JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE PROJECT FOR COMPREHENSIVE TRAFFIC MANAGEMENT PLAN FOR METRO MANILA

TECHNICAL REPORT NO. 11

EDSA BUSWAY U-TURN

November 2022

ALMEC CORPORATION

ORIENTAL CONSULTANTS GLOBAL CO., LTD.

TRANSPORTATION RESEARCH INSTITUTE CO., LTD.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

CTMP	Comprehensive Traffic Management Plan
JICA	Japan International Cooperation Agency
JPT	JICA Project Team
EDSA	Epifanio de los Santos Avenue
PCU	passenger car unit

1 REVIEW OF U-TURN SLOTS ALONG EDSA NORTH SECTION

1.1 Introduction

A new bus operation scheme called EDSA Carousel was introduced in 2021 in which an exclusive bus lane is set up along EDSA's innermost lane. Such an arrangement has eliminated the conflict between buses on the bus lane and right-turning vehicles including bicycles on the bicycle lanes at intersections.

On the other hand, there are conflicts in bus movement with the left-turning and U-turning vehicles at the intersections and U-turn slots. The conflict is explicit at three U-turn slots northbound of EDSA between EDSA-North and Monumento.

An analysis was made to study the impact of EDSA Carousel, which runs along the innermost lane at these three U-turn slots. It was revealed by the study that traffic operation at these U-turn slots is at an acceptable level without causing congestion except for U-turn slot at EDSA–Quezon City Academy, where congestion is expected during the afternoon peak hours.

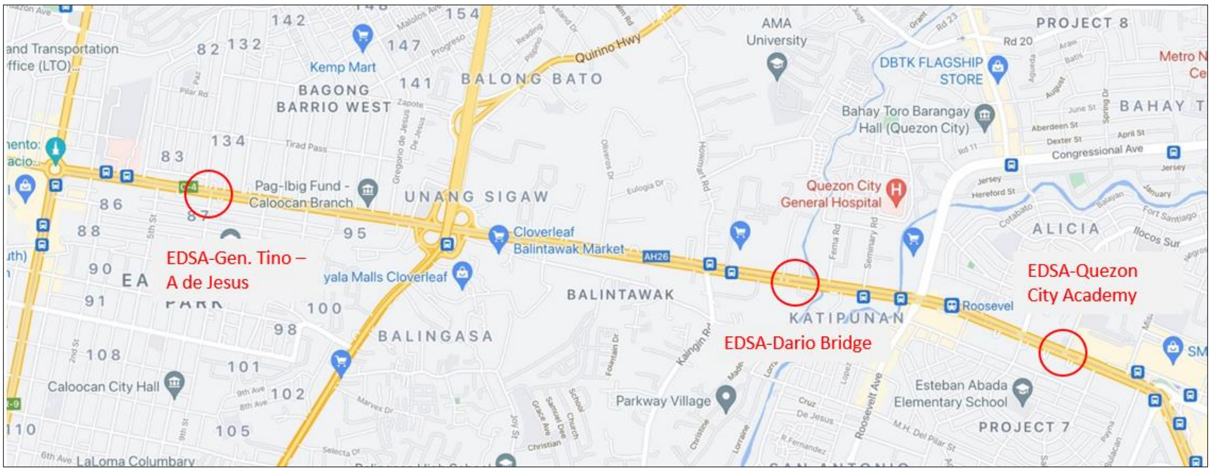
The traffic count survey was conducted on 29 June 2021 (EDSA–Dario Bridge), 30 June 2021 (EDSA–Quezon City Academy), and 5 August 2021 (EDSA–EDSA–Gen. Tinio/A de Jesus). These locations do not have signals at the U-turn slot. The signals were installed at EDSA–Gen. Tinio/A de Jesus on 3 August 2021 and at EDSA–Quezon City Academy and EDSA–Dario Bridge in November 2021.

The survey was made prior to the traffic signal installation at these U-turn slots. Thus, no evaluation is made on the operation of the traffic signal. Furthermore, the control signal for bus departure was installed at select bus stations in 2022 to prevent bus bunching and to make bus intervals. The scheme is also not reviewed in the report.

2 U-TURN SLOTS ALONG EDSA NORTH SECTION

There are three (3) U-turn slots along the north section of EDSA as shown below.

EDSA–Quezon City Academy and EDSA–Dario Bridge are for U-turns only from both approaches. The U-turn slot at EDSA–Gen. Tino- A de Jesus allows a left turn for EDSA westbound traffic into 8th Street, which is a southbound one-way street.



Source: JPT

Figure 2.1: U-turn Slot Locations

3 TRAFFIC VOLUME

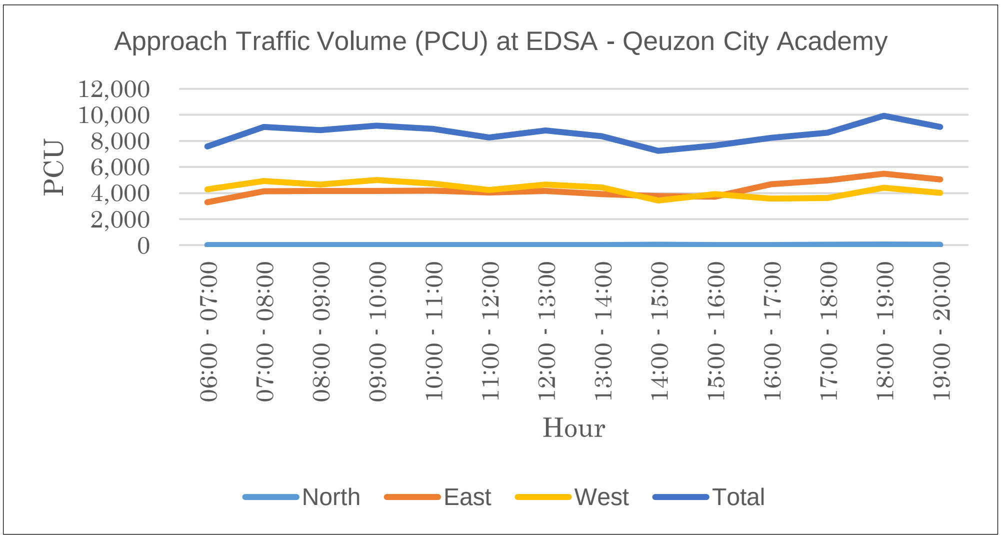
A traffic volume count survey was conducted at the three U-turn slots. The survey was conducted from 06:00 until 20:00. Buses on the bus lane are included in the count. Different types of vehicles create varying degrees of impact on the traffic flow. As a result, the traffic count data of different vehicle types were converted to passenger car equivalent by applying passenger car unit (PCU).

3.1 Traffic Volume Hourly Variation

The traffic count survey shows the traffic characteristics at three U-turn slots. Hourly traffic counts in PCU approaching the U-turn slot are shown and described below.

(1) EDSA–Quezon City Academy

- The total traffic volume varied slightly throughout the day with a noticeable increase in the evening.
- The traffic volume is at the same level at the east and west approaches.
- Only a right turn is allowed from the north approach (Nueva Ecija Street Extension), and the volume is very small.

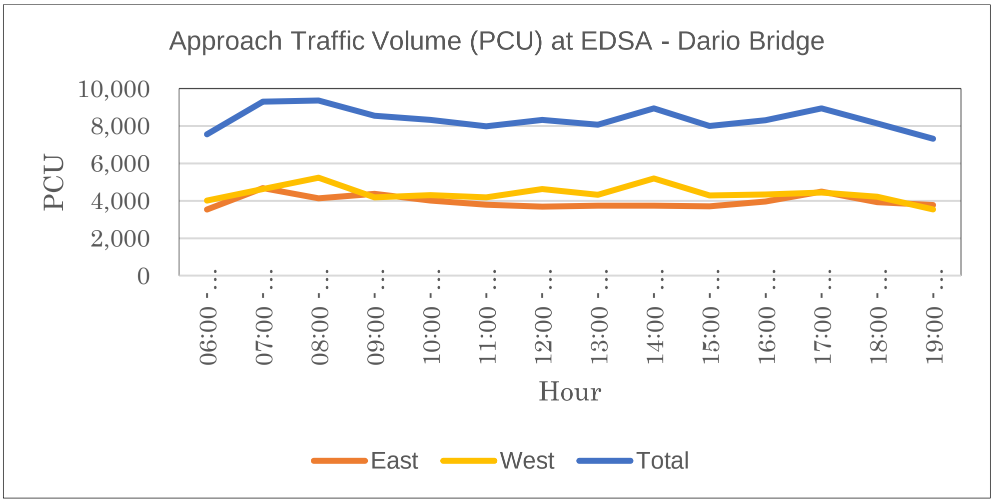


Source: JICA Project Team

Figure 3.1: Approach Hourly Traffic (PCU) at EDSA–Quezon City Academy (30 June 2021)

(2) EDSA–Dario Bridge

- The total traffic is slightly varied throughout the day with an increase in the morning.
- The traffic volume is at the same level for east and west approaches.

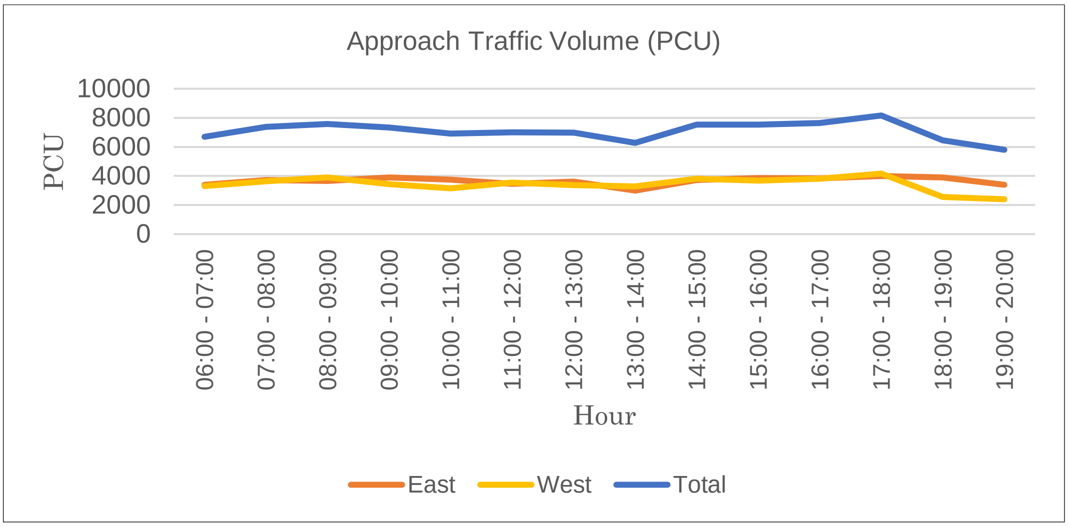


Source: JICA Project Team

Figure 3.2: Approach Hourly Traffic (PCU) at EDSA–Dario Bridge (29 June 2021)

(3) EDSA–A de Jesus

- The total traffic volume varied slightly throughout the day with a noticeable increase in the evening.
- Traffic volume is at the same level at the east and west approaches from 06:00 to 20:00.



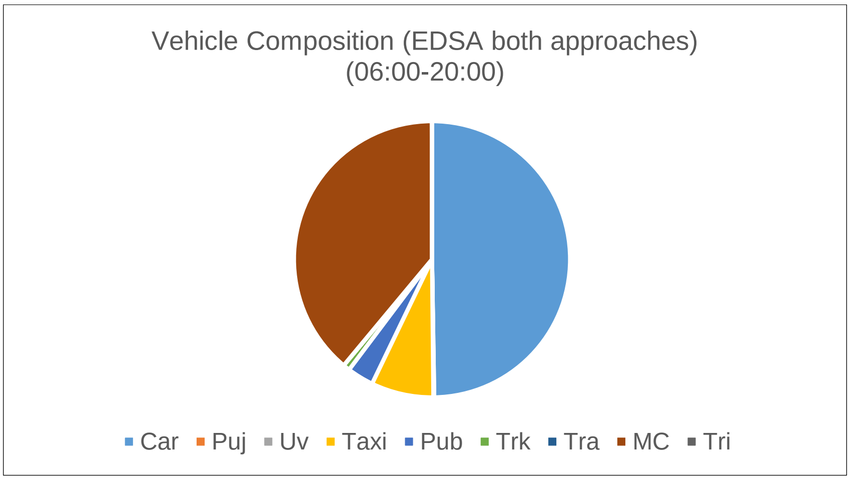
Source: JICA Project Team

Figure 3.3: Approach Hourly Traffic (PCU) at EDSA–A de Jesus (5 August 2021)

It is observed that traffic volume shows a small variation from 06:00 to 20:00 at three U-turn slots indicating that the ratio of commuting traffic is relatively small compared with the long-haul traffic.

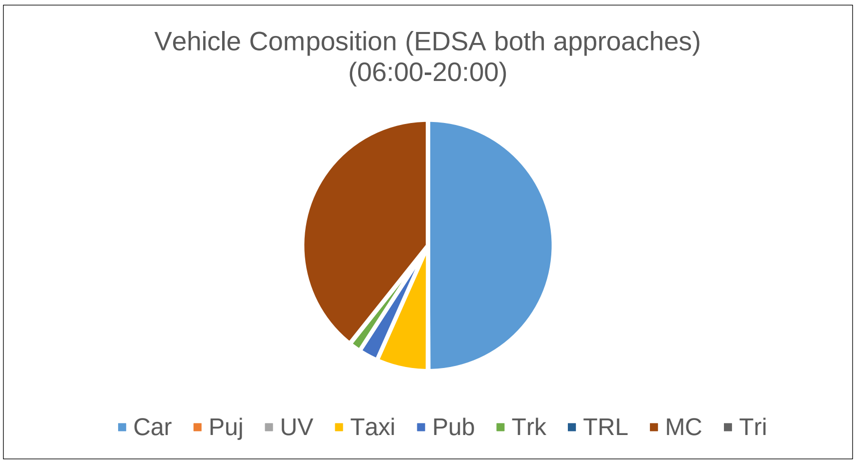
3.2 Vehicle Composition

Vehicle compositions of stream along EDSA at approach are shown below. The motorcycle count has a large portion of vehicle composition (approximately 40%) at the three U-turn slots. Motorcycles are dominant along EDSA–A de Jesus. This may cause traffic safety issues due to the differences in the maneuverability of cars and motorcycles. Moreover, U-turning motorcycles swerve to the innermost lane before a U-turn creating a complicated flow of cars and motorcycles at U-turn approach.



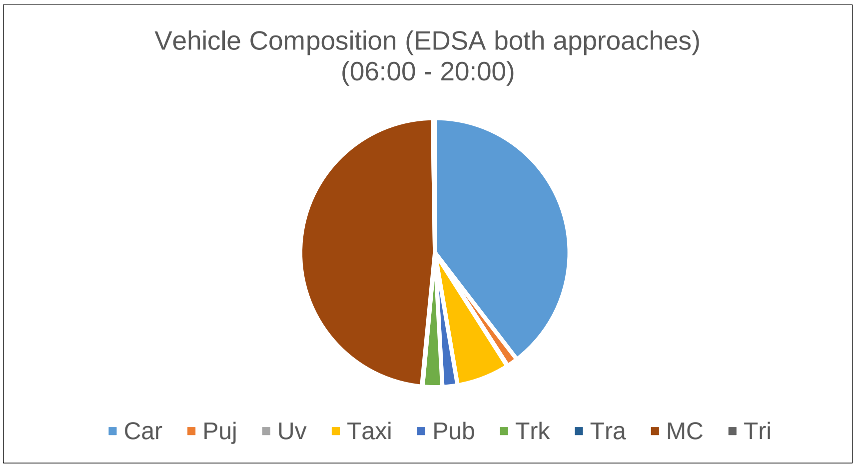
Source: JICA Project Team

Figure 3.4: Vehicle Composition at EDSA–Quezon City Academy (EDSA Both Approaches, 06:00–20:00, 30 June 2021)



Source: JICA Project Team

Figure 3.5: Vehicle Composition at EDSA–Dario Bridge (EDSA Both Approaches, 06:00–20:00, 29 June 2021)



Source: JICA Project Team

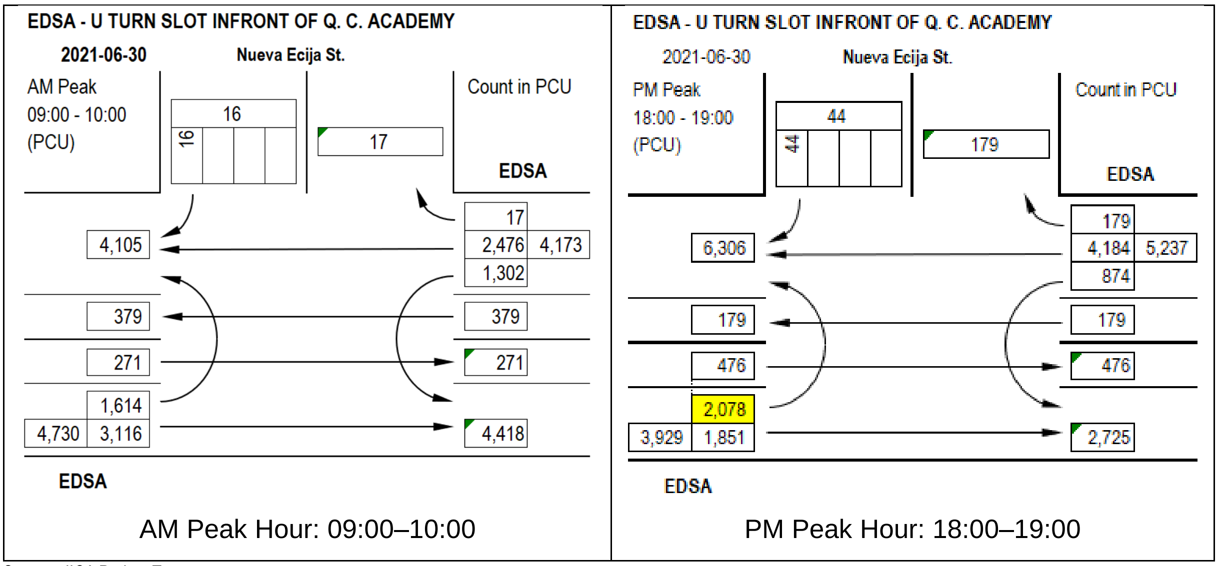
Figure 3.6: Vehicle Composition at EDSA–A de Jesus (EDSA Both Approaches, 06:00–20:00, 5 August 2021)

3.3 Peak Hour Traffic

To further analyze the traffic condition at the U-turn slots, peak hour traffic in PCU is graphically presented for AM and PM peak hours. The traffic count marked in yellow indicates the traffic count to be noted.

