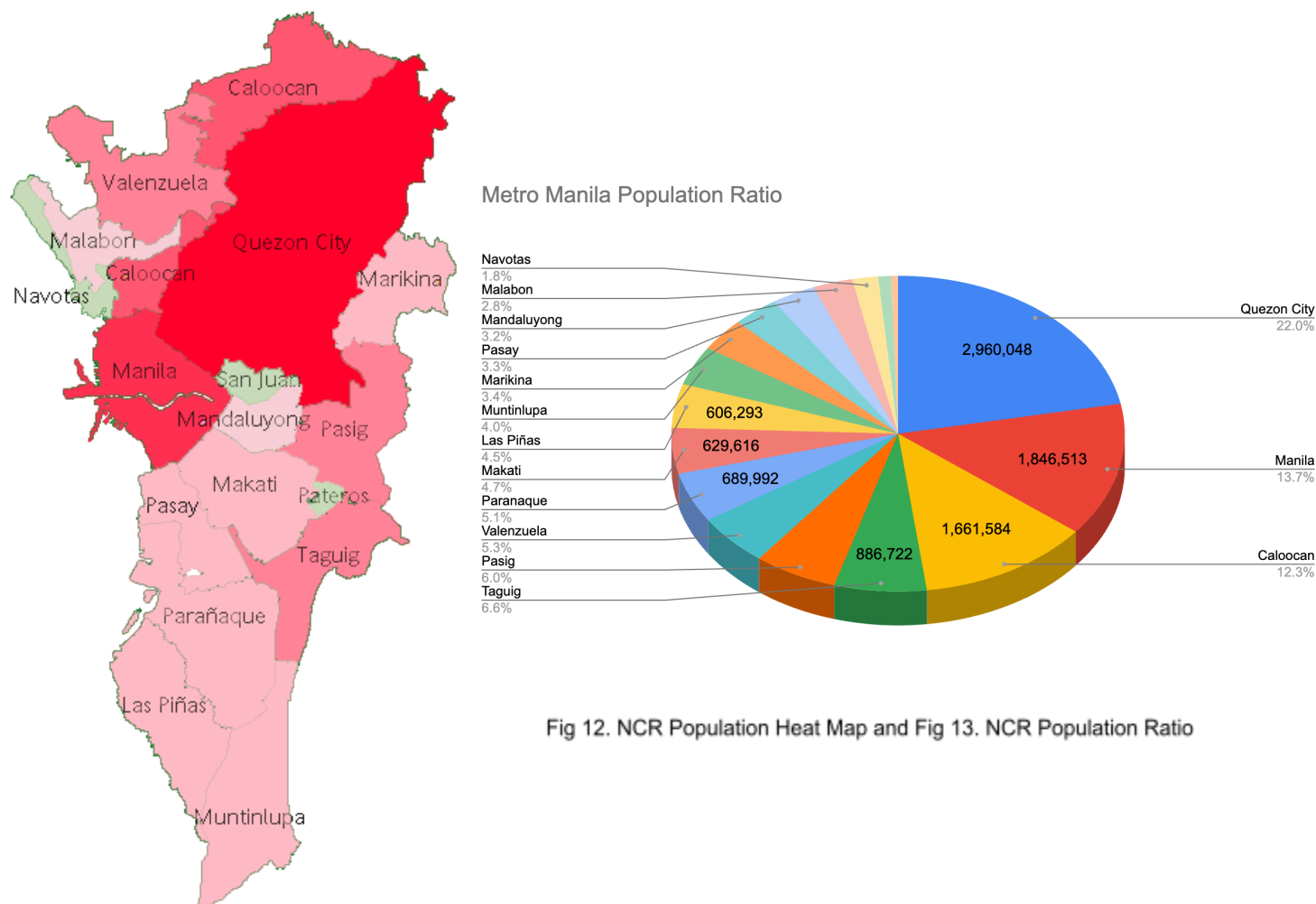


Fig 12. NCR Population Heat Map and Fig 13. NCR Population Ratio

Quezon City had the biggest population in Metro Manila's 16 highly urbanized cities (HUCs) in 2020, with 2,960,048 people, followed by the City of Manila with 1,846,513 people and the City of Caloocan with 1,661,584 people. Pateros has the least population of 65,227 people.

NCR Vehicular Accidents

Based from MMDA's data for 2022, the top 2 in terms of counts of vehicle type involved in these accidents are **cars** with 72,295 followed by motorcycle with 31,124.

In December 2022, the MMDA reported close to 58,000 road crashes for the whole year, or an average of 157 incidents daily.

2022 Vehicular Accidents by Vehicle Type

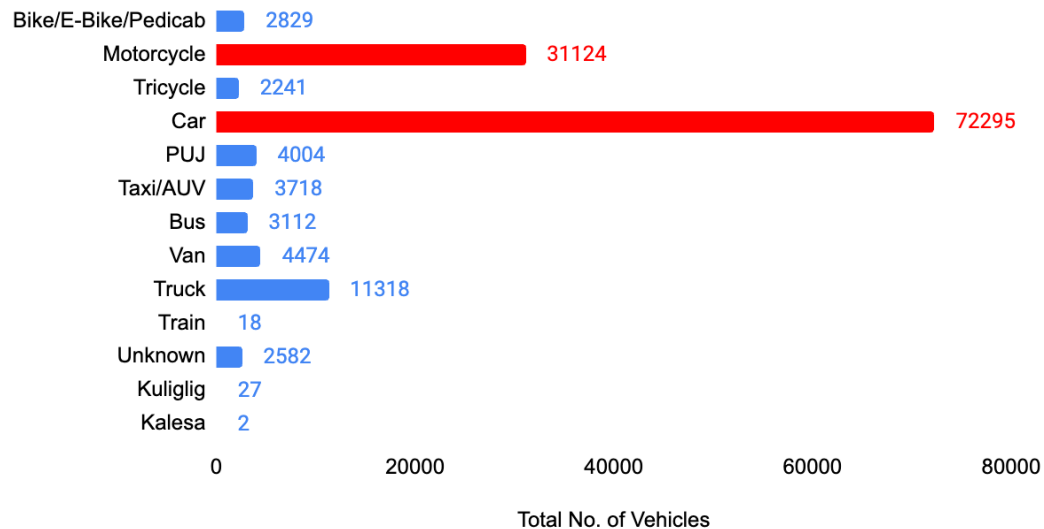


Fig 14. 2022 Accidents - Count of Vehicular Type Involved

Chapter 2: Statement of the Problem / Objectives

As traffic in Metro Manila is emerging year after year, it affects the quality of life of all Filipinos and citizens living in the metro. Travel durations are worsening for the working individuals and students.

Having converted 10% per year of commuters and car/mc users to become renters near their workplaces, will it also be efficient for them in terms of finances for the succeeding months? How will it affect the traffic in the metro in 2 years time?

Objectives:

This paper has the following objectives:

1. Assess if renting is economical compared to daily commute to work.
2. Assess if renting is economical compared to daily driving to work.
3. Project the average daily traffic in 2024 and 2025 provided a reduction of cars and motorcycles by 10% annually for.
4. Provide recommendations to help ease the traffic congestion in Metro Manila

Chapter 3: Analyses

Datasets

- MMDA Annual Average Daily Traffic 2021 and 2022
- SP201 Survey Data (85 respondents)
- Survey from Renters in NCR (50 respondents)
- Survey of Car Users in NCR (50 respondents)
- Gasoline Prices (FX Empire)
- PSA NCR Population 2021
- MMDA Vehicular Accident Data 2022

Descriptive and Diagnostic Analysis

The current traffic data and vehicular accidents from MMDA will be described and the survey via Google forms about commute within NCR, the rental data survey from workers and students and car users survey on their monthly gas consumption.

Predictive Analysis

The data involving gasoline prices will be predicted for the next 2 years. Forecasting and linear regression will be used to predict the annual average daily traffic for 2023 onwards based on historical data of AADT 2021 and 2022, and also gasoline price from the last 3 years. Air quality will also be predicted based on results of reducing motor vehicle users.

Quantitative and Qualitative

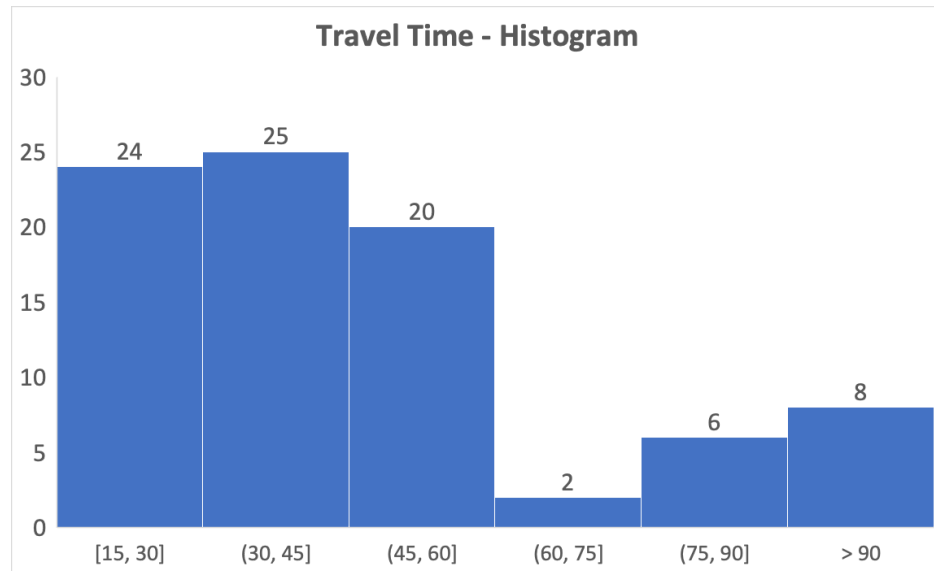
This research will use both quantitative and qualitative types of approach.

Limitations

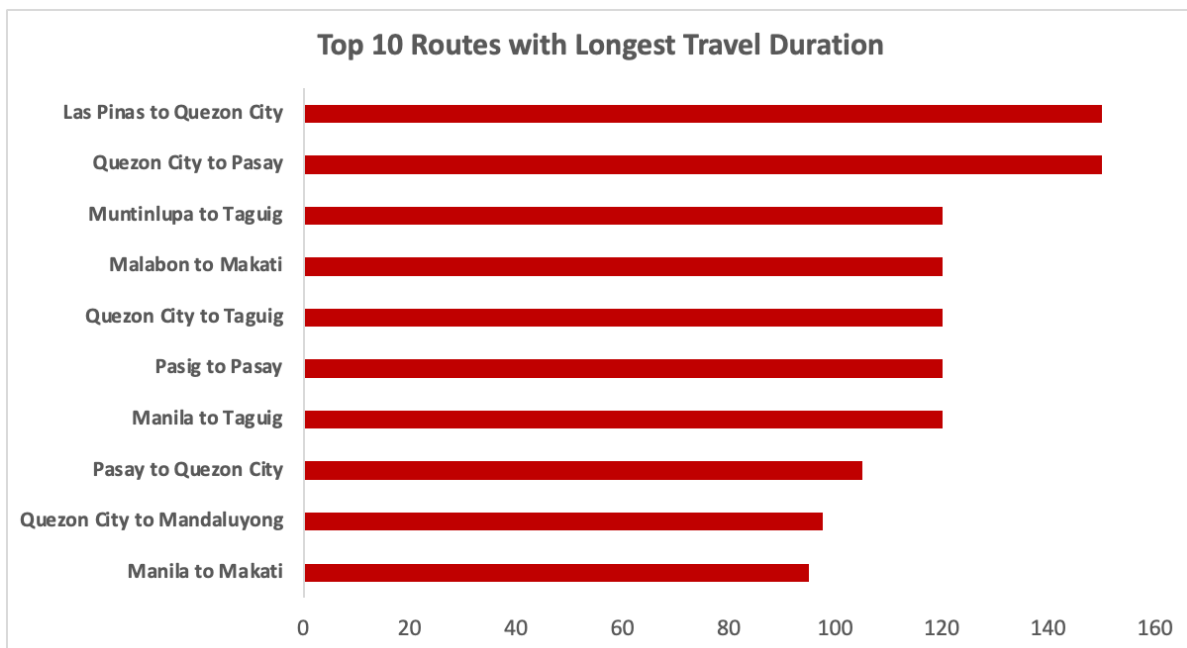
The data widely used in this paper are surveys from NCR citizens. The total respondents are 185 people, and it doesn't represent the 13.5 million inhabitants of the NCR region.