(4) EDSA–Quezon City Academy

- U-turn traffic volume is high for all cases except the east approach in PM peak hours. U-turn traffic volume on the west approach is higher than through traffic during the PM peak hour.
- The volume of U-turn traffic indicates that one U-turn lane is not enough to accommodate U-turn traffic resulting in the interaction between U-turn traffic and through traffic.
- There is a large bus traffic on the west approach during the PM peak hour. The actual number of buses on the bus lane is 212 units indicating one bus every 17 seconds.
- Traffic from the north approach (Nueva Ecija St.) is small in the AM peak hour. The right-turning vehicles have an almost negligible impact on through traffic along EDSA.

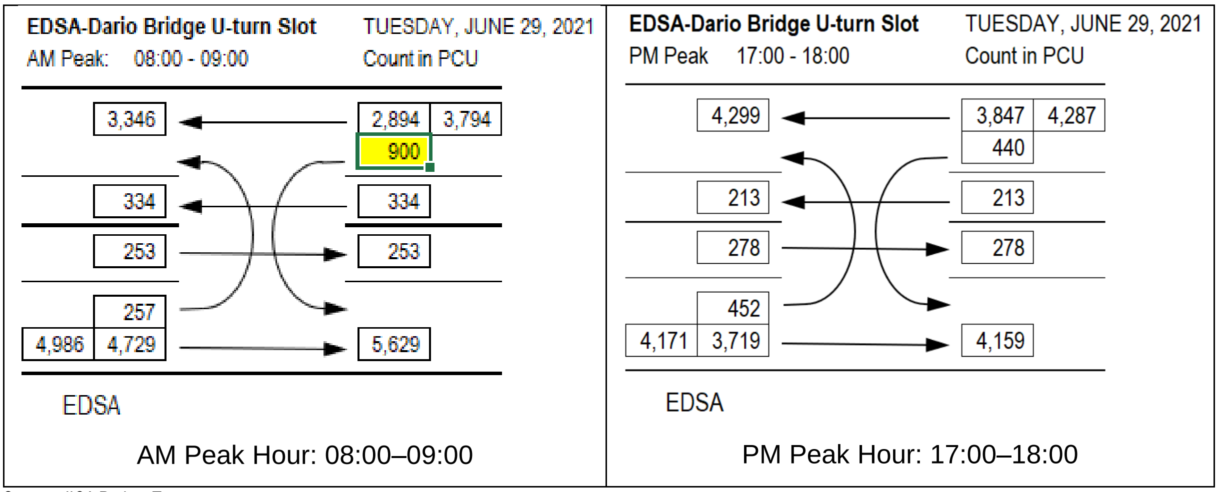


Source: JICA Project Team

Figure 3.7: Peak Hour Traffic (PCU) at EDSA–Quezon City Academy

(5) EDSA–Dario Bridge

- High U-turn traffic is observed on the east approach during AM peak hour. Majority of this U-turn traffic seems to be inbound traffic from Congressional Ave. making right turn at EDSA–Roosevelt intersection heading for CBD.
- U-turn traffic is at a comparable level during PM peak hour.

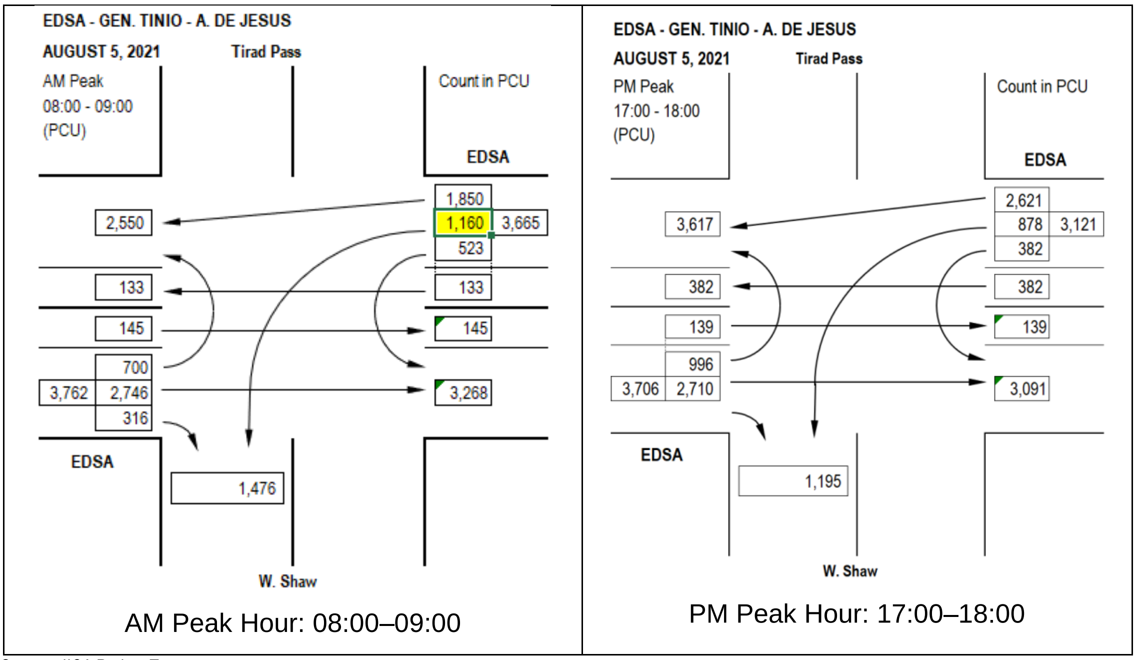


Source: JICA Project Team

Figure 3.8: Peak Hour Traffic (PCU) at EDSA–Dario Bridge

(6) EDSA–Gen. Tinio–A de Jesus

- Vehicles turning left into 8th Street (which is one-way southbound) and U-turning from the east approach are comparable with through traffic during AM peak hour.



Source: JICA Project Team

Figure 3.9: Peak Hour Traffic (PCU) at EDSA–Gen. Tinio–A de Jesus

4 CAPACITY ANALYSIS

Capacity analysis is a process that calculates the ratio of traffic demand relative to intersection capacity. The analysis compares the directional traffic count obtained by traffic count survey and intersection capacity estimated based on intersection geometry (number of lanes, lane width, the direction of movement for each lane, etc.).

The result shows how an intersection is congested. The calculation result, which is the Y-value ranging from 0 to 1, indicates the level of congestion at the intersection.

As the general rule of thumb, if the volume capacity ratio (Y-value) is higher than 0.7, a traffic signal is needed at the intersection. If the Y-value exceeds 0.9, the intersection is congested, and a waiting queue develops.

In the calculation, turning traffic volume is converted to through traffic volume as the maneuverability of turning traffic is lower than through traffic resulting in higher effective traffic volume. There is no standard conversion factor of U-turn traffic. No factor is applied to U-turning traffic volume. This means that the capacity analysis shows slightly better traffic conditions than the actual situation.

The capacity analysis was applied to three (3) U-turn slots using higher peak hour traffic between AM and PM peak hours. The results are summarized below. No data are shown for the lower Y value.

Table 4.1: Y-value at Three U-turn Slots

Peak / Location	Quezon City Academy	Dario Bridge	Gen. Tinio / A de Jesus
AM Peak		0.74	
PM Peak	0.98		0.77

Source: JICA Project Team

The results indicate that two U-turn slots, Dario Bridge and A de Jesus are not saturated, and congestion does not develop during peak hours. On the other hand, the total demand at Quezon City Academy exceeds the capacity limit of 0.9 causing congestion. The main cause of congestion is the large U-turn traffic, which is larger than through traffic.

5 TRANSIT SIGNAL PRIORITY[1]

Transit signal priority is one of the signal operation strategies that gives favorable treatment to public transport. When a public transport approaching a signal is detected, the green signal for that direction is extended to allow the bus to pass through the intersection without stopping. It terminates the red signal earlier than scheduled to prioritize the green signal to the bus. Installation of a vehicle detector is required, and the transit signal priority function of the local controller must be set. The measure does not require large cost, and it is effective in reducing the travel time of public transport.

It was planned to introduce transit signal priority to the signals installed at these U-turn openings along EDSA to enhance the bus operation with minimum impact on other traffics. However, the plan was not implemented as the location of the bus detector and the setup procedure of the local controller were not clearly explained by the supplier.

[1] https://ops.fhwa.dot.gov/publications/fhwahop08024/chapter9.htm

6 FINDINGS AND CONCLUSION

6.1 Findings

The findings of the analysis are the following:

(i) Traffic volume is high throughout a day with a slight increase during AM or PM peak at three U-turn slots.

(ii) Motorcycle occupies a large portion of traffic. This may cause traffic safety issues due to different maneuverability of car and motorcycles.

(iii) Proportion of U-turning traffic is high at three U-turn slots due to the closure of the EDSA–Roosevelt Intersection and the limited routes to make a left turn from EDSA.

(iv) At Quezon City Academy, traffic volume exceeds the capacity of U-turn slots during PM peak hours due to high U-turn traffic on the west approach.

(v) No queue is expected to develop at Quezon City Academy and throughout the day at the other two U-turn slots (Dario Bridge and A de Jesus) because traffic demand is below capacity.

6.2 Conclusion and Recommendation

(i) At the moment, three U-turn slots are functional and serve a large amount of U-turn traffic. With the small increase in traffic congestion, these U-turn slots would become a bottleneck.

(ii) Additional measures are required to manage the U-turn slots in addition to the newly installed signal, which must operate as transit signal priority.

(iii) Another potential improvement measure recommended is to control bus interval and prevent bus bunching. This can be done by a bus traffic signal at the bus station.

(iv) The use of buses with large capacities such as articulated buses will be effective in increasing the capacity of the bus lane.

(v) DPWH's plan to construct a flyover over Roosevelt / Congressional Ave. and to open the intersection would help decongest U-turn slots. Its technical feasibility is yet to be studied as LRT pillars stand at the intersection.

(vi) The closing of intersections and guiding traffic to use U-turn slots is commonly applied in Metro Manila. It must be carefully studied and reviewed as the measure is effective only when certain conditions are met. It could be a cause of congestion when traffic demand is high as the total traffic volume at the location closed becomes higher than the case when the intersection is open.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE PROJECT FOR COMPREHENSIVE TRAFFIC MANAGEMENT PLAN FOR METRO MANILA

TECHNICAL REPORT NO. 12

BIKE LANE CASE STUDY

November 2022

ALMEC CORPORATION
ORIENTAL CONSULTANTS GLOBAL CO., LTD.
TRANSPORTATION RESEARCH INSTITUTE CO., LTD.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

CTMP	Comprehensive Traffic Management Plan
DPWH	Department of Public Works and Highways
JICA	Japan International Cooperation Agency
JPT	JICA Project Team
KPI	key performance indicator
LGU	local government unit
MMDA	Metropolitan Manila Development Authority
PUB	public utility bus
PUJ	public utility jeepney
PUV	public utility vehicle
VISTRO	Vision Traffix and Optimization

1 BACKGROUND

1.1 Objectives

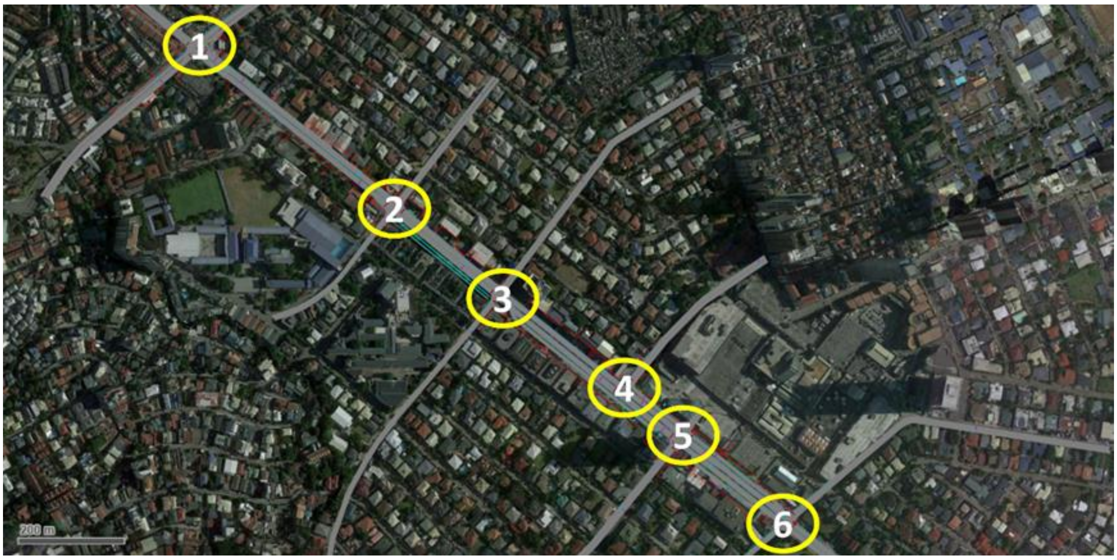
When the pandemic hit the Philippines in the year 2020, the government implemented several measures to prevent COVID-19 from spreading further. One of these measures is the limitation of public utility vehicles (PUVs) from plying the roads. Since people need to travel to work, they have turned to using bicycles as alternative transportation, increasing bicycle users. For the safety of bicycle users, the Department of Public Works and Highways (DPWH) and the local government units (LGUs) have started to implement bicycle lanes along the roads they manage. However, the implementation of exclusive bicycle lanes brought concerns such as the reduction of capacity of the carriageway, which would affect traffic congestion.

Thus, the bike lane study aims to determine the impact of the implementation of dedicated bicycle lanes on traffic flow.

1.2 Study Area

To evaluate the impact of bicycle lanes, Ortigas Avenue, a major corridor, was chosen as the study area. This is because San Juan is one of the first LGUs to implement bicycle lanes and JICA project team (JPT) and MMDA Counterpart conducted a case study in the sections and have a microsimulation model already. Ortigas Avenue covers a total of six (6) intersections, namely:

(i) Ortigas Ave.–Santolan;
(ii) Ortigas Ave.–Madison;
(iii) Ortigas Ave.–Roosevelt;
(iv) Ortigas Ave.–Club Filipino;
(v) Ortigas Ave.–Wilson St.; and
(vi) Ortigas Ave.–Connecticut St.

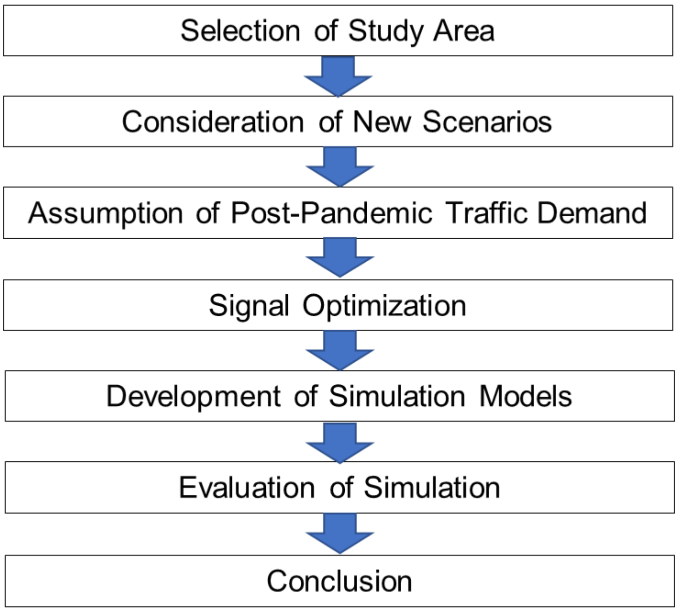


Source: JPT

Figure 1.1: Project Area

1.3 Overall Approach

The overall approach is shown in Figure 1.2. First, it was decided Ortigas Avenue will be chosen as the study area as it is a major corridor that has bicycle lanes implemented by the San Juan LGU. After determining the study area, new scenarios were considered, such as the post-pandemic traffic demand. Since there are no traffic volume counts for the post-pandemic traffic demand, assumptions were made. After assuming the post-pandemic traffic demand, traffic signals were optimized, which was used in the simulation. Once all inputs were ready, the simulation models from Pilot Project 1 were revised and adjusted to fit the new scenarios. After the development of simulation models comes the evaluation and conclusion on the impact of the implementation of bicycle lanes on the traffic flow. The results of this series of work were discussed at CPT meetings to determine policy.