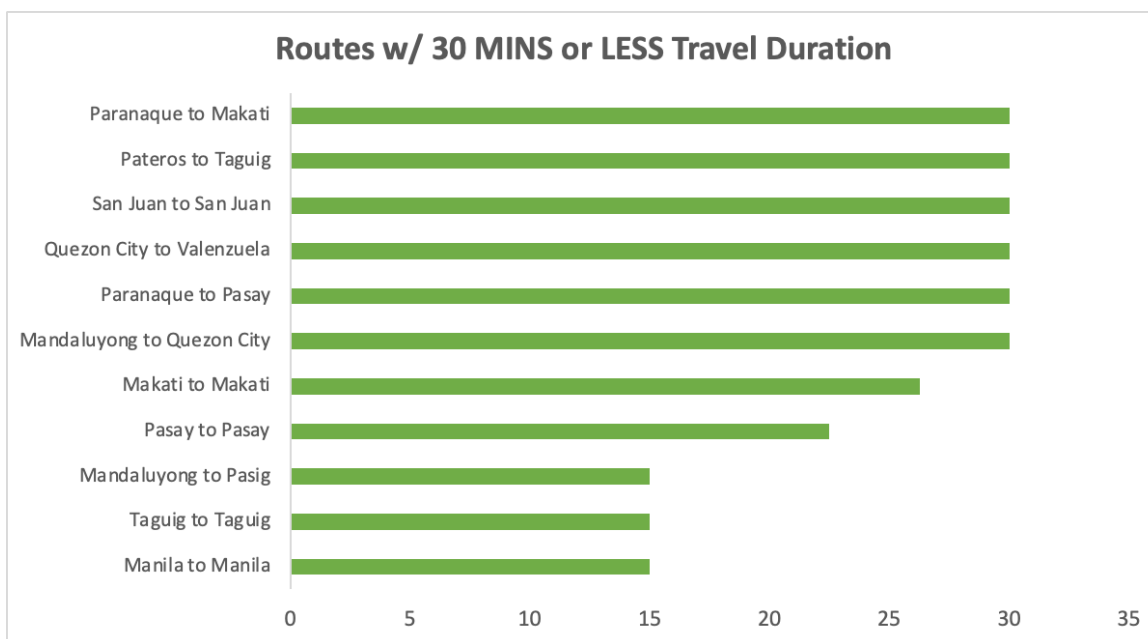
Chapter 4: Results and Discussion

Having a sample size of 85 respondents for the travel time, their average travel time is 55 minutes, with a standard deviation of 31.27.



Out of the 85 respondents, 49 have less than an hour of one-way travel. About 43% of the respondents have inefficient travel time going to work/school.

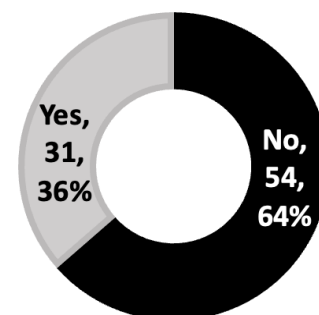
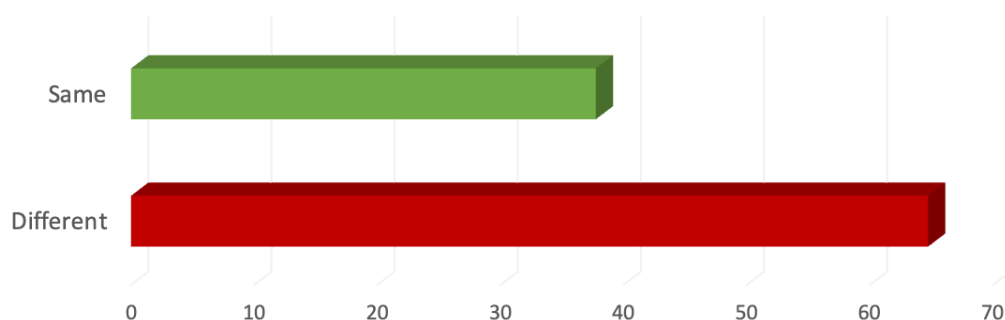




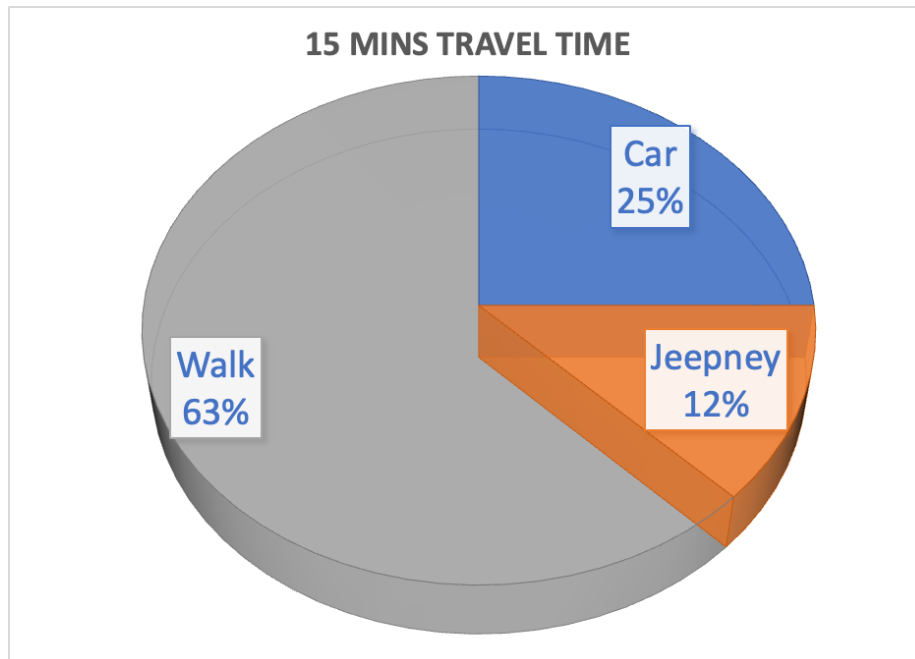
The two charts on top clearly show that travel time of intercity trips is better than from one city to another.