Source: JPT

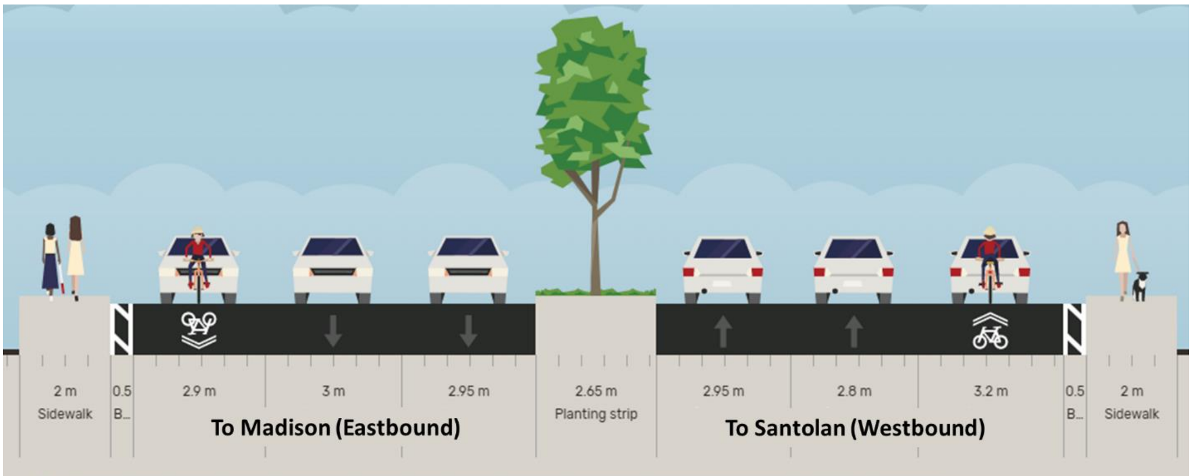
Figure 1.2: Workflow for the Bike Lane Study

2 CONSIDERATION OF SCENARIOS

2.1 Road Cross-section

The cross-section of the road is a factor in the consideration of the implementation of bicycle lanes. The number of lanes and road widths determine if a separate bicycle lane is needed or if a shared bicycle lane would suffice. The road conditions of the segments along Ortigas Avenue are presented below.

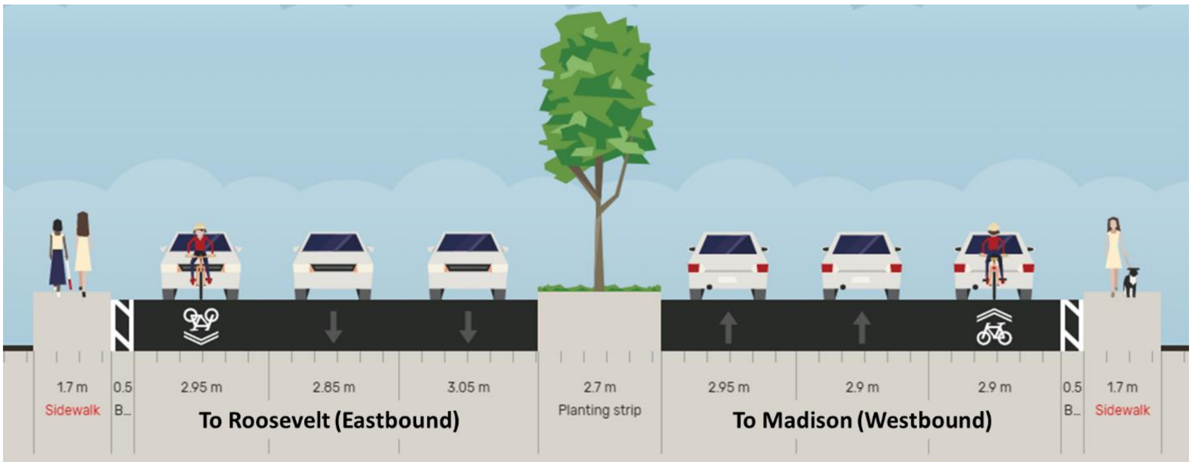
The road segment of Santolan to Madison has three lanes per direction, as shown in Figure 2.1. The eastbound road to Madison has lane widths ranging from 2.90 to 3.00m, while the westbound road to Santolan has lane widths ranging from 2.80m to 3.20m.



Source: JPT

Figure 2.1: Cross-section of Segment from Santolan to Madison

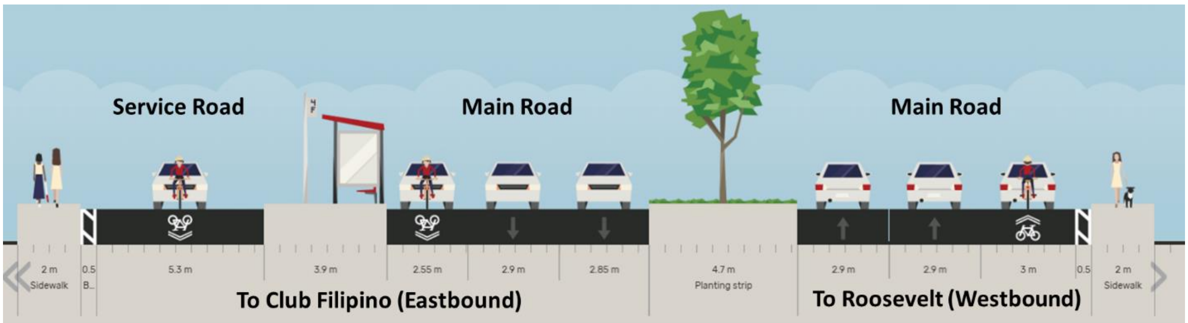
The road segment from Madison to Roosevelt has three lanes per direction. The road to Roosevelt has widths ranging from 2.85 to 3.05m, while the road to Madison has widths ranging from 2.90 to 2.95m.



Source: JPT

Figure 2.2: Cross-section of Segment from Madison to Roosevelt

Going to Club Filipino eastbound, vehicles may take the service road with a carriageway width of 5.30m or the main road, which has three lanes with widths ranging from 2.55 to 2.90m. Meanwhile, vehicles going to Roosevelt westbound have to take the main road which has three lanes with widths ranging from 2.90 to 3.00m.



Source: JPT

Figure 2.3: Cross-section of Segment from Roosevelt to Club Filipino

Vehicles may continue to traverse the service road going to Wilson eastbound with a carriageway width of 5.25m. Another option going to Wilson eastbound is through the main road with three lanes with widths ranging from 3.20 to 4.10m. As for vehicles going to Club Filipino westbound, they may take either the service road with a carriageway width of 5.25m or the main road which has three lanes with widths ranging from 2.40 to 3.40m.

Source: JPT

Figure 2.4: Cross-section of Segment from Club Filipino to Wilson

The service road extends until Connecticut going eastbound. The service road has a carriageway width of 5.30m, while the main road has three lanes with widths ranging from 2.70 to 3.45m. Going to Wilson westbound, vehicles could pass along the service road with a carriageway width of 5.25m or along the main road which has three lanes with widths ranging from 2.90 to 3.00m.

Source: JPT

Figure 2.5: Cross-section of Segment from Wilson to Connecticut

2.2 Traffic Demand

1) Before Pandemic (2019) and During Pandemic (2020)

Comparing the 14-hour traffic volume count data collected from the six intersections along the Ortigas Avenue corridor, Table 2.1 shows that the number of PUVs significantly decreased from 2018/2019 to 2020. This decrease is because of the restriction of public transportation trips ordered by the Philippine government due to the pandemic in 2020. The number of PUJs decreased by 73.89% from 2018/2019 to 2020, while the number of UV express lessened by 52.90%. Bus numbers were also reduced by 36.68% from 2018/2019 to 2020. Due to these travel limitations, the commuting public resorted to using bicycles as an alternative mode of transport. The situation resulted in an increase of 266.43% in bicycle users from 2018/2019 to 2020, as recorded in the 14-hour survey. In total, there was a 5.54% decrease in the number of vehicles plying along Ortigas Avenue from 2018/2019 to 2020.

Table 2.1: Comparison of 14-hour Vehicle Volumes of 2018/2019 and 2020

Time of Day	Car		PUJ		UV		Taxi		PUB		Truck	
	2018/2019	2020	2018/2019	2020	2018/2019	2020	2018/2019	2020	2018/2019	2020	2018/2019	2020
0600 - 0700	13,342	10,447	390	123	17	7	1,053	1,021	164	159	197	145
0700 - 0800	15,963	11,787	546	119	25	20	1,117	1,318	224	166	263	219
0800 - 0900	18,502	15,003	486	117	37	16	1,433	1,596	223	160	280	305
0900 - 1000	17,803	14,605	417	113	15	2	1,379	1,560	212	145	289	419
1000 - 1100	17,931	14,167	401	116	18	3	1,339	1,497	278	145	421	561
1100 - 1200	17,189	15,192	335	98	4	4	1,148	1,403	237	133	440	572
1200 - 1300	17,633	13,835	376	102	13	2	1,074	1,068	225	121	409	405
1300 - 1400	16,514	13,191	338	90	10	3	1,314	1,216	270	147	524	484
1400 - 1500	17,604	13,682	342	79	11	4	1,084	1,189	198	141	443	445
1500 - 1600	18,136	14,468	334	89	0	1	978	1,123	231	143	377	426
1600 - 1700	18,326	15,329	321	95	5	5	942	1,259	236	155	369	393
1700 - 1800	18,131	15,299	342	95	0	4	902	1,139	236	151	320	359
1800 - 1900	17,625	14,594	317	70	0	2	826	1,003	224	139	288	272
1900 - 2000	16,690	13,040	280	58	0	0	739	830	199	94	240	238
TOTAL	241,389	194,639	5,225	1,364	155	73	15,328	17,222	3,157	1,999	4,860	5,243
% Change	-19.37%		-73.89%		-52.90%		12.36%		-36.68%		7.88%	

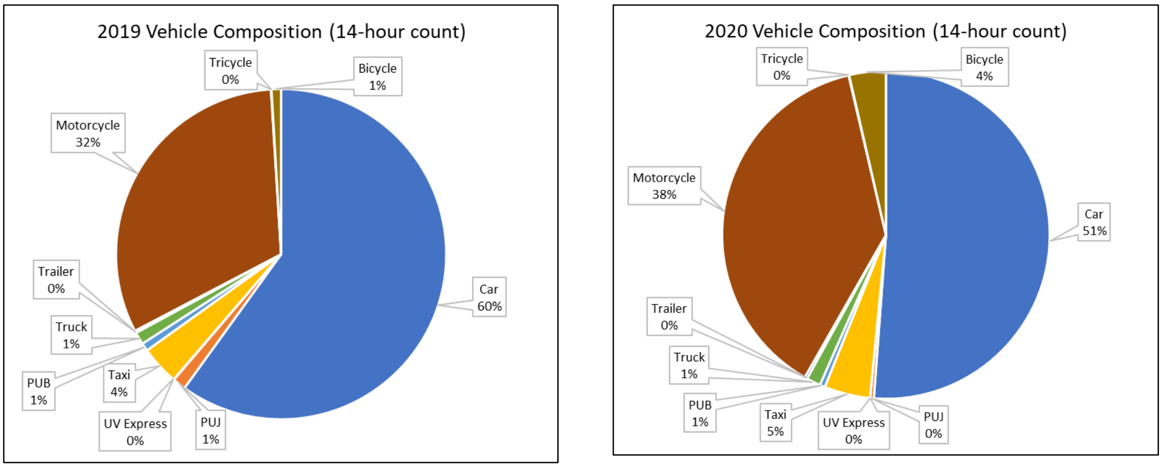
Source: JPT

Table 2.2: Comparison of 14-hour Vehicle Volumes of 2018/2019 and 2020

Time of Day	Trailer		Motorcycle		Tricycle		Bicycle		TOTAL	
	2018/2019	2020	2018/2019	2020	2018/2019	2020	2018/2019	2020	2018/2019	2020
0600 - 0700	1	24	7,440	7,699	14	10	576	2,028	23,194	21,663
0700 - 0800	0	29	10,243	9,433	7	15	821	1,956	29,209	25,062
0800 - 0900	0	27	11,635	10,580	24	25	452	1,551	33,072	29,380
0900 - 1000	15	29	11,022	10,204	15	18	284	1,057	31,451	28,152
1000 - 1100	43	126	9,758	10,663	23	21	179	802	30,391	28,101
1100 - 1200	189	198	8,289	11,537	9	13	147	644	27,987	29,794
1200 - 1300	125	173	7,571	10,618	2	7	111	464	27,539	26,795
1300 - 1400	182	104	7,691	9,605	25	21	97	347	26,965	25,208
1400 - 1500	115	91	8,884	10,280	23	26	100	445	28,804	26,382
1500 - 1600	85	83	8,980	10,507	22	12	111	554	29,254	27,406
1600 - 1700	47	56	9,503	11,429	20	20	274	1,047	30,043	29,788
1700 - 1800	41	32	9,295	11,558	17	13	259	1,229	29,543	29,879
1800 - 1900	30	28	9,026	10,979	11	8	203	903	28,550	27,998
1900 - 2000	20	14	8,271	9,708	11	6	133	703	26,583	24,691
TOTAL	893	1,014	127,608	144,800	223	215	3,747	13,730	**402,585**	**380,299**
% Change	13.55%		13.47%		-3.59%		266.43%		-5.54%	

Source: JPT

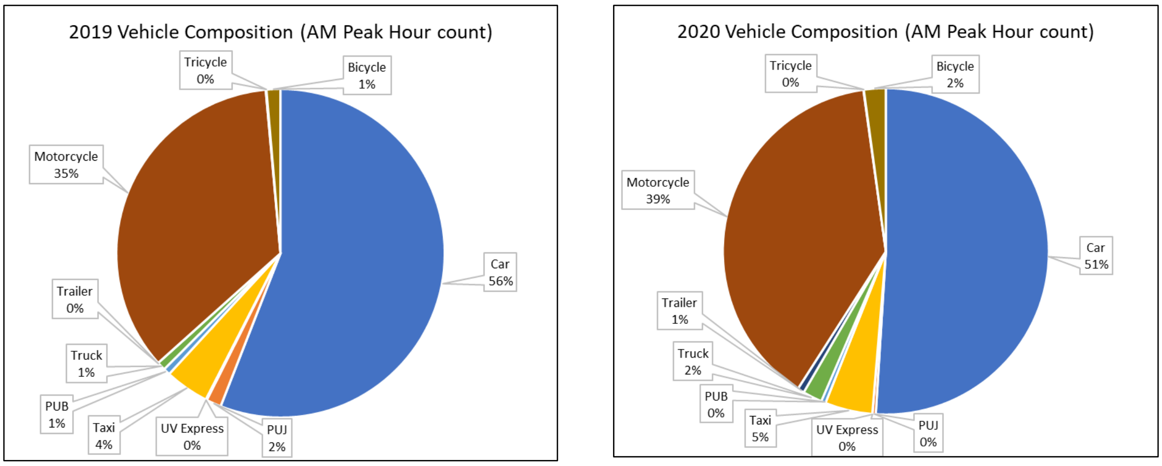
Figure 2.6 shows the 14-hour count vehicle composition of years 2019 and 2020. The figure showed the decrease in the share of cars from 60% in 2019 to 51% in 2020. Moreover, there was an increase in share for motorcycles from 32% in 2019 to 38% in 2020, and bicycles with 1% in 2019 to 4% in 2020.



Source: JPT

Figure 2.6: Comparison of 2019 and 2020 Vehicle Composition (14-hour Count)

The same observation could be seen for the AM peak hour counts of 2019 and 2020. The AM peak hour period for 2019 was from 8–9AM. It shifted to 11AM–12PM in 2020. Cars decreased from 56% to 51% from 2019 to 2020; while an increase in the modal share was seen for motorcycles and bicycles from 2019 to 2020.



Source: JPT

Figure 2.7: Comparison of 2019 and 2020 Vehicle Composition (AM Peak Hour Count)

2) Assumption of Post-Pandemic Traffic Data

One of the considerations in the scenarios for the bike lane study is the post-pandemic traffic volume count data. However, since the data is not available, certain assumptions had to be made to come up with the post-pandemic traffic volume count data.

As seen in Table 2.1, the number of PUVs was greater in 2019 due to pre-pandemic conditions. With the assumption that everything would be back to normal in the post-pandemic scenario, the same number of PUVs was used as post-pandemic traffic data. Aside from that, it was also assumed that bicycle usage in 2020 will continue in the post-pandemic scenario. Thus, the number of bicycle users in 2020 was used as post-pandemic traffic data. As for the other vehicles (cars, taxis, trucks, trailers, motorcycles, and tricycles), the 2019 traffic counts were multiplied by the 2020 vehicle composition. Shown in Table 2.3 are the post-pandemic traffic volume count data using the assumptions stated above.

Table 2.3: Assumed Post-Pandemic Traffic Volume Count Data

Year	Cars	PUJ	UV	Taxi	PUB	Truck	Trailer	Motorcycle	Tricycle	Bicycle	Total (veh/hr)
2019	19,520	**711**	**51**	1,521	**365**	300	0	12,522	27	429	35,447
2020	18,870	120	4	1,730	163	702	250	14,325	17	**811**	36,992
Post-Pandemic	18,108	**714**	**53**	1,582	**366**	704	242	13,657	24	**811**	36,261

Source: JPT

2.3 Scenario Setting

In this study, a total of eight (8) different scenarios were considered. The following traffic management countermeasures were applied in all scenarios: (i) geometric improvements at Club Filipino and (ii) regulation change at the Santolan intersection. The methods also used different traffic demand data: scenarios 1 and 2 used the 2020 traffic volume counts; scenarios 3 and 4 used the 2019 traffic volume counts; scenarios 5A and 5 used the post-pandemic traffic volume counts, and scenarios 6 and 7 used post-pandemic traffic volume counts multiplied by 1.05. Scenarios 6 and 7 were multiplied by 1.05 because the assumed traffic growth rate was 5%. Optimized signal timing and offset data were done in VISTRO software. Moreover, several scenarios have no exclusive bicycle and motorcycle lanes—meaning cyclists use the road with other motorized vehicles. Meanwhile, different scenarios have exclusive bicycle lanes that pass along the main road, while one scenario has an exclusive bicycle lane that passes along the service road. A summary of the scenarios and their corresponding conditions are shown in Table 2.4.

Table 2.4: Summary of Scenarios and Corresponding Conditions

Scenario	Traffic Management Countermeasures	Traffic Demand & Modal Share	Signalization	Dedicated bicycle and motorcycle lanes		
				Not implemented (Shared lanes)	Main Road	Service Road
1	✓	2020 traffic count data & 2020 modal share	Vistro	✓		
2	✓	2020 traffic count data & 2020 modal share	Vistro		✓	
3	✓	2019 traffic count data & 2019 modal share	Vistro	✓		
4	✓	2019 traffic count data & 2019 modal share	Vistro		✓	
5A	✓	Post-pandemic traffic count data & 2020 modal share	Vistro	✓		
5	✓	Post-pandemic traffic count data & 2020 modal share	Vistro		✓	
6	✓	Post-pandemic traffic count data*1.05 & 2020 modal share	Vistro		✓	
7	✓	Post-pandemic traffic count data*1.05 & 2020 modal share	Vistro			✓

Source: JPT

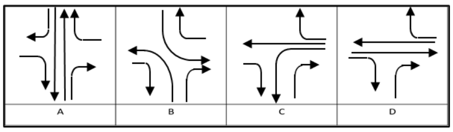
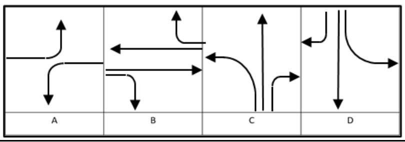
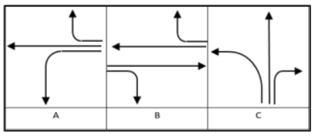
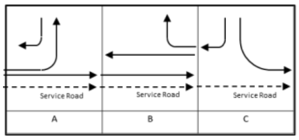
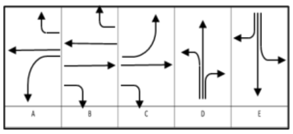
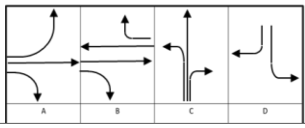
2.4 Signal Optimization in Vistro

The cycle length from the capacity analysis in Case Study 2 (130 seconds) was utilized in optimizing signal phasing and offset timing for 2019 scenarios, namely, scenarios 3, 4, and 5. On the other hand, cycle length from the best scenario in Pilot Project 1 (110 seconds) was applied for 2020 scenarios, namely, scenarios 1 and 2.

PCU values computed from the traffic demand per scenario and the revised signal phasing in Pilot Project 1 in Vistro software were encoded. The network optimization parameters such as the master controller (Ortigas–Santolan), signal coordination group (all six intersections in the study), priority flow (eastbound), and cycle time limits were considered in optimizing the corridor's signal phasing and offset timing. The maximum cycle length assigned to scenarios 6 and 7 was 150 seconds.

VISTRO computes the length of the best fit cycle through the process of iteration. The solution scores of signal coordination based on the objective functions (volume/capacity balancing and minimizing critical movement delay) were calculated with an interval of 5 seconds. The cycle length with the lowest score shall be selected as the best fit cycle length. Table 2.5 shows the optimized signal timing parameter per scenario, while Table 2.6 presents the revised offset and cycle length.

Table 2.5: Signal Timing Parameters and Phasing Diagram

Intersection	Signal Phasing Diagram	Scenario	Phasing				
			A	B	C	D	E
Ortigas – Santolan		Scenario 1 & 2	28	22	32	28	
		Scenario 3 & 4	32	29	33	36	
		Scenario 5	31	27	31	41	
		Scenario 6 & 7	36	31	36	47	
Ortigas – Madison		Scenario 1 & 2	17	59	17	17	
		Scenario 3 & 4	17	76	20	17	
		Scenario 5	17	76	20	17	
		Scenario 6 & 7	17	92	24	17	
Ortigas – Roosevelt		Scenario 1 & 2	17	66	27		
		Scenario 3 & 4	22	81	27		
		Scenario 5	25	78	27		
		Scenario 6 & 7	29	94	27		
Ortigas – Club Filipino		Scenario 1 & 2	45	48	17		
		Scenario 3 & 4	48	65	17		
		Scenario 5	46	67	17		
		Scenario 6 & 7	54	77	19		
Ortigas – Wilson		Scenario 1 & 2	27	30	12	26	15
		Scenario 3 & 4	26	55	12	17	20
		Scenario 5	27	52	13	18	20
		Scenario 6 & 7	31	66	12	21	20
Ortigas – Connecticut		Scenario 1 & 2	20	53	15	22	
		Scenario 3 & 4	31	62	15	22	
		Scenario 5	27	66	15	22	
		Scenario 6 & 7	34	79	15	22	

Source: JPT

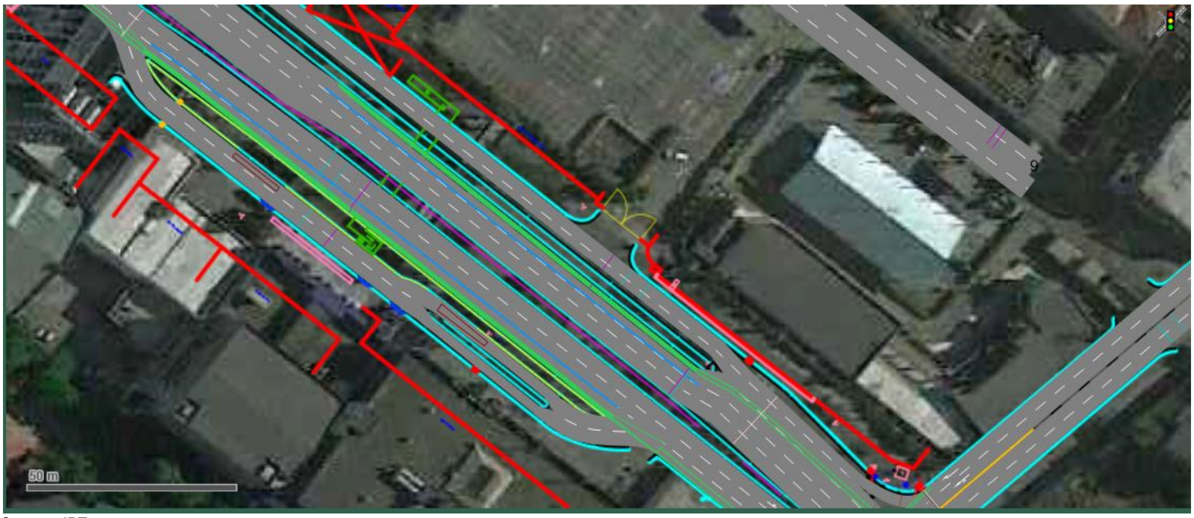
Table 2.6: Revised Offset

Scenario\Intersection	Ortigas-Santolan	Ortigas-Madison	Ortigas-Roosevelt	Ortigas-Club Filipino	Ortigas-Wilson	Ortigas-Connecticut	Cycle Length (s)
Scenario 1 & 2	0	39	31	82	5	49	**110**
Scenario 3 & 4	0	83	71	67	91	9	**130**
Scenario 5	0	29	17	13	39	88	**130**
Scenario 6 & 7	0	28	12	21	47	100	**150**

Source: JPT

3 DEVELOPMENT OF THE SIMULATION MODEL

The study used the simulation model which was created in a previous pilot project (refer to Final Report Appendix I). It has been calibrated and validated already. The simulation model was duplicated and revised based on the conditions of the scenario. Different inputs based on the traffic demand data were prepared, as well as the offset and signal timing data. Since the previous simulation model had bicycle lanes along the service road, the major revision that had to be done was to relocate the bicycle lanes along the main road. Figure 3.1 shows a screenshot of the road with the bicycle lanes (in green line) on the main road.



Source: JPT

Figure 3.1: Screenshot of Simulation Model with Bicycle Lanes along the Main Road

3.1 Development of Dedicated Bike Lanes and Motorcycle Lanes

In response to the safety issues for bike lane and motorcycle lane, preliminary bike lanes implemented by San Juan City were reviewed. Based on the Japanese bike lane environment and DPWH guidelines, improvement measures were discussed by the MMDA and the San Juan City LGU.

The JPT proposed to either have shared bicycle lanes or exclusive bicycle and motorcycle lanes along the Ortigas corridor. To ensure safety at sections, such as intersections and bus stops which have a risk of conflict, the following principles were recommended to enhance road safety:

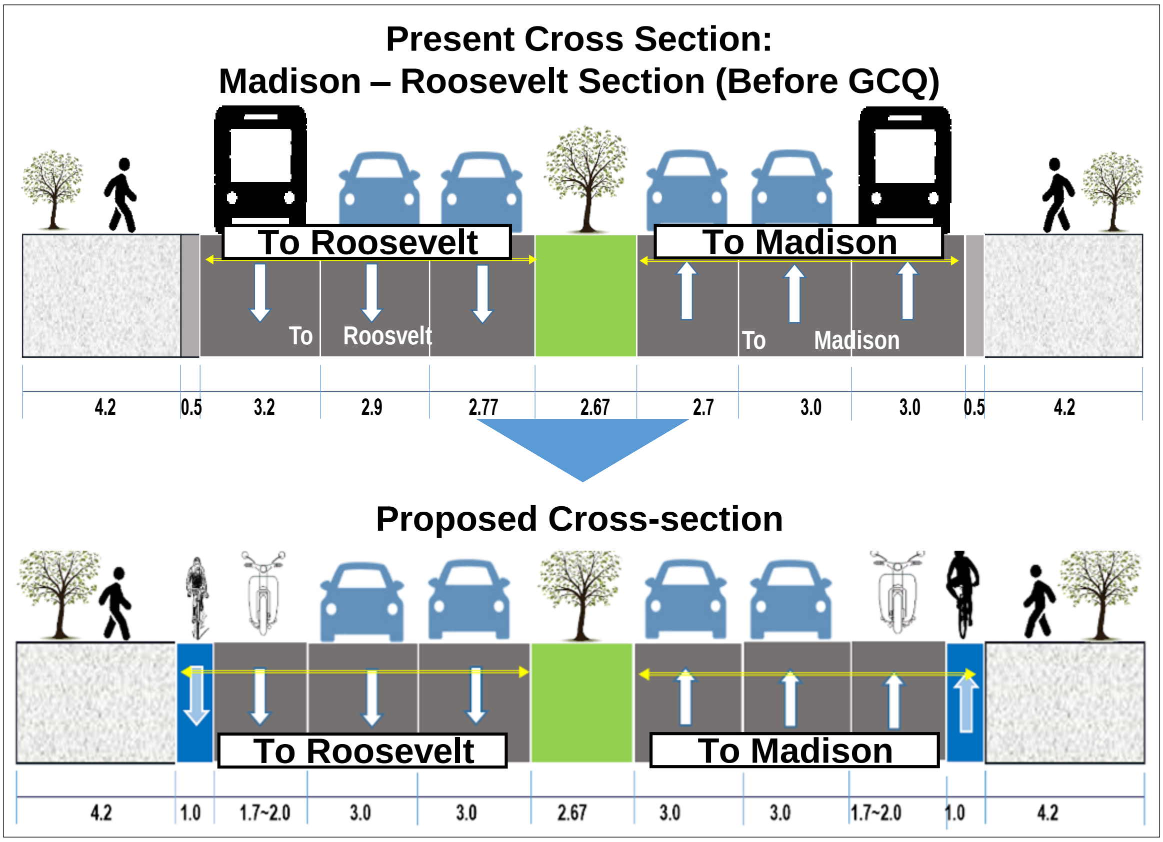
(i) The bike lane should secure 1.0m width or more and should be placed on the outermost lane.

(ii) If service roads are available, it should be utilized to secure capacity for traffic and safety.

(iii) Exclusive bike lane should be separated by bollards.

(iv) If the road’s traffic capacity near an intersection cannot be maintained, a shared lane without bollards can be introduced. It should be indicated by noticeable arrow markings.

Figure 3.2 shows the proposed drawing of a cross-section with bike lanes.



Source: JPT

Figure 3.2: Proposed Cross-section Layout with Bike Lane

3.2 Intersection Layout with Arrow Markings

The following principles of intersection layout were recommended to promote safety:

(i) Appropriate separation and coexistence among pedestrians, bicyclists, and motorists at intersections;

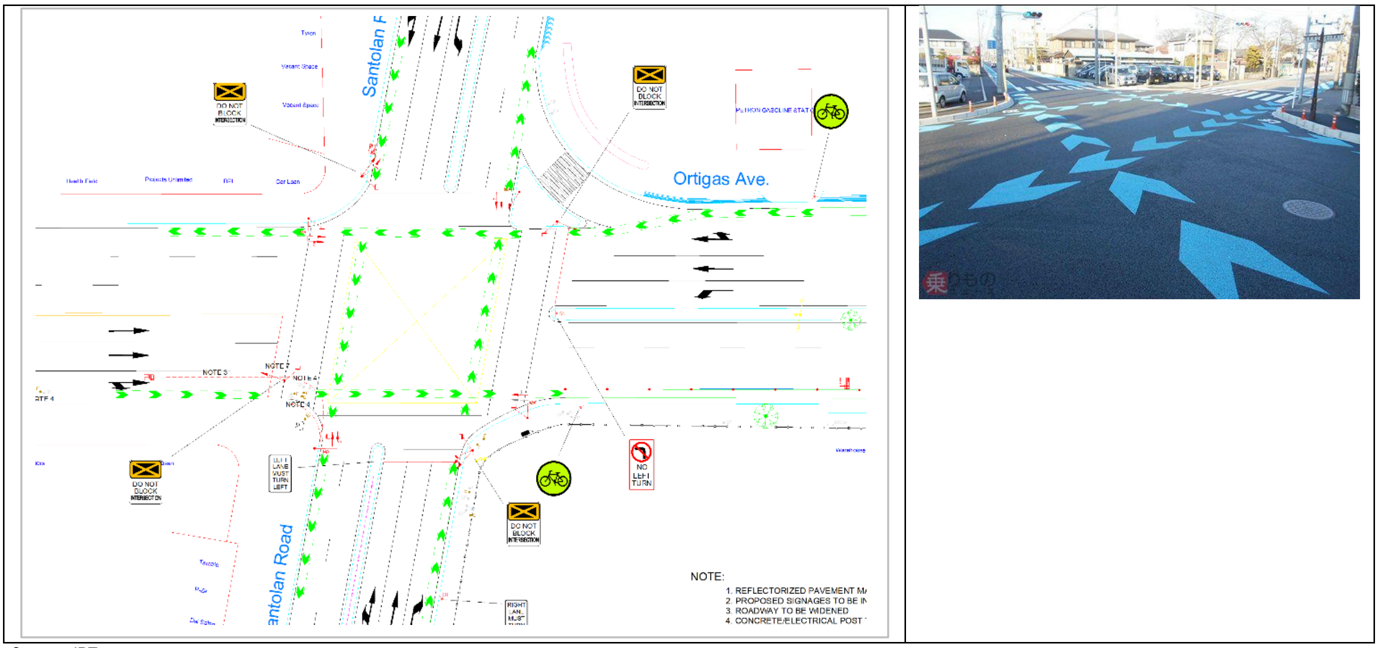
(ii) Lane markings in the intersection should be kept straight;

(iii) Direction of traffic within an intersection should be clear;

(iv) Safety measures for right turn (signal for bicycle, road marking); and

(v) Securing stagnation space for two-step left turns of bicycle.

Based on these principles, arrow road markings indicating bicycle lanes were proposed to clarify the traffic flow at the intersection, as illustrated in Figure 3.3.