TRAVEL DURATIONS OF WORKING IN SAME CITY VS DIFFERENT CITY

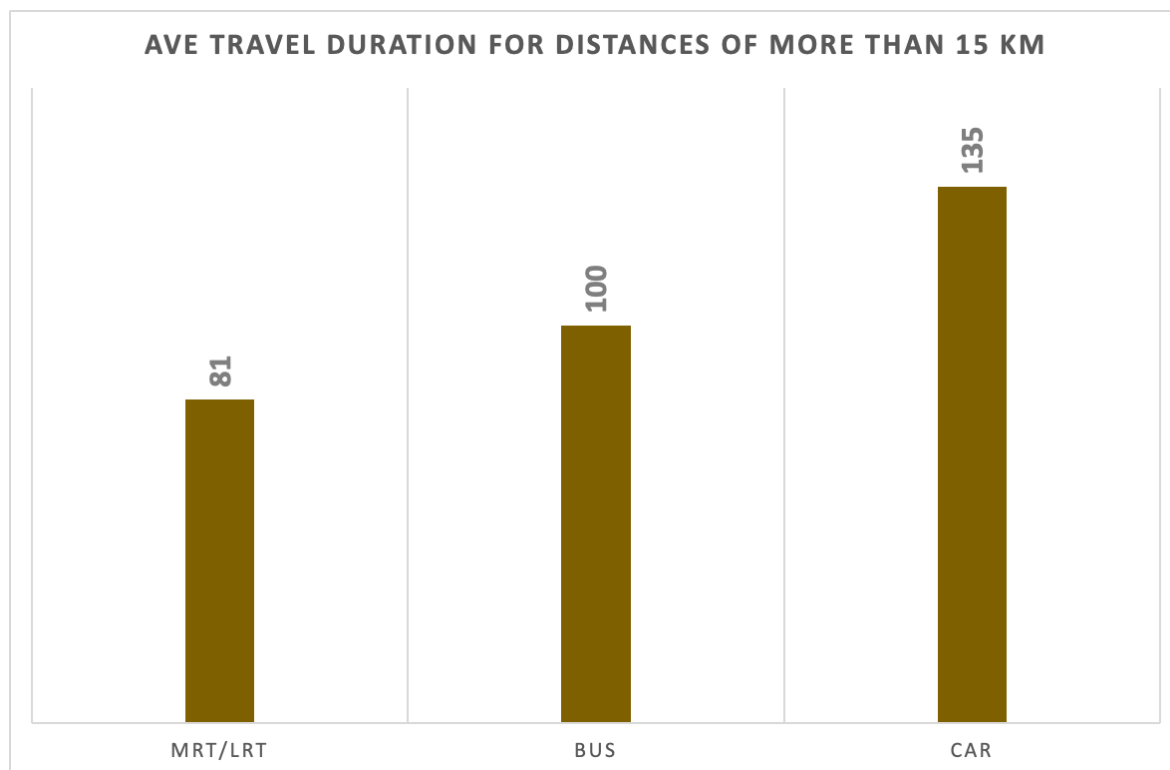
RATIO OF WORKING AND LIVING IN THE SAME CITY



Below is a pie chart showing all the respondents with 15 mins one-way travel time, and 63% are walking towards their workplace.



For travel distances more than 15 km, it shows that it takes too much time for the cars and buses compared to the mass transit MRT/LRT.



Below is the original dataset from MMDA. We didn't use the 2020 due to pandemic.

Annual Average Daily Traffic – MMDA

	Year	Car	PUV	UV	Taxi	Pub	Truck	Trailer	MC	Tricycle
0	2021	1399242	73766	25805	130855	24693	84738	18477	1421642	18455
1	2022	1563069	100876	33639	125008	23412	74942	20030	1573729	21050

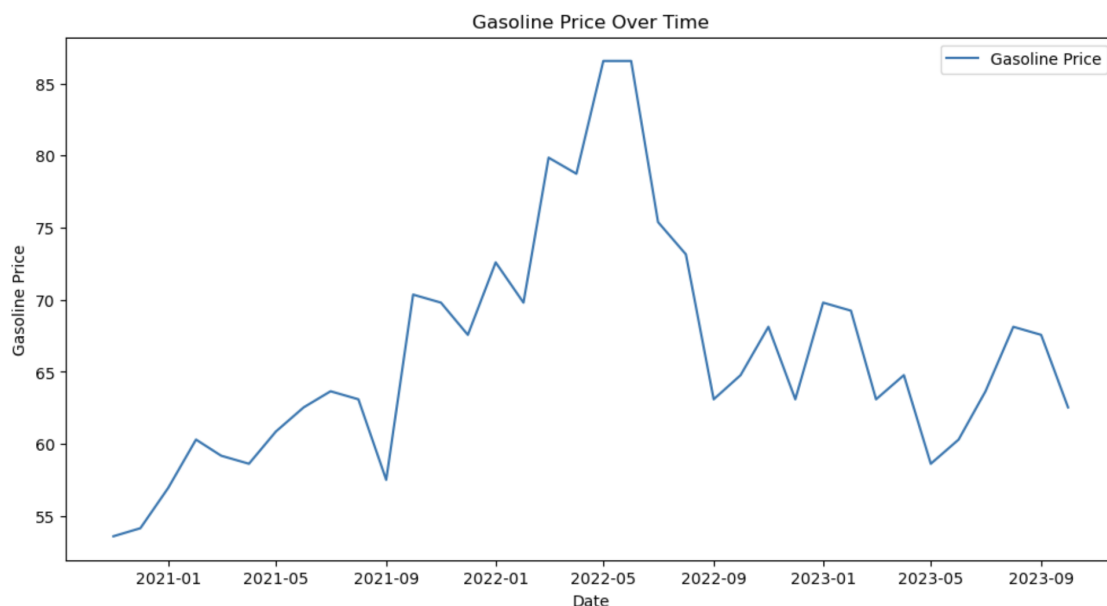
Since MMDA still has no data for 2023, we will be doing forecasting until 2025. After using the formula FORECASTING in Microsoft Excel, it gives this data:

Year	Car	PUV	UV	Taxi	Pub	Truck	Trailer	MC	Tricycle
2021	1399242	73766	25805	130855	24693	84738	18477	1421642	18455
2022	1563069	100876	33639	125008	23412	74942	20030	1573729	21050
2023	1726896	127986	41473	119161	22131	65146	21583	1725816	23645
2024	1890723	155096	49307	113314	20850	55350	23136	1877903	26240
2025	2054550	182206	57141	107467	19569	45554	24689	2029990	28835

According to JICA, the growth is about 1.73% annually, and the forecasting results above are too much and not realistic. By applying the formula to the original data, the forecasting will be more realistic:

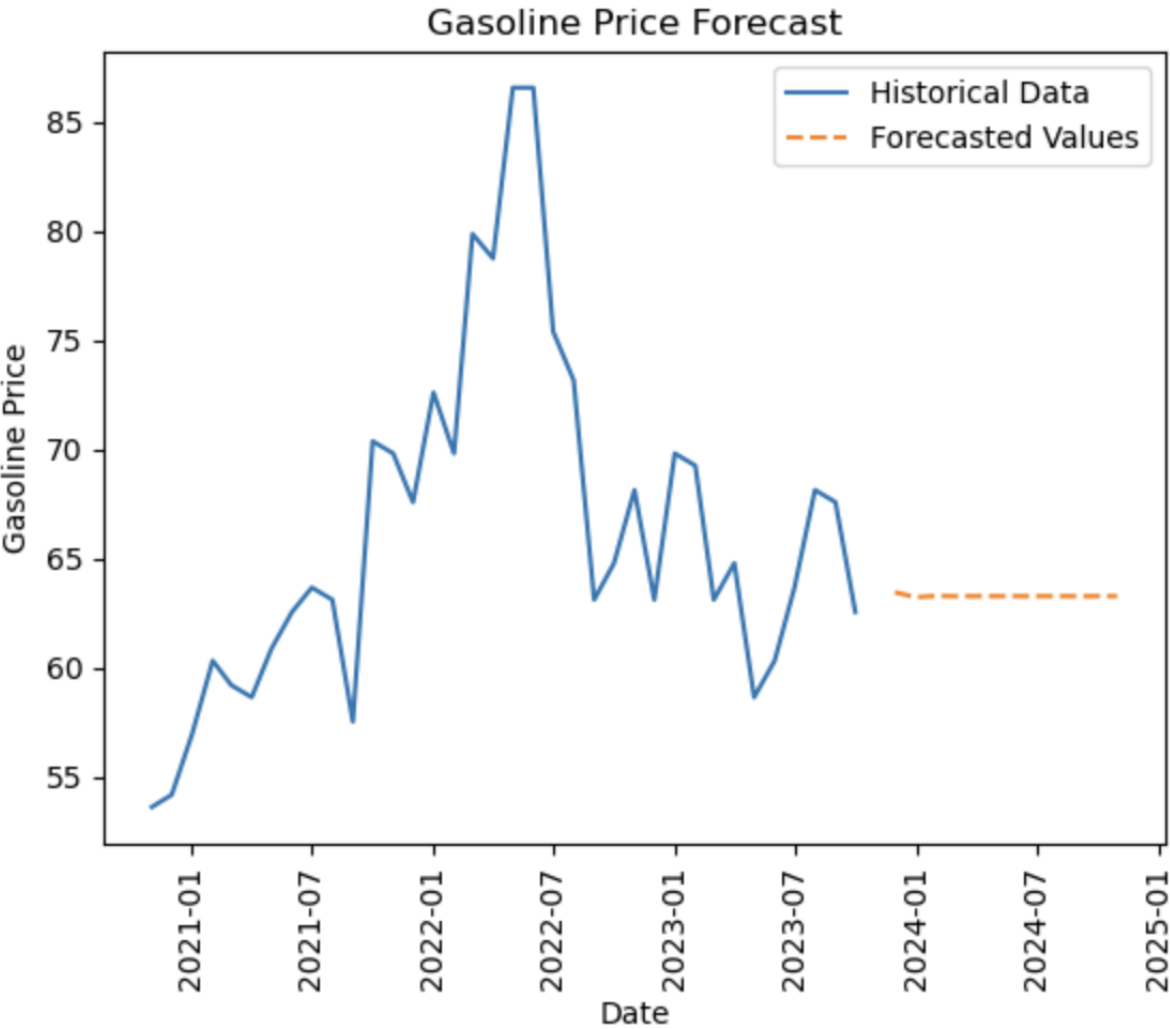
Year	Car	PUV	UV	Taxi	Pub	Truck	Trailer	MC	Tricycle
2021	1399242	73766	25805	130855	24693	84738	18477	1421642	18455
2022	1563069	100876	33639	125008	23412	74942	20030	1573729	21050
2023	1590110	102621	34221	127171	23817	76238	20377	1600955	21414
2024	1617619	104397	34813	129371	24229	77557	20729	1628651	21785
2025	1645604	106203	35415	131609	24648	78899	21088	1656827	22162

Gasoline Price Statistics Nov 2020- Oct 2023



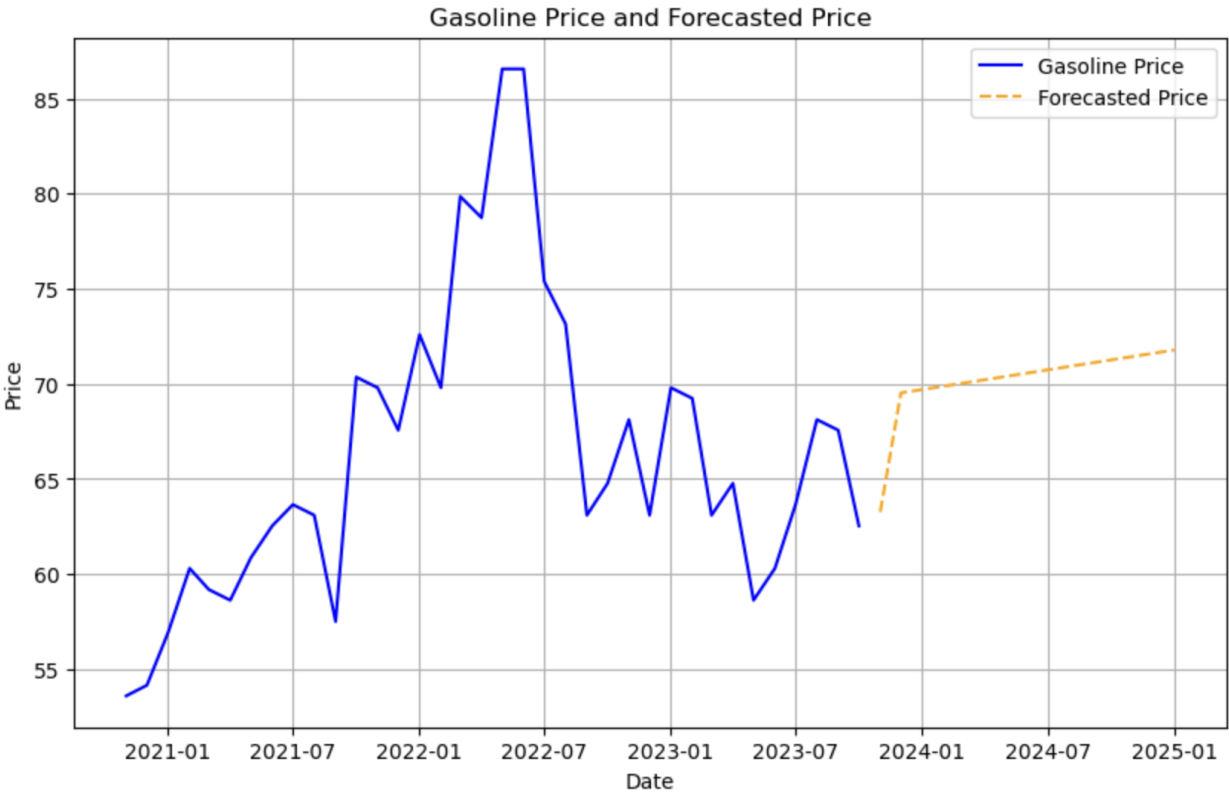
The data of the price of gasoline in the Philippines above shows the last 36 readings from the present. We would like to forecast the price up to the year 2025. By using the statsmodel in Python, particularly the ARIMA model, we get the following forecasted values:

	Date	Forecasted Price
36	2023-11-30	63.439728
37	2023-12-31	63.217596
38	2024-01-31	63.272487
39	2024-02-29	63.258923
40	2024-03-31	63.262275
41	2024-04-30	63.261446
42	2024-05-31	63.261651
43	2024-06-30	63.261601
44	2024-07-31	63.261613
45	2024-08-31	63.261610
46	2024-09-30	63.261611
47	2024-10-31	63.261611



As I don't see the figures quite making sense, let's try the forecasting of MS Excel.
Below is the result of the forecast and the corresponding plot:

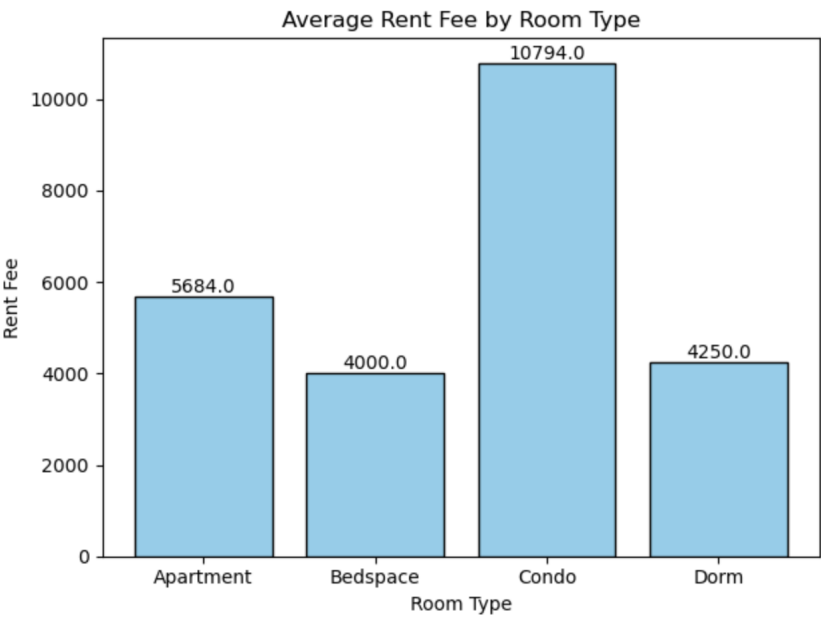
	Date	Gasoline Price
36	2023-11-01	63.271609
37	2023-12-01	69.526763
38	2024-01-01	69.702851
39	2024-02-01	69.878938
40	2024-03-01	70.043665
41	2024-04-01	70.219752
42	2024-05-01	70.390159
43	2024-06-01	70.566246
44	2024-07-01	70.736654
45	2024-08-01	70.912741
46	2024-09-01	71.088828
47	2024-10-01	71.259235
48	2024-11-01	71.435323
49	2024-12-01	71.605730
50	2025-01-01	71.781817