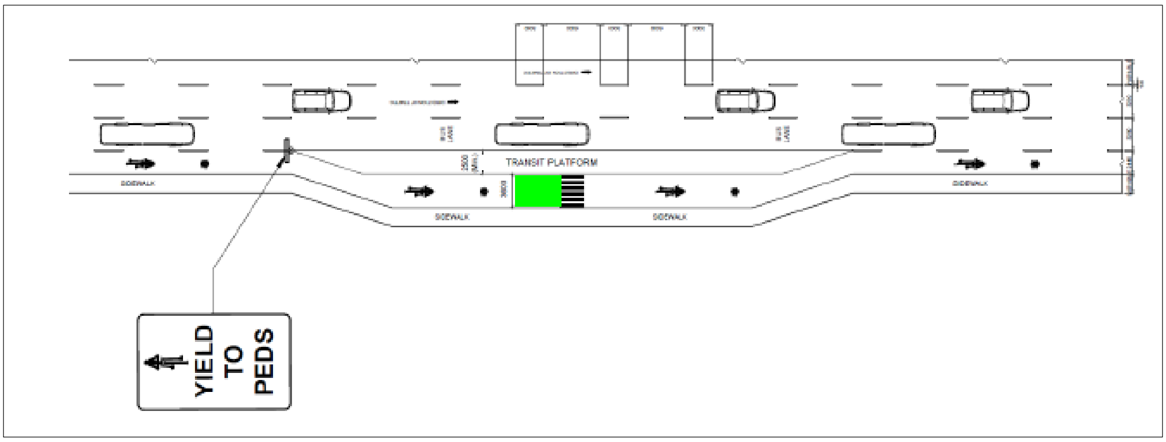


Source: JPT

Figure 3.3: Proposed Layout of Bike Lane at an Intersection and an Example in Japan

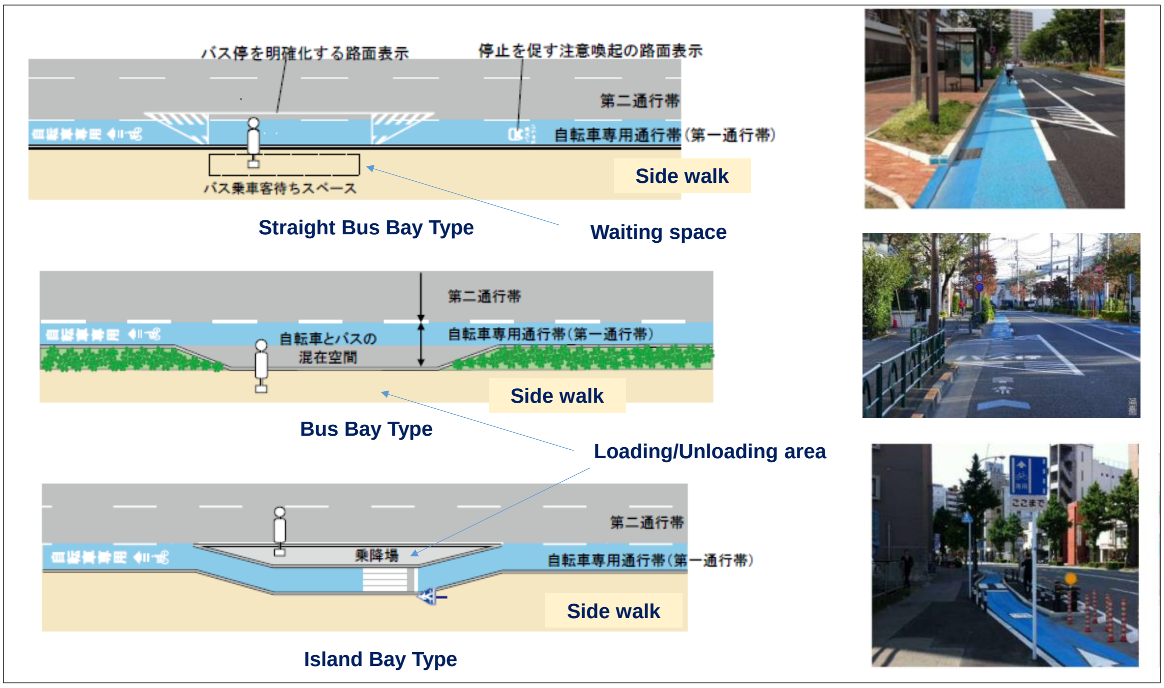
3.3 Improvement of PUB/PUJ Loading and Unloading Areas (Transit Platforms)

A transit platform to improve PUB/PUJ loading and unloading area was proposed to avoid conflict between bicycles and passengers. Based on the "Guidelines on the Design of Bicycle Facilities along National Roads," shifting the bike to the sidewalk side to secure the transit platform and yield to pedestrians is recommended, as shown in Figure 3.4. The island bus bay type is recommended by the "Bicycle Environmental Guideline in Japan" if there is enough space. If sufficient space is not available, it is recommended to have road markings displaying bus bays for cyclists to know that they are approaching a bus stop.



Source: DPWH Guidelines on the Design of Bicycle Facilities Along National Roads

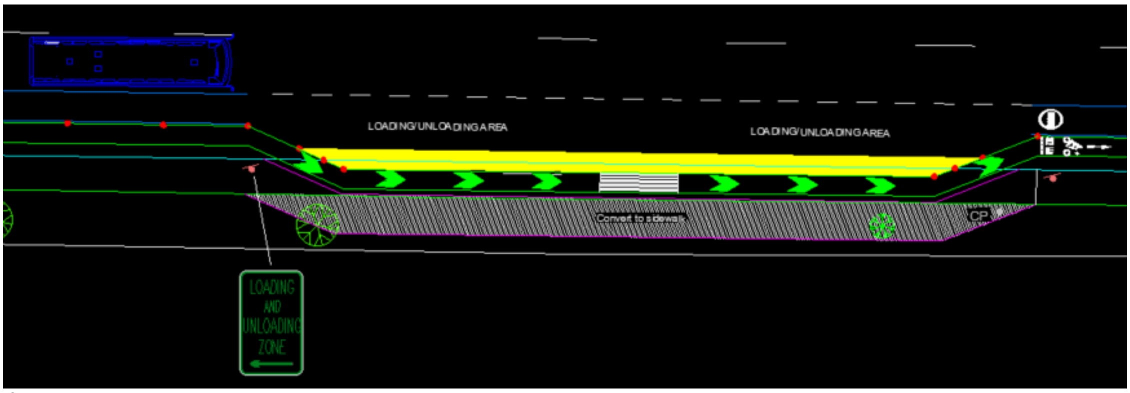
Figure 3.4: Sample of Transit Stop Loading and Unloading Bay (with Transit Platform) Recommended by DPWH Guidelines



Source: Guidelines for Creating a Safe and Comfortable Bicycle Usage Environment Ministry of Land Infrastructure and Tourism,Japan

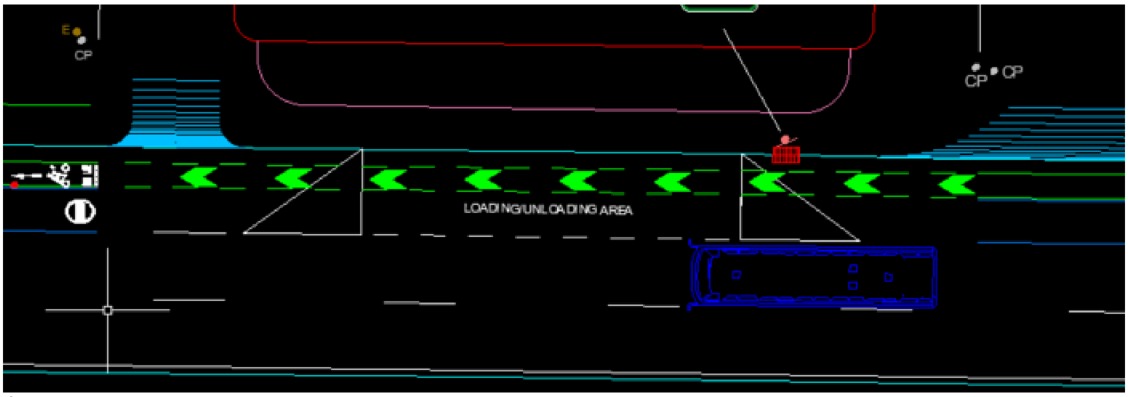
Figure 3.5: Sample of Transit Stop Bay Recommended by Bicycle Environmental Guideline in Japan

In this study, two transit platforms located between Santolan and Madison and between Madison and Club Filipino eastbound were proposed. Also, two locations were designed as straight bus bays westbound.



Source: JPT

Figure 3.6: Proposed Transit Stop Loading and Unloading Bay (with Transit Platform)



Source: JPT

Figure 3.7: Proposed Transit Stop Loading and Unloading Bay

4 EVALUATION

4.1 Key Performance Indicators

Key performance indicators (KPIs) will help evaluate the impact of the implementation of bicycle lanes on the traffic flow. The JPT performed corridor analysis since the bicycle lanes are located along the corridor. Vehicle travel time counters were placed at the east of Santolan intersection and at the west of Connecticut intersection to satisfy the KPIs, as shown in Figure 4.1.

The KPIs to evaluate the study are the following:

(a) **Average Travel Time (sec):** The average travel time of all vehicles passing from Santolan to Connecticut and vice versa.

(b) **Average Delay (sec):** The difference between the theoretical free-flow travel time and the simulated travel time of all vehicles passing from Santolan to Connecticut and vice versa.

(c) **Average Travel Speed (kph):** The distance between Santolan and Connecticut (2.3 km) over the average travel time of vehicles passing through the eastbound and westbound directions starting and ending in Santolan and Connecticut.

Source: JPT

Figure 4.1: Location of Vehicle Travel Time Counters

Tables 4.1 and 4.2 presents the KPI results of the simulation per scenario. Comparing scenarios 1 (without bicycle lane) and 2 (with bicycle lane), there was a 10-second increase in average travel time in scenario 2 for other vehicles. As for scenarios 3 (without bicycle lane) and 4 (with bicycle lane), there was a 15-second increase in the average travel time for scenario 4. Meanwhile, scenarios 5A (without bicycle lane) and 5 (with bicycle lane) show a 20-second increase in the average travel time when bicycle lanes are implemented. Based on these percentages, it can be said that the implementation of bike lanes has no significant impact on reducing road capacity. The same trend could be observed for the average delay. Furthermore, the KPIs of scenario 7 was more favorable compared with scenario 6 which both have dedicated bike lanes. The positive outcome of scenario 7 may be due to the bicycle lanes passing along the service road.

Table 4.1: KPI Results for Scenarios 1 to 4

Key Performance Indicator	Direction	SC1		SC2		SC3		SC4	
		Other Vehs	Bikes	Other Vehs	Bikes	Other Vehs	Bikes	Other Vehs	Bikes
Average Travel Time (sec)	EB	275	378	291	443	276	385	309	404
	WB	233	353	238	387	286	355	274	399
	Weighted Ave. EB & WB	254	366	264	411	280	368	295	400
Average Delay (sec)	EB	139	87	152	150	144	95	175	108
	WB	112	66	114	93	165	64	149	104
	Weighted Ave. EB & WB	125	77	133	118	153	77	165	106
Average Travel Speed (kph)	EB	30.1	21.9	28.5	18.7	30.0	21.5	26.8	20.5
	WB	35.5	23.5	34.8	21.4	28.9	23.3	30.3	20.8
	Weighted Ave. EB & WB	32.9	22.7	31.7	20.2	29.6	22.5	28.2	20.7

* SC1 (without bicycle lane) and SC2 (with bicycle lane), 2020 Traffic Volume (During Pandemic)
* SC3 (without bicycle lane) and SC4 (with bicycle lane), 2019 Traffic Volume (Before the Pandemic)
Source: JPT

Table 4.2: KPI Results for Scenarios 5 to 7

Key Performance Indicator	Direction	SC5A (Post Pandemic w/o bikes)		SC5 (Post Pandemic w/ bikes)		SC6		SC7	
		Other Vehs	Bikes	Other Vehs	Bikes	Other Vehs	Bikes	Other Vehs	Bikes
Average Travel Time (sec)	EB	328	410	348	431	400	443	347	0
	WB	328	357	277	385	294	393	302	358
	Weighted Ave. EB & WB	328	386	319	405	356	414	328	358
Average Delay (sec)	EB	195	119	214	138	266	148	213	0
	WB	206	67	153	91	170	101	178	65
	Weighted Ave. EB & WB	199	96	189	112	225	120	198	65
Average Travel Speed (kph)	EB	25.2	20.2	23.8	19.2	20.7	18.7	23.8	0.0
	WB	25.3	23.2	29.9	21.5	28.1	21.1	27.4	23.1
	Weighted Ave. EB & WB	25.2	21.5	26.3	20.5	23.8	20.1	25.3	23.1

*SC5A (without bicycle lane) and SC5 (with bicycle lane), Post-Pandemic assumption
*SC6 (with bicycle lane) and SC7 (with bicycle lane + Service road), Post-Pandemic assumption *1.05
*Travel Speed in SC7cannot computed in same section because of the utilization of service road.
Source: JPT

4.2 Safety

In this study, the JPT evaluated the safety of implementing separate bicycle lanes compared to having shared lanes. The following were done to assess the road safety for bicycle users:

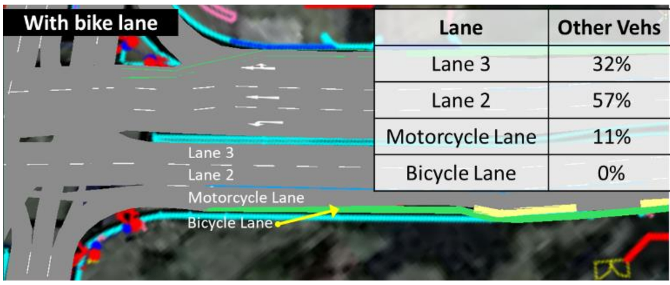
(i) Set a detector at each lane;

(ii) Count volume of each mode;

(iii) Compare modal share rate for each lane;

Based on the results, 87% of bicycles used the outermost lane (lane 1) when there was no bicycle lane, as shown in Figure 4.2. Having a physically separated bicycle lane would be safer for bike users as it would lessen road conflicts with other vehicles.

Lane	Other Vehs	Bicycle	Motorcycle
Lane 3	31%	1%	21%
Lane 2	40%	11%	33%
Lane 1	29%	87%	46%



Lane	Other Vehs	Bicycle	Motorcycle
Lane 3	32%	0%	9%
Lane 2	57%	0%	34%
Motorcycle Lane	11%	0%	57%
Bicycle Lane	0%	100%	0%

Source: JPT

Figure 4.2: Safety Evaluation of Bicycle Lane

4.3 Passenger Estimates

The passenger estimates in passenger-kilometers were evaluated. The recorded number of vehicles in the simulation per scenario was multiplied by the 24-hour passenger factor from MUCEP 2015 to compute the passenger estimates. After that, it was multiplied by the distance traveled by the corresponding mode of transport.

As presented in Table 4.3, the scenarios with the least number of passenger estimates for PUVs are scenarios 1 and 2 since they used the 2020 traffic count data, which is reasonable since the government limited public transportation when the pandemic hit in 2020. When bike lanes are built, passenger-km tends to decrease slightly but not significantly.

Table 4.3: Passenger Estimates per Scenario

Passenger Estimate											
Passenger Factor (24 hrs)		1.58	2.17	34.19	1.0	0.81	8.84	6.06	0.94	1.2	
Scenario	**Direction**	**Car**	**HGV**	**Bus**	**Bike**	**Taxi**	**Jeepney**	**UV**	**Tricycle**	**Motorcycle**	**Total (passenger-km)**
Scenario 1	EB	1,550.27	127.35	693.77	36.68	54.96	228.30	0.00	1.72	957.34	3,651
	WB	1,822.61	99.49	439.33	34.84	71.31	178.50	6.06	0.00	897.90	3,551
Scenario 2	EB	1,564.96	144.09	761.13	33.24	64.24	229.59	0.00	1.73	953.96	3,753
	WB	1,737.44	103.40	439.03	36.70	59.38	178.38	11.12	0.00	884.12	3,450
Scenario 3	EB	1,834.51	63.68	1,576.31	38.62	78.73	1,141.18	11.18	3.45	1,347.45	6,096
	WB	1,597.25	31.84	2,133.94	55.01	90.62	584.20	33.37	0.00	911.34	5,438
Scenario 4	EB	1,831.26	48.04	1,522.27	38.79	79.21	1,115.18	11.24	5.20	1,313.34	5,965
	WB	1,555.03	31.82	2,195.14	71.57	92.04	583.78	33.35	0.00	862.57	5,426
Scenario 5A	EB	1,890.66	175.17	1,450.60	40.35	78.76	1,125.18	11.18	3.45	1,224.26	6,000
	WB	1,715.41	91.53	2,133.88	34.84	66.85	584.18	11.12	0.00	884.69	5,523
Scenario 5	EB	1,807.71	172.17	1,395.40	33.24	82.20	1,065.96	11.24	3.47	1,178.21	5,750
	WB	1,630.30	99.60	2,195.14	34.87	59.38	583.78	33.35	0.00	833.54	5,470
Scenario 6	EB	1,822.45	160.33	1,585.68	33.24	82.20	1,147.96	22.48	1.73	1,182.66	6,039
	WB	1,714.72	99.81	2,383.30	36.70	68.29	616.21	44.47	0.00	881.93	5,846
Scenario 7	EB	1,880.80	168.14	1,521.38	0.00	71.74	1,082.91	22.47	1.73	1,195.53	5,945
	WB	1,730.30	107.28	2,381.34	44.00	68.32	615.71	44.43	0.00	889.88	5,882

* SC1 (without bicycle lane) and SC2 (with bicycle lane), 2020 Traffic Volume (During Pandemic)
* SC3 (without bicycle lane) and SC4 (with bicycle lane), 2019 Traffic Volume (Before the Pandemic)
*SC5A (without bicycle lane) and SC5 (with bicycle lane), Post-Pandemic assumption
*SC6 (with bicycle lane) and SC7 (with bicycle lane + Service road), Post-Pandemic assumption *1.05
*Travel Speed in SC7cannot computed in same section because of the utilization of service road.
Source: JPT

5 CONCLUSION AND FINDINGS

As seen from the simulation results, implementing bicycle lanes has minimal effect on the traffic flow. Thus, if the Philippine government will continue to promote active transport, dedicated bicycle lanes along corridors with physical barriers are recommended to increase road safety of bike users and to promote smoother traffic.

The following are the recommendations for the bicycle lane network along the Ortigas corridor:

(i) Use of physical delineators or barriers would improve bicycle lane implementation;

(ii) There should be the improvement in the transit platforms of PUVs;

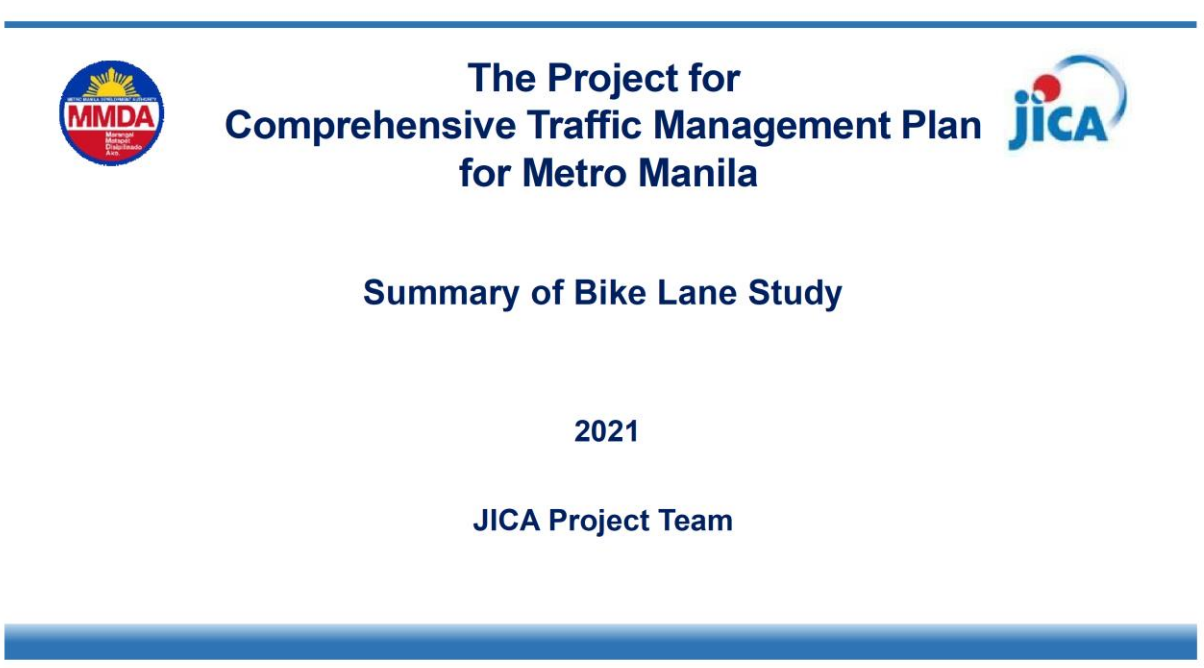
(iii) Clear lane markings should be provided at intersections;

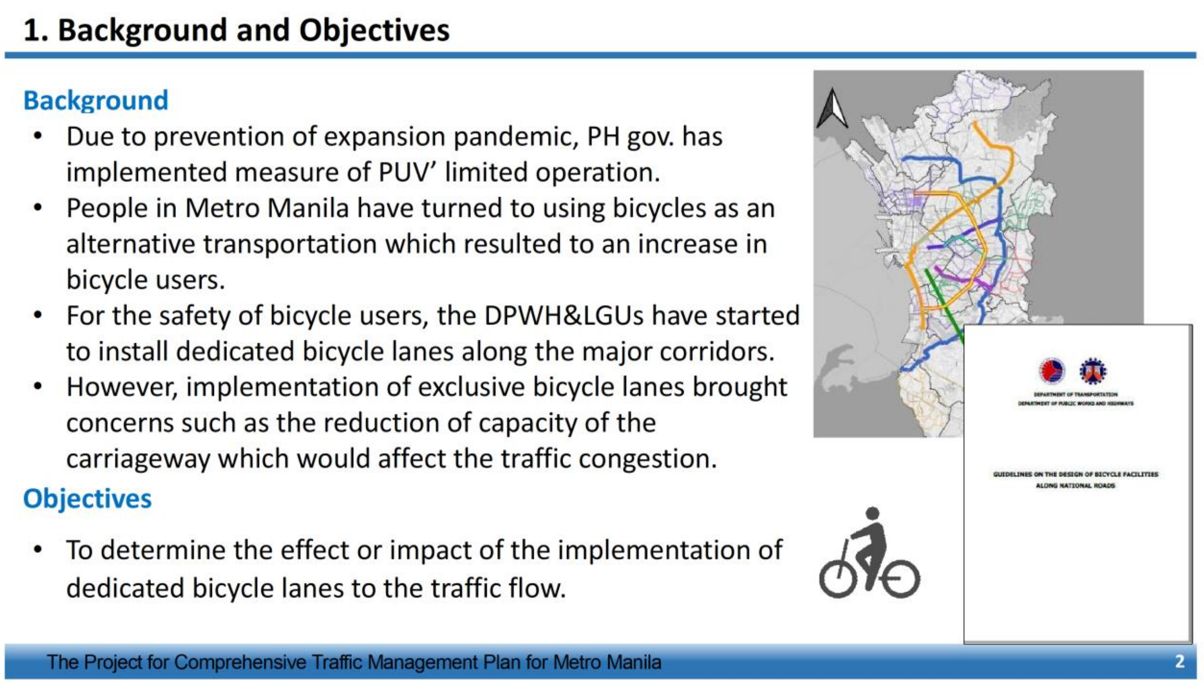
(iv) Service roads should be used optimally; and

(v) Traffic signals for bicycle users should be implemented.

However, the results and recommendations of this study are for the Ortigas corridor only. Further studies should be made if dedicated bicycle lanes will be implemented in other areas. Several factors such as the number of lanes, road width, traffic volume, and road configuration, among others should be considered in the analysis.

6 REFERENCE


MMDA
The Project for
Comprehensive Traffic Management Plan
for Metro Manila
JICA
Summary of Bike Lane Study
2021
JICA Project Team

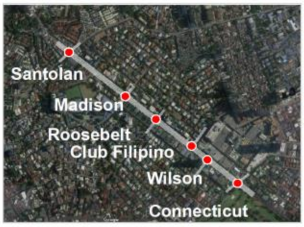

1. Background and Objectives
Background
• Due to prevention of expansion pandemic, PH gov. has implemented measure of PUV' limited operation.
• People in Metro Manila have turned to using bicycles as an alternative transportation which resulted to an increase in bicycle users.
• For the safety of bicycle users, the DPWH&LGUs have started to install dedicated bicycle lanes along the major corridors.
• However, implementation of exclusive bicycle lanes brought concerns such as the reduction of capacity of the carriageway which would affect the traffic congestion.
Objectives
• To determine the effect or impact of the implementation of dedicated bicycle lanes to the traffic flow.
DEPARTMENT OF TRANSPORTATION
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
GUIDELINES ON THE DESIGN OF BICYCLE FACILITIES ALONG NATIONAL ROADS
The Project for Comprehensive Traffic Management Plan for Metro Manila
2

2. Result of Case Study (Micro Simulation)

Study Area:

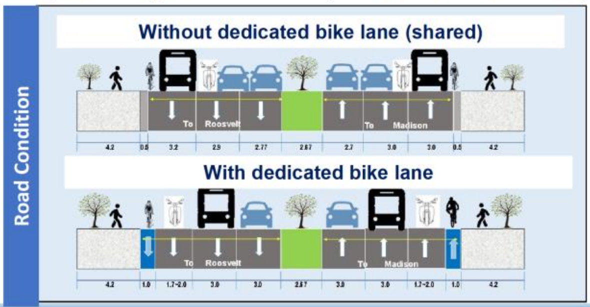
Ortigas Ave. from Santolan to Connecticut

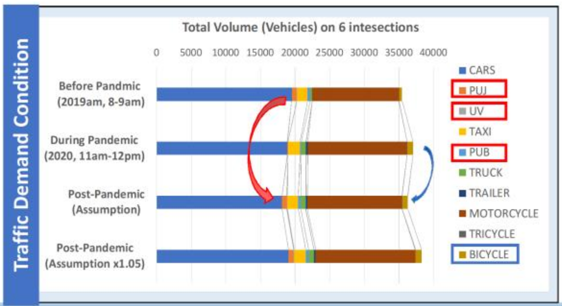
- San Juan has already implemented dedicated bike lane and motorcycle lanes on the site.



Pre-Conditions / Scenario setting :

Depend on preconditions (road, traffic demand), the affect will be difference:





2. Result of Case Study (Micro Simulation)

Study Result

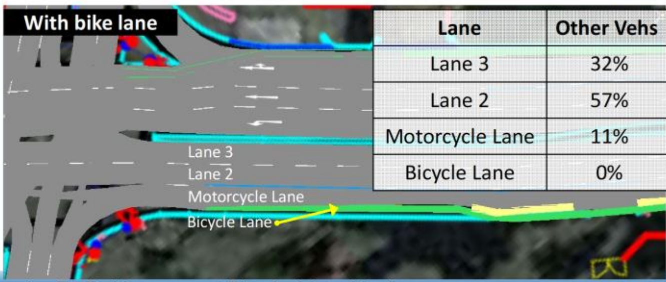
- In case of 3lanes per direction, based on comparison between without and with dedicated bike lane, there is not significant affect for travel time. (same traffic demand, modal share)
- In case of post pandemic (recovered PUV), also not significant negative impact.

2020 +10s 2019 +15s +20s

Key Performance Indicator	Direction	During Pandemic				Traffic same as Before Pandemic				Post Pandemic			
		Without bike lane		With bike lane		Without bike lane		With bike lane		Without bike lane		With bike lane	
		Other Vehs	Bikes	Other Vehs	Bikes	Other Vehs	Bikes	Other Vehs	Bikes	Other Vehs	Bikes	Other Vehs	Bikes
Average Travel Time (sec)	EB	275	378	291	443	276	385	309	404	326	403	383	445
	WB	233	353	238	387	286	355	274	399	317	360	284	402
	Weighted Ave. EB & WB	254	366	264	411	280	368	295	400	322	384	342	421
Average Delay (sec)	EB	139	87	152	150	144	95	175	108	193	113	249	151
	WB	112	66	114	93	165	64	149	104	195	70	159	110
	Weighted Ave. EB & WB	125	77	133	118	153	77	165	106	194	94	211	128
Average Travel Speed (kph)	EB	30.1	21.9	28.5	18.7	30.0	21.5	26.8	20.5	25.4	20.5	21.6	18.6
	WB	35.5	23.5	34.8	21.4	28.9	23.3	30.3	20.8	26.1	23.0	29.2	20.6
	Weighted Ave. EB & WB	32.9	22.7	31.7	20.2	29.6	22.5	28.2	20.7	25.7	21.7	24.8	19.7

- The separation of bicycles and other vehicles will improve safety.

Lane	Other Vehs	Bicycle	Motorcycle
Lane 3	31%	1%	21%
Lane 2	40%	11%	33%
Lane 1	29%	87%	46%



Lane	Other Vehs	Bicycle	Motorcycle
Lane 3	32%	0%	9%
Lane 2	57%	0%	34%
Motorcycle Lane	11%	0%	57%
Bicycle Lane	0%	100%	0%

3. Conclusion and Recommendation

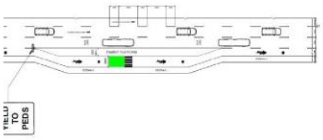
Conclusion and Findings based on Case Study

- If PH Gov. promote active transport and intend to keep or increase bicycle users, dedicated bike lanes along the major corridors (more than 3 lanes) separate bicycles from other vehicles to reduce conflicts and ensure safety and smooth traffic flow.

→ However, if bike lane develop, the study carefully for specific section is essential. Consider No. lane, width, traffic volume, configuration

Recommendation for Ortigas Corridor Bike Lane Network

- The use of physical delineators or barriers would improve bike lane implementation
- Improvement of PUVs transit platforms
- Provide lane markings at intersection layouts
- Better utilization of service roads
- Implement signalization for bicycle users



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE PROJECT FOR COMPREHENSIVE TRAFFIC MANAGEMENT PLAN FOR METRO MANILA

TECHNICAL REPORT NO. 13

ACTIVE TRANSPORT

November 2022

ALMEC CORPORATION
ORIENTAL CONSULTANTS GLOBAL CO., LTD.
TRANSPORTATION RESEARCH INSTITUTE CO., LTD.

TABLE OF CONTENTS

APPENDICES

List of Tables

LIST OF FIGURES

ABBREVIATIONS

AT	active transportation
C-road	circumferential road
CTMP	Comprehensive Traffic Management Plan
DILG	Department of the Interior and Local Government
DOTr	Department of Transportation
DPWH	Department of Public Works and Highways
EDSA	Epifanio delos Santos Avenue
JICA	Japan International Cooperation Agency
JPT	JICA Project Team
JUMSUT	JICA Update on Manila Study on Urban Transport
LGU	local government unit
MM	Metro Manila
MMDA	Metropolitan Manila Development Authority
MMUTIS	Metro Manila Urban Transportation Integration Study
MUCEP	MMUTIS Update and Capacity Enhancement Project
NGA	national government agency
NGO	non-government organization
PWD	person with disability
R-road	radial road

1 INTRODUCTION

1.1 Background

Active transportation, active transport, soft mobility, human-powered transport, non-motorized transportation (NMTs), and the like, are forms of transportation that are built on physical activity. Some examples of these are walking, bicycling, scooting, skateboarding, etc. The term active was considered since not only does it promote an affordable non-polluting sustainable form of transportation, but it also encourages healthy physical activity.

In Metro Manila, the use of the road is a privilege, and with the DOTr and DPWH laying out bike lanes along the carriageway, bicycle users must commit to following traffic rules and regulations on the road that motorized vehicles comply with. By having a share of the road space, bicycle users also share the responsibility and the accountability to abide by traffic enforcement. It is in this regard, at least from the perspective of traffic management, that bicycles can be treated as vehicles as well. Therefore, pedestrian transportation and bicycle transportation should be analyzed separately, to lay out the current issues and prospective programs for both sectors of active transport.

1.2 Objectives

This chapter aims to lay out the initial action plan to improve active transport in Metro Manila by doing the following:

(i) Understand the situation of active transport in Metro Manila using the data available.

(ii) Develop a walkability index of sidewalks given the material on hand and assess the walkability of the major roads of LGUs.

(iii) Perform a case study to evaluate the walkability of local roads in the city of Mandaluyong.

(iv) Propose an inter-agency coordination framework for local roads' traffic management and transport planning.

2 STATUS OF ACTIVE TRANSPORTATION (AT)

2.1 Before Pandemic

LGUs have historically been the pioneer of bike lane construction. In 2003, the city of Marikina started to build its bike lane network, and to date, it boasts a respectable 52km bike lane network. Additionally, the bike capital of the Philippines Iloilo city has bested all LGUs in the country with its comprehensively built 11-km bike lane network which was poised to expand to 32km. The cities of Marikina and Iloilo prove that they have been the prime movers of bicycle users in the country and should be a great example of how LGUs can champion the cause of active transportation. Currently, other LGUs in Metro Manila such as the cities of Quezon City, Pasig City, and Taguig City are planning their bike lane network as well.