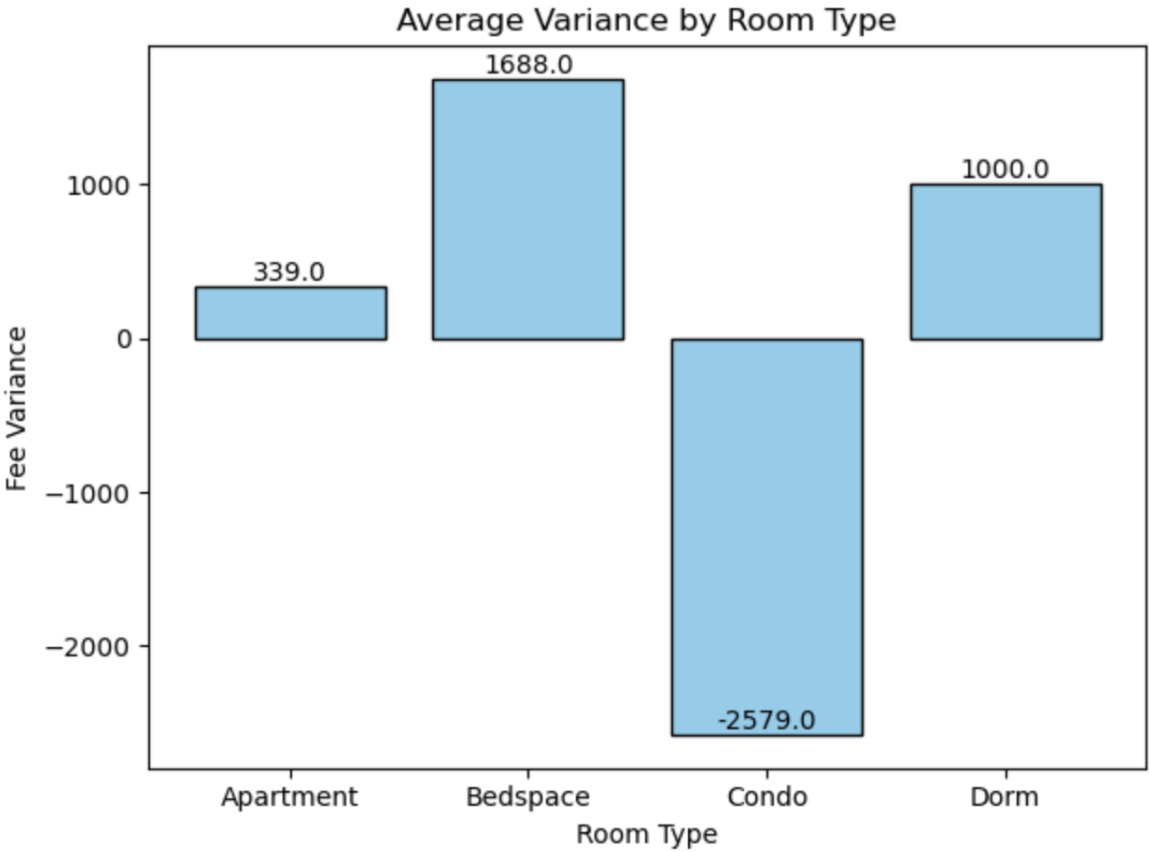
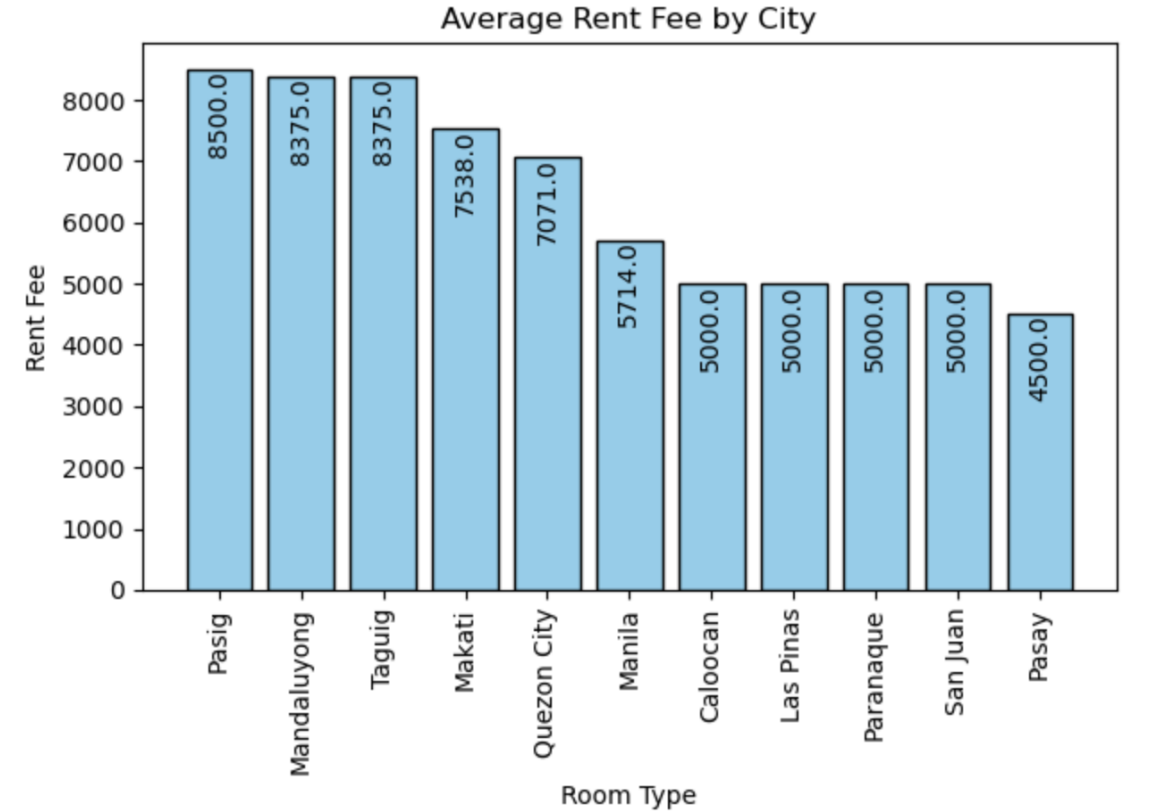
Monthly Consumption (L)

200	13940.0
180	12546.0
175	12197.5
170	11849.0
160	11152.0
150	10455.0
140	9758.0
130	9061.0
120	8364.0
110	7667.0
100	6970.0
90	6273.0
85	5924.5
80	5576.0
75	5227.5
70	4879.0

Name: Monthly Cost (Jan 2024),



		RENT TYPE			
Monthly Liters	Monthly Fuel Cost	Apartment	Bedspace	Condo	Dorm
200	13940	8256	9940	3146	9690
180	12546	6862	8546	1752	8296
175	12197.5	6513.5	8197.5	1403.5	7947.5
170	11849	6165	7849	1055	7599
160	11152	5468	7152	358	6902
150	10455	4771	6455	-339	6205
140	9758	4074	5758	-1036	5508
130	9061	3377	5061	-1733	4811
120	8364	2680	4364	-2430	4114
110	7667	1983	3667	-3127	3417
100	6970	1286	2970	-3824	2720
90	6273	589	2273	-4521	2023
85	5924.5	240.5	1924.5	-4869.5	1674.5
80	5576	-108	1576	-5218	1326
75	5227.5	-456.5	1227.5	-5566.5	977.5
70	4879	-805	879	-5915	629



```

Amounts Exceeding Fares
-3700    3
-2700    2
-2550    2
-3600    1
-4650    1
-4700    1
-2650    1
-5600    1
Name: Variance, dtype: int64

```

```

negative_values = rent['Variance'][rent['Variance'] < 0]
negative_value_counts = negative_values.value_counts()

print("Amounts Exceeding Fares")
print(negative_value_counts)

```

Amounts Exceeding Fares	Amounts Not Exceeding Fares
-3700 3	2300 4
-750 2	750 3
-2550 2	200 2
-1300 2	800 2
-2700 2	300 2
-300 1	1300 2
-1750 1	3500 1
-600 1	1750 1
-250 1	2850 1
-2650 1	1250 1
-4700 1	2800 1
-800 1	1350 1
-550 1	2350 1
-4650 1	700 1
-3600 1	1800 1
-1200 1	250 1
-5600 1	350 1
	1600 1

```

Name: Variance, dtype: int64
Name: Variance, dtype: int64

```

```

negative_count = (rent['Variance'] < 0).sum()

print(f'Number of renters who pays rent higher than his commute fares: {negative_count}')