Source: brommieskywalker.blogspot.com (L) and facebook.com/ Iloilo Bike Lanes/ (R)

Figure 2.1: Bike Lane Networks of Marikina City (Left) and Iloilo City (Right)

2.2 Pandemic's Effect on AT

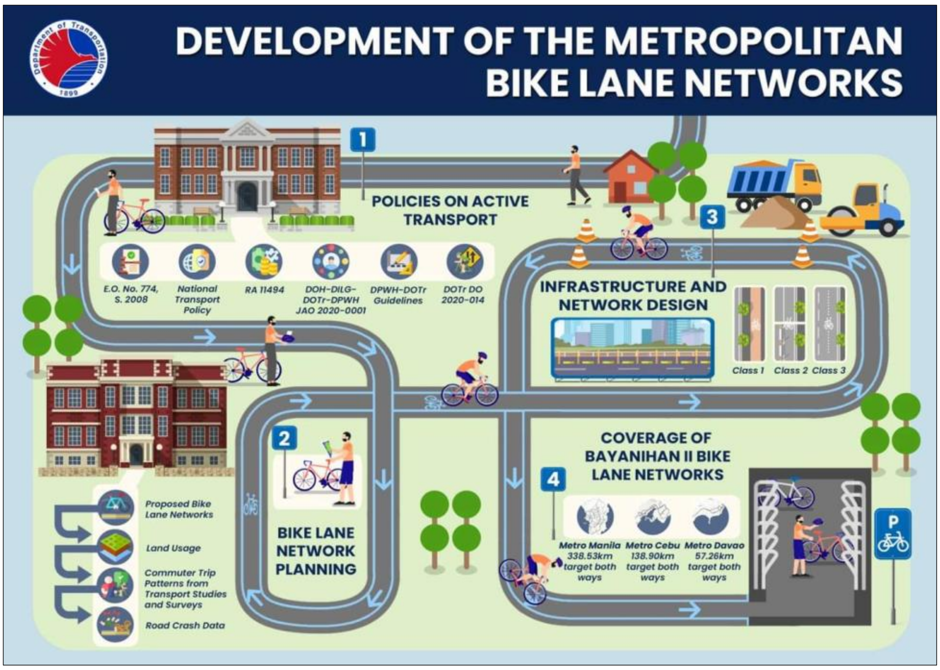
Public transportation was shut down during the pandemic. The commuters' way of traveling to work, groceries, or trips were thru private motorized vehicles, walking and cycling. Even when the quarantine restrictions were eased, public transportation resumed, and public utility vehicles had reduced capacity to ensure social distancing. These events led to the rise of the number of bicycle users in Metro Manila, and other megacities such as Cebu and Davao.

This bike boom prompted the DOTr and DPWH to hastily build and pop bike lanes for bicycle users in Metro Manila. To date, more than 300km of bike lanes have been erected in Metro Manila, and over 500km of bike lane network have been constructed in the country in less than a year, mostly in urban centers such as Cebu, and Davao. The political will of the agency made the promotion of active transportation a priority, and with the EDSA greenways project underway, active transportation has solidified its spot in Metro Manila's transportation roadmap. Given this, monitoring and evaluation of the constructed bike lanes are significant in their maintenance and expansion in the greater Metro Manila area. According to the MMDA's Bike Lane Program Office, more than 200,000 bike trips were recorded on Commonwealth Ave., Ortigas Ave., and Quirino Ave. in April 2022 only.

Additionally, the Institute for Climate and Sustainable Cities (ICSC) estimated that around half a million daily bicycle users during the peak of the pandemic in 2021. Even with the resumption of public transportation, bicycle lanes have been part of the promotion of active transport by the NGAs and LGUs. With the resumption of public utility vehicles' full capacity, the number of bicycle lane users is to decrease. Now, the question is not whether to remove the mere painting that was marked along the road but how to optimize mode allocation of the carriageway.

2.3 Current Policies in Active Transportation

As stated above, Marikina City initiated the promotion of non-motorized transportation. The DOTr laid out the development of the Metro Manila bike lane networks in four (4) steps, as shown below:



Source: DOTr Website : https://dotr.gov.ph/55-dotrnews/3375-why-are-we-developing-bike-lanes-in-metropolitan-areas.html

Figure 2.2: DOTr's Bike Lane Development Program

First, the policies on bicycle transportation (and active transportation) in general were laid out in several key national government statutes such as the:

(a) **E.O. No. 774, s. 2008:** To re-organize the presidential task force on climate change, this E.O. was promulgated. Along with its provisions, it stated that the then DOTC shall lead a Task Group to reform its transportation sector. The main guiding principle asserted was that non-motorized locomotion and collective transportation shall be favored in the new transportation system.

(b) **NEDA National Transport Policy**: In its Implementing Rules and Regulations, inclusive and people-oriented mobility was stated to be prioritized over vehicle mobility. This crystal-clear policy direction would be enough for decision-makers in national government agencies to put forth all sectors of active transport, both walking and bicycle use, as their main concern.

(c) **DOH-DILG-DOTr-DPWH Joint Administrative Order 2020-0001**: The JAO was guidance on the implementation of AT projects by delineating the roles of national government agencies and local government units.

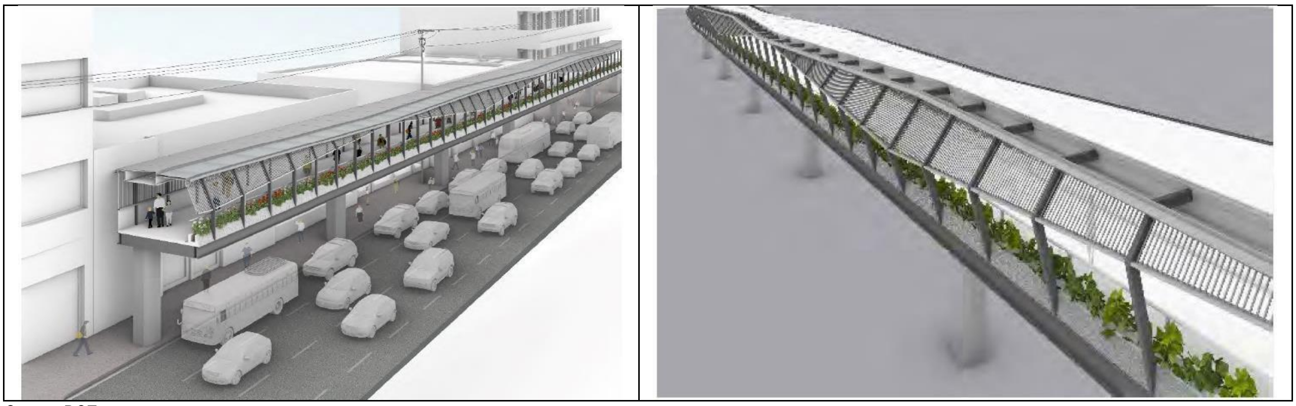
Second, in their Bike Lane Network Planning, the DOTr based the bike lane network maps on groups such as MNL Moves, the Institute of Climate and Sustainable Cities, and the

University of Twente. Additionally, the key activity areas were overlaid based on the land use data from MMDA and OSM. Given these, an inquiry on how these studies from independent groups and institutions would simply work out on the carriageway of Metro Manila's major arterials and thoroughfares would be appropriately warranted.

Given these, the DOTr, with the help of other government and non-government agencies such as DPWH, MMDA, and DILG, has constructed more than 500km of bike lane network around the country, with Metro Manila, Cebu, and Davao being the pilot projects. Below is the current bike lane network map in Metro Manila showing the existing and planned lanes for the different cities.

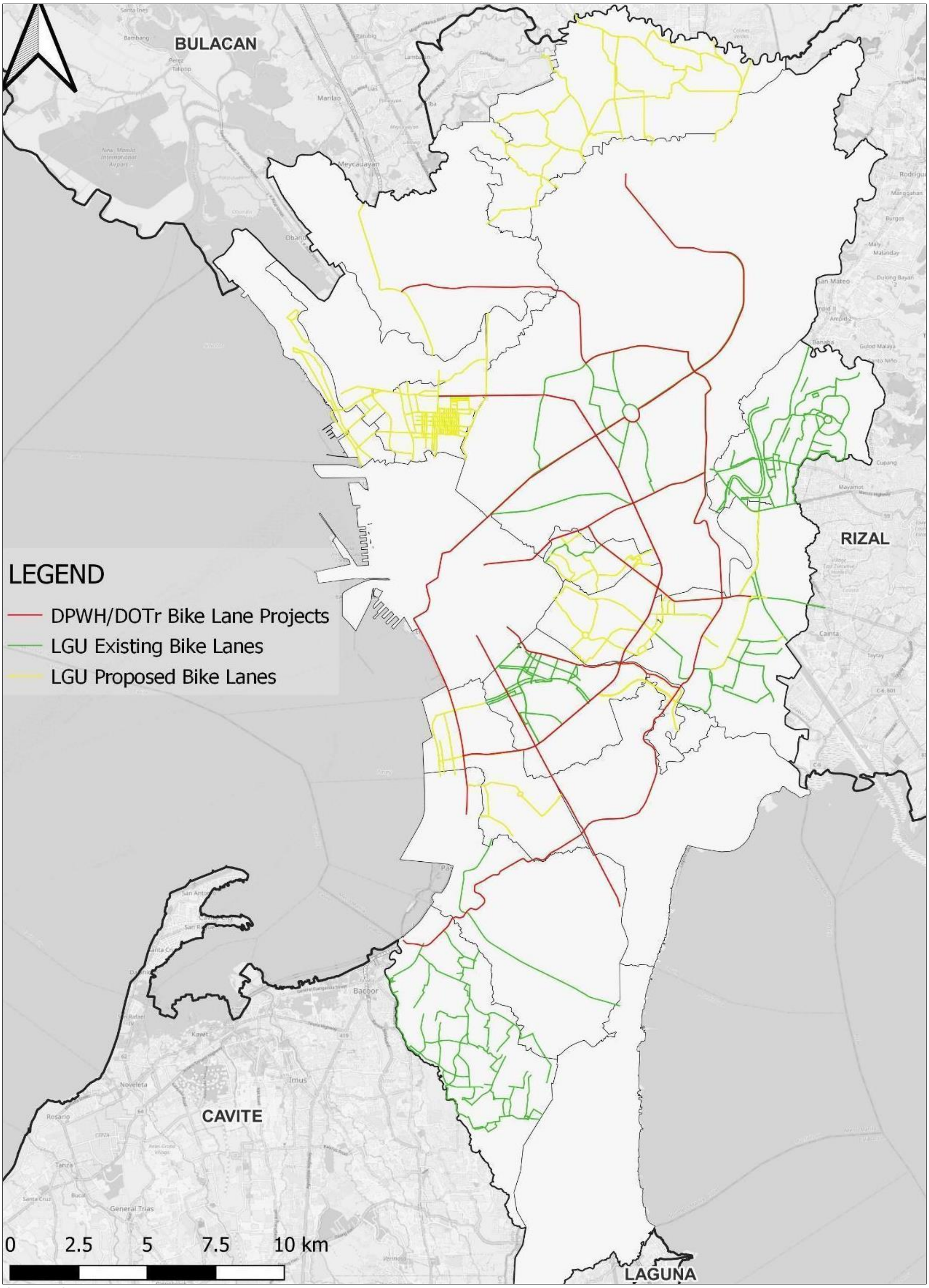
2.4 DOTr's EDSA Greenways Project

The EDSA Greenways project aims to improve the pedestrian environment of four major areas along EDSA namely Balintawak, Cubao, Guadaloupe, and Taft stations. The project will consist of a 5-km walkway for the four locations which would replace and widen the existing footbridges while constructing new ones as well. Its project manual claims that elevators would be attached to the walkways for the needs of the elderly, pregnant women, PWDs, and those people traveling with small children. It would also be connected to railway stations to promote the use of public transportation. The DOTr's Annual Report of 2021 said that it expects that after the completion of the four-station package, a total of 980,000 pedestrians per day will use the footbridge network and the number of footpath users will decrease.



Source: DOTr

Figure 2.3: Conceptual Visualization of EDSA Greenways Project



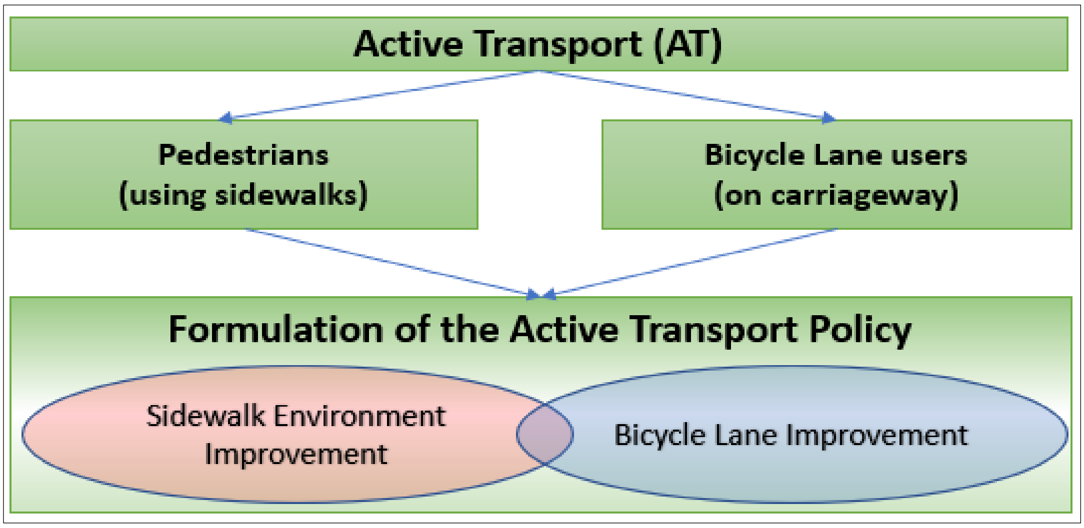
Source: DOTr and MMDA

Figure 2.4: Bike Lane Network in Metro Manila (Existing and Proposed)

3 APPROACH TO ACTIVE TRANSPORT PLANNING

Simply active transport in the country lacks historical and existing information. Since 2015, there are no accurate and comprehensive measures of the number of trips, travel characteristics, length, time of travel, etc. for walking and bicycle users. Although there were select surveys done by MMDA and DOTr, and several NGOs on certain corridors, for bicycle users only, this does not give us the totality of the situation. The lack of data hinders the development of active transport in Metro Manila and the country. And to acknowledge the lack of information would be the first step in genuinely advocating active transport. With this, this report utilizes the road inventory survey done in the project to paint a picture of the condition of active transport in Metro Manila.

The figure above shows the approach of the chapter on active transport. In formulating the AT policy, it is important to highlight the needs and issues of pedestrians and bicycle users alike. The AT policy would be a comprehensive framework containing the plans for pedestrian transportation and bicycle users. For this chapter, since this will be an initial step in looking at active transport, an improvement in walkability and a peek into the development of the bicycle lanes in Metro Manila would be its focus.

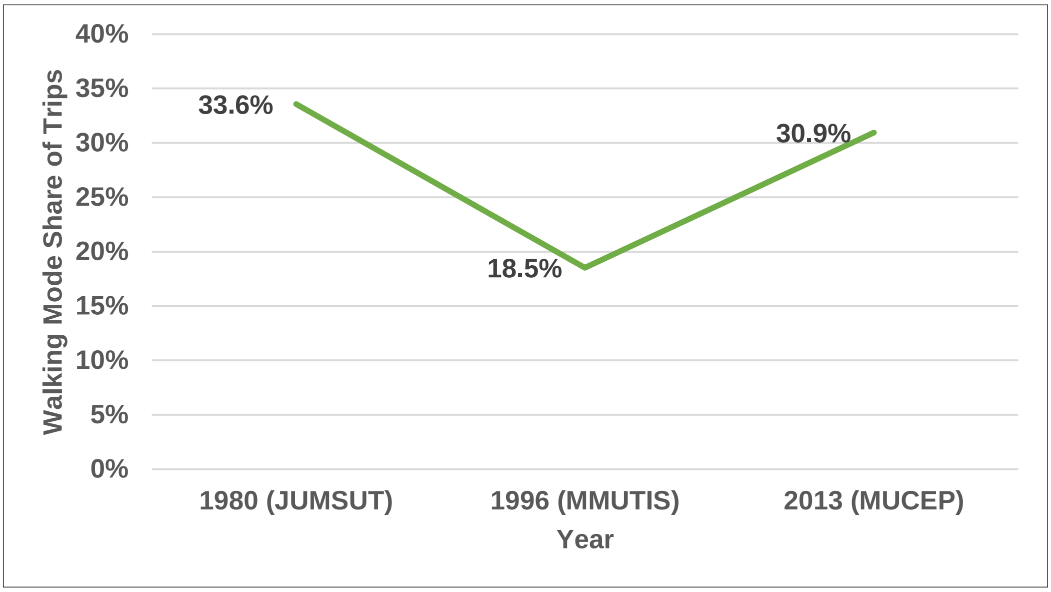


Source: JPT

Figure 3.1: Formulation of Active Transportation Policy

4 SIDEWALK AND PEDESTRIAN TRANSPORTATION

Everybody walks, all trips for whatever purpose begin and end with walking. One walks to a PUV stop to board a bus or a jeepney and then walks after disembarking. Therefore, footpaths and sidewalks deserve the highest priority in infrastructure investment. Urban areas in Metro Manila, or the Philippines in general, have changed dramatically during the 20th century, and with this the change in the role of pedestrian transportation. One can assume that more Filipinos today walk than people from previous generations. Although the number of trips is steadily increasing, walking has been a utilitarian activity for Filipinos, this meant that walking was done for a necessary/essential purpose and not for recreation. Numerous factors could support and explain this phenomenon. First, people choose to avoid walking due to its inconvenience relative to private mechanical transport. Second, there is a low priority granted to pedestrian transportation concerning the automobile.