```

```

Number of renters who pays rent higher than his commute fares: 23

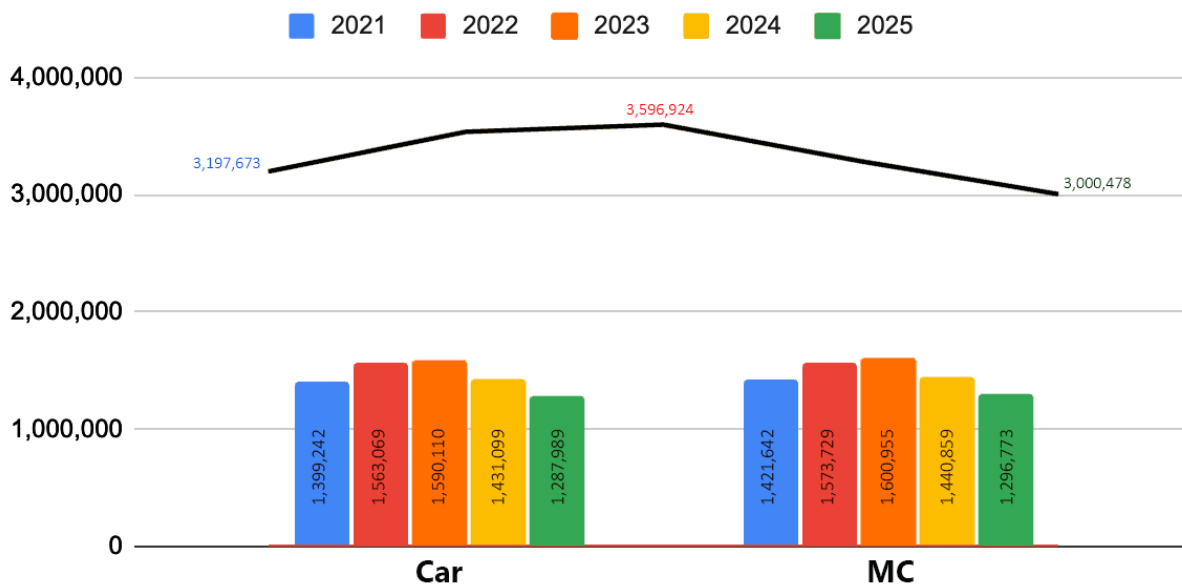
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Out of 50 renters (respondents), 27 have been living cost-efficiently as they are saving not just time and energy, but also money due to the fare being more expensive when you go home back and forth daily.

As we reduced 10% of cars and motorcycles annually starting 2024, as an effect of encouraging commuters and daily drivers (those who go to work by personal vehicle) to rent a boarding/housing near their workplace, and promoting carpooling and mass transit, we get to these numbers as speculations.

Year	Car	PUV	UV	Taxi	Pub	Truck	Trailer	MC	Tricycle	TOTAL
2021	1,399,242	73,766	25,805	130,855	24,693	84,738	18,477	1,421,642	18,455	3,197,673
2022	1,563,069	100,876	33,639	125,008	23,412	74,942	20,030	1,573,729	21,050	3,535,755
2023	1,590,110	102,621	34,221	127,171	23,817	76,238	20,377	1,600,955	21,414	3,596,924
2024	1,431,099	104,397	34,813	129,371	24,229	77,557	20,729	1,440,859	21,785	3,284,838
2025	1,287,989	106,203	35,415	131,609	24,648	78,899	21,088	1,296,773	22,162	3,004,785

Projected Average Daily Traffic, 2021-2025



Chapter 5: Conclusion

The forecasting data shows that from the traffic measurement from 2022 which 3.53 million vehicles rose to 3.72 million vehicles, adding up to almost 190,000 more vehicles by 2025.

Having surveyed 85 respondents about their travel to work experience, we found out that those who live and work in the same city have lesser travel time compared to those who travel outside their home city. There are instances where those who are just living beyond the border of the city have a quick travel time because of the short

distance between his/her work and home location. Average travel time of all the respondents is 55 minutes for a one-way trip, which proves that Metro Manila is indeed problematic in terms of traffic.

There are only 24 respondents with 30 minutes or less travel time one-way which is the only bin we can consider as time and energy efficient. There are 25 with 45 minutes travel time that we can consider to be tolerable for Metro Manila standards. Out of 85, 31 people live and work in the same city.

The main transport efficient for long distance travel (beyond 15 km) is the MRT/LRT. It takes 100 minutes and 135 minutes on an average for buses and cars respectively.

The MMDA Annual Average Daily Traffic shows that in 2022, around 3.53 million motor vehicles were passing through Metro Manila roads. After forecasting using 2021 and 2022 data, it is predicted that it went up to 3.59 million vehicles as everything is starting to get back to normal. Further forecasting foresees 3.66 million for 2024 and 3.72 million for 2025.

It is found that walking is the fastest mode of transport (for distances not more than 1 km) and the most beneficial in terms of health and fitness. Out of 8 respondents with 15 mins travel time, 5 are walking towards their workplace.

As we are checking if renting a housing near the workplace would decrease the presence of motor vehicles, 50 people were surveyed about their renting experiences. The data shows that 54% or 27 renters are more than break-even with their supposed commute expenses. The other 23 are paying more than the commute expenses, but only 12 people are paying more than 2,000 pesos, and those are living in condominiums. All the room types are economical except for condominiums.

A data of gasoline price in the Philippines for a span of 3 years (36 months) was retrieved starting from Nov 2020 to Oct 2023. Forecasting the price until year 2025, we get P69.7/liter for Jan 2024 up to P71.78/liter in Jan 2025.

For the car driver's survey, the data shows that a minimum of 70 liters were consumed for a minimum of 10 km distance one-way daily. When the forecasted fuel cost is multiplied to the monthly consumption, we get a projected monthly fuel expenses where we compare it to the average rental fees we got from the other data set (rent survey). The table shows that for lower fuel monthly consumptions, it is not advised to go for room-types shaded in red. All the white ones in the 'Rent Type' portion means

that it is within the equivalent monthly fuel expenses/budget. Those who have 160 L consumption per month could go with the condominiums without spending extra.

We assume that if 10% of car and motorcycle users would switch to renting a housing near the workplace, we could improve the daily traffic figures by 10% annually. By 2024, we project that the AADT will be down to 3.28M motor vehicles from 3.59M, and by the following year will be down to 3M, reducing 590K cars and motorcycles combined.

Chapter 6: Recommendation

It is recommended to rent a place near your workplace if the travel time it consumes is more than 1 hour for your one-way trip. Not only does it save you time and give you productivity, but it also provides you convenience and doesn't wear you out during a long troublesome trip to and from work. Paying an extra small amount for convenience is not bad.

Walking and taking public transportation are in general both less expensive than driving. Gas (petrol for some), insurance, depreciation, parking (when relevant) all add to the cost of driving, and are almost certain to cost you more. However, if the cost of driving is shared by several people (car pooling), its cost may be less than the cost of public transportation - all this depends on local circumstances.

Driving a personal vehicle is convenient indeed as it gives more security and privacy, but engaging with a heavy traffic (1-2 hours) on a daily basis would also consume more gas and also there's a maintenance cost to think about.

Utilizing mass transport frees up the space that your vehicle would have been occupying. It's highly advisable to take the public transport if you're not in a hurry or emergency.

Chapter 7: References

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