Source: JPT

Figure 4.1: Trends on Interzonal Walking Trips in MM

The figure above shows the percentage of walking trips in Metro Manila. The three baseline studies accounted for all the inter-zonal trips in Metro Manila and the percentage will be higher if the intra-zonal trips were included given that walking can also be accomplished in short-distance trips as well. It is tragic to confront the realities that haunt the current system of pedestrians in Metro Manila, but it is imperative to address them. For example, it is time-consuming to traverse the corridors of Ortigas, Ayala Ave., and BGC, on a normal day not just because of the heat from the weather, and smoke from vehicles, but pedestrians have more time waiting at traffic signals due to the less time given to them at intersections.

The state of pedestrian transportation in Metro Manila, and the Philippines in general, has been acknowledged in the recent high-level development plans of the government such as National Transport Policy, and with this, the direction of transport policy of Metro Manila would be shifted from vehicle-centric to a people-oriented approach. It is in this regard that we need to formulate a workable action plan to turn the National Transport Policy established by the National Economic and Development Authority into reality.

4.1 Accessibility and Walkability

In this project, to match function of traffic management, the JPT proposes to reclassify the roads according to function. Roads have two essential functions, that is, to provide space for traffic/mobility and to provide access. For example, expressways and Class A roads are primarily concerned with faster and smoother movement of through traffic both for people and goods. On the other hand, Classes C, D, and E roads provide access to land uses. Class B roads have mixed functions, i.e., both serving traffic and providing accessibility. Table 4.1 shows the proposed functional classification of the roads developed by the MMDA and the JPT.

Accessibility is having the potential to get to one's destination and to have as many choices of modes as possible to various destinations. It is comprised of the first and last-mile trips between origin and destination, the walking trips during mode transfers, and the choices of the number of modes. For every commuter trip, walking is imperative whether it be from origin to the public transport terminal, and from the terminal to their egress point, ergo, walking is inevitable. This makes accessibility directly related to walkability. Therefore, if we want to make transportation networks more accessible, sidewalks need to be more walkable.

Table 4.1: Functional Road Class Definition

Road	Class	Definition	Function
Expressways and Major Arterials	A	• Controlled access or Limited access road with access ramps, lane dividers, etc., for high-speed traffic • Affect basic urban space & land use. • Backbone serving major traffic flow in Metro Manila such as R1 to R10, C1-C6, and those with the same function as an integrated network.	Traffic
Minor Arterials	B	• Provide access to international airports and ports and other major traffic generating sources. • Articulate primary road network. • Provide major traffic flow with alternate routes. • Affect basic urban space & land use.	
Major Collectors	C	• Connect major traffic-generating sources of LGU to Primary roads. • Connect Barangay centers with LGU/City Hall • Serve main traffic within LGUs	
Minor Collectors	D	• Connect barangays with other barangays • Roads that connect main socio-economic activity facilities/areas such as schools, hospitals, markets, etc. for the residents in LGUs and provide good access to primary/secondary roads • Roads that serve main traffic circulation within LGUs	
Local Streets	E	• Roads that complete destination trips, connected to other roads but do not belong to the classes above. • Living roads that prioritize pedestrians • Roads that mostly serve intra-barangay traffic, gated villages,	Access

Source: JPT

4.2 Walking Trip Characteristics

Past survey results are used to understand trends in walking-related trips. Table 4.2 shows the share of pedestrian trips according to age. Since 1999, the ages 16–65 have been the dominant group since the population of Metro Manila is relatively young, and in the working-age bracket.

Table 4.2: Share of Walking Trips by Age (%)

Share of Trips		1982 (JUMSUT)	1999 (MMUTIS)	2015 (MUCEP)
Age Group	< 15	64	43	39
	16–65	35	55	59
	> 66	0	1	2

Source: JPT

Table 4.3 shows the share of pedestrian trips according to sex. The percentage of walking trips had a clear gender gap in the 80s. The share of walking trips by women has steadily been increasing and slightly overtaken that of the male. An analysis of the purpose of the trips per sex showed that more women took short-distance trips (for grocery, school, chores) while men took longer distances, but fewer in number, for work.

Table 4.3: Share of Walking Trips by Sex(%)

Share of Trips		1982 (JUMSUT)	1999 (MMUTIS)	2015 (MUCEP)
Sex	Male	64	47	44
	Female	35	53	56

Source: JPT

Table 4.4 shows the share of walking trips according to income level. The percentage of walking trips across all income levels is statistically the same, except for the 4th and 5th quintile which can afford private motorized vehicles.

Table 4.4: Share of Walking Trips by Income Level (%)

Share of Trips		1982 (JUMSUT)	1999 (MMUTIS)	2015 (MUCEP)
Income Level	1 Quintile	20	20	21
	2 Quintile	22	23	22
	3 Quintile	22	23	21
	4 Quintile	21	19	19
	5 Quintile	16	15	16

Source: JPT

Table 4.5 shows the share of walking trips according to purpose. Most of the walking trips recorded are pedestrians walking home, and from school. However, in recent decades, there were more private trips (recreation, leisure, etc.) than those in the 1980s. Work and private trips account for almost half of the walking trips observed, this highlights the need for the improvement of sidewalks near educational institutions and open spaces.

Table 4.5: Share of Walking Trips by Purpose (%)

Share of Trips		1982 (JUMSUT)	1999 (MMUTIS)	2015 (MUCEP)
Trip Purpose	To Work	10.2	10	10.1
	To School	35.6	22.1	20.9
	At Work	0.3	3	0.1
	Private	4.1	18.4	18.7
	To Home	49.8	46.5	50.2
Ave. Trip Length		1.24	1.35	1.25
Ave. Travel Time (min)		13.2	10.9	12.1

Source: JPT

4.3 Key Issues in Pedestrian Transportation

1) Sidewalk Infrastructure

Table 4.6 shows the sidewalk data of the Class A and B roads, aggregated per LGU, from the road inventory survey gathered in the project. At 85.2% availability, the data shows that Metro Manila has a respectable sidewalk network along with the major thoroughfares. This means that for every 100m of a major road in Metro Manila, 85m has a sidewalk.

Table 4.6: Availability Data along Major Corridors by LGU

LGU	Sidewalk Width and Availability (%)					Average Width (m) (Both Directions)
	None	<2.0	<3.0	>3.0	Availability	
Caloocan	24.0	58.3	16.2	1.7	76.0	2.5
Las Pinas	17.9	64.7	14.2	3.7	82.1	2.9
Makati	13.3	45.9	33.8	6.9	86.7	3.5
Malabon	14.7	83.0	2.3	0	85.3	2.5
Mandaluyong	17.8	56.7	22.2	3.3	82.2	3.0
Manila	18.3	56.9	17.6	7.2	81.7	3.7
Marikina	15.8	41.8	24.1	18.3	84.2	3.8
Muntinlupa	11.9	40.0	24.5	24.1	88.1	4.3
Navotas	13.4	32.0	54.6	0	86.6	3.3
Paranaque	8.1	59.4	25.0	7.6	91.9	4.5
Pasay	18.3	52.2	23.7	5.8	81.7	3.7
Pasig	23.5	49.8	18.5	8.2	76.5	3.0
Pateros	0	27.7	72.3	0	100.0	2.6
Quezon	16.0	46.2	25.6	12.4	84.0	3.8
San Juan	9.4	41.4	30.8	18.5	90.6	4.0
Taguig	34.5	50.0	6.6	9.3	65.5	2.6
Valenzuela	12.0	78.5	7.7	1.9	88.0	2.7

Source: JPT

The City of Taguig got the lowest score at 70% and with a sidewalk average width of 2.6m for both directions. This means that for every 100m of major roads in Taguig, 30m have no sidewalk. On the contrary, Paranaque got the highest percentage at 95%. Since the city has predominantly residential areas, the major roads in the city are very few which made it more feasible for a more connected sidewalk. The top three LGUs that got the highest and lowest sidewalk availability were highlighted in green and red colors, respectively. The figures noted that Pateros got 100% sidewalk availability because the road inventory survey conducted included the Class A and Class B roads only, and Pateros only have 2.1km of these road classes, making it a mediocre indicator of whether the municipality has a respectable sidewalk network. It should also be noted however that the breakdown of the sidewalk widths was included in the figure. For the case of Valenzuela, it has an above-average sidewalk availability at 89%, however, a commanding majority of these have less than 2m widths, for both directions.

Furthermore, it was interesting to mention that the northern part of Metro Manila which consists of the LGUs of Caloocan, Malabon, Navotas, and Valenzuela (CAMANAVA) has the lowest percentage of sidewalks with a width greater than 3m. While those LGUs in the southern part such as Makati, Pasay, and Muntinlupa have a consistently greater percentage. With these striking differences, the LGUs from south of MM has better sidewalk infrastructure relative to their northern counterparts.

The LGUs in the eastern part of MM got average or decent scores. Alternatively, a better indicator for those LGUs who have longer road lengths such as Quezon and Manila would be to determine the sidewalk median width, rather than the average width, to give a better idea of the sidewalk condition. Even then, the sidewalk availability for all LGUs (along major roads) is above the 69% mark.

The data on the following figures were gathered from the road inventory survey conducted in the project. The road inventory survey included gathering information on the sidewalk widths, traffic signs, street trees, and bike lane provisions, among others. This was useful in determining different factors that affect walkability.

Table 4.7 shows the sidewalk availability data by a corridor (C and R roads). R2, R3, and R9 have the highest sidewalk availability ratings. Generally, radial roads have higher sidewalk availability than circumferential roads. The lower percentage of sidewalk availability for the circumferential roads may allude to the fact that they had more flyovers (C4, C5, C6), and underpasses (C4, C5) where pedestrians are not provided access.

Table 4.7: Sidewalk Availability Data by Major Corridor

C&R Road (Class A)	Sidewalk Width and Availability (%)					Average Width (m) (Both Directions)
	None	<2.0	<3.0	>3.0	Availability	
C1	20.6	27.0	36.5	16.0	79.4	4.6
C2	11.8	32.1	29.1	27.1	88.2	8.2
C3	8.3	39.4	45.8	6.5	91.7	3.5
C4	25.7	42.2	27.7	3.9	74.3	3.1
C5	48.1	43.4	8.3	0.1	51.9	1.8
C6	19.1	66.1	14.0	0.8	80.9	1.8
R1	33.4	23.4	39.6	3.6	66.6	3.0
R2	2.0	84.9	13.1	0	98	3.2
R3	4.3	35.8	47.2	12.8	95.7	5.6
R4	18.2	65.6	16.5	0	81.8	3.1
R5	12.9	55.1	32.1	0	87.1	4.7
R6	11.2	25.4	10.8	52.6	88.8	6.4
R7	17.5	36.7	16.4	28.4	82.5	3.7
R8	19.1	45.7	34.3	0	80.9	3.2
R9	4.8	93.8	1.4	0	95.2	3.0
R10	19.8	43.8	32.6	3.8	80.2	3.2

Source: JPT

2) Sidewalk Conditions

Aside from the lack of sidewalk infrastructure (inadequate width, no amenities, etc.), the sidewalks in Metro Manila also suffer from poor sidewalk conditions. The poor sidewalk conditions involve several elements such as poor pavement conditions, faded or unclear paintings or markings, uneven slopes, and the prevalence of potholes.

Figure 4.2 shows the sidewalks in Pasay City and Pasig City. Both sidewalks are connected, with pedestrian crossings, and bridges, and have access to public transportation. However, both have poor sidewalk conditions. The sidewalk can barely accommodate one (1) person traversing one one-way. On the left, the pedestrians are exposed to the foul smell from the drainage and the narrowing width on the corner approach. Even though the scene is uncommon, the image on the right has been the poster boy for the unfortunate state of sidewalks in Metro Manila.

Table 4.8 is the table showing the sidewalk condition, aggregated per LGU, from the road inventory survey gathered in the project. At 85.2% availability, the data shows that Metro Manila has a decent sidewalk network along with the major thoroughfares. This means that for every 100m of a major road in Metro Manila, 15m have no sidewalk.

Table 4.8: Sidewalk Conditions of Major Roads by LGU

LGU	Sidewalk Availability (%)	Sidewalk Condition (%)	
		Bad	Good
Caloocan	76.0	92.3	7.7
Las Pinas	82.1	74.7	25.3
Makati	86.7	81.5	18.5
Malabon	85.3	93.3	6.7
Mandaluyong	82.2	91.1	8.9
Manila	81.7	99.8	0.12
Marikina	84.2	96.4	3.6
Muntinlupa	88.1	68.4	31.6
Navotas	86.6	100.0	0
Paranaque	91.9	84.5	15.6
Pasay	81.7	80.2	19.8
Pasig	76.5	91.1	8.9
Pateros	100.0	100	0
Quezon	84.0	91.1	8.9
San Juan	90.6	83.5	16.5
Taguig	65.5	87.2	12.8
Valenzuela	88.0	94.2	5.8

Source: JPT

Source: JPT

Figure 4.2: Sidewalks with Poor Conditions in Pasay (Left) and Pasig (Right)

Table 4.9 shows the sidewalk condition in each corridor.

Table 4.9: Sidewalk Condition Data by Major Corridor

C&R Roads (Class A)	Sidewalk Availability (%)	Sidewalk Condition (%)	
		Bad	Good
C1	79.4	93.3	6.7
C2	88.2	97.8	2.2
C3	91.7	95.0	5.0
C4	74.3	83.4	16.6
C5	51.9	84.0	16.0
C6	80.9	99.8	0.2
R1	66.6	64.6	35.4
R2	98.0	97.2	2.8
R3	95.7	87.7	12.3
R4	81.8	94.2	5.3
R5	87.1	99.9	0
R6	88.8	69.4	30.6
R7	82.5	81.5	18.5
R8	80.9	81.4	18.6
R9	95.2	82.7	17.3
R10	80.2	96.5	3.4

Source: JPT

3) Obstructed Sidewalks

Sidewalk obstructions are any structures, materials, or activities within the sidewalk that impede the free and clear passage of pedestrians. Other obstructions include household encroachments that obstruct the sidewalk such as protruding gates, tents, etc. Obstructed carriageways are hindrances to walkability, and force pedestrians to walk on the road exposing them to other modes such as motorcycles and vehicles.

4.4 Walkability of Sidewalks in Metro Manila

To further our understanding of pedestrian transportation in Metro Manila, a vision of what an ideal and walkable sidewalk must be defined. Below is the table showing the characteristics and the corresponding parameters of an ideal sidewalk. A walkable sidewalk in Metro Manila is a sidewalk that pedestrians can use conveniently, safely, and comfortably, for any purpose pedestrians may have.

Table 4.10: List of Walkability Indicators from the Road Inventory Survey

Convenience (C) Indicators		
Factor		Description
C1	Width	Average sidewalk width
C2	Conditions	% Sidewalk with good condition[1]
C3	Connectivity	% Road length with available sidewalk
Pedestrian Safety (S) Indicators		
S1	Ped Crossings	No. of pedestrian crossings/km
S2	Ped Bridges/Overpasses	No. of pedestrian bridges/km
S3	Ped Underpasses	No. of underpasses/km
S5	Streetlights	No. of streetlights/km
Comfortability (F) Indicators		
F1	Presence of Street Trees	No. of street trees/km
F2	Bike Lane Provision	% Road length with available sidewalk
F3	Ped Amenities	No. of amenities/km

Source: JPT

From, the table above, walkability can be defined as the extent to which the built environment is “walking-friendly”. A walkable sidewalk is where pedestrians have the option and preference to walk to their destinations conveniently, safely, and comfortably. Using these definitions of walkability, we can derive a walkability index to measure how walkable the sidewalks are in Metro Manila. The methodology used in this study is based on three simple but crucial factors that evaluate walkability. The project considered the replication of the method that would be done by either MMDA or LGUs in future walkability index field surveys. For each city, a road inventory survey was conducted along major roads for all the LGUs in MM. Additionally, the local streets (Class C) were included for the LGUs of Mandaluyong and Pasig. The roads were surveyed using the parameters, as shown in Table 4.11.

The walkability index did not consider the land use and the trip generation since the survey area is mostly major thoroughfares in Metro Manila and could be sure to generate walking trips. Moreover, utilization should not be considered as a parameter in the assessment of the walkability of sidewalks because it would project a lower walkability score for those sidewalks that have no/fewer pedestrians, even though these can still be considered walkable. One of the advantages of this walkability index is that it almost completely removed subjectivity from the scores and would rely solely on what is objectively on the road. The formula below describes the computation for the walkability index:

$$Walkability\ Index = Convenience + Ped.Safety + Comfort$$

Table 4.11: Guide for Walkability Index

Walkability Index	Convenience Score	Pedestrian Safety Score	Comfort Score
1	• Average of >2.5m width • Leveled, concrete, minimal obstructions, no potholes, clearly marked, painted	• Has pedestrian crossings, traffic signs are found, traffic signals, and bike lanes are provided,	• All sidewalks are connected and available • Streetlights and trees are present
0.5	• Average less than 2.5m width, • Poor to fair sidewalk condition), might have a slight slope, faded paintings, minimal obstructions	• Pedestrian crossings are sometimes not available • Bike lanes are not present on all sidewalks	• Not all sidewalks are available and connected • Some sidewalks have streetlights and trees
0	• Less than 1m average sidewalk, • Almost all sidewalks are in poor condition, with lots of potholes and obstructions	• No pedestrian crossings, no bike lanes, no traffic signs, and no traffic signals	• No sidewalks are connected, and sidewalks are not found • No streetlights and no trees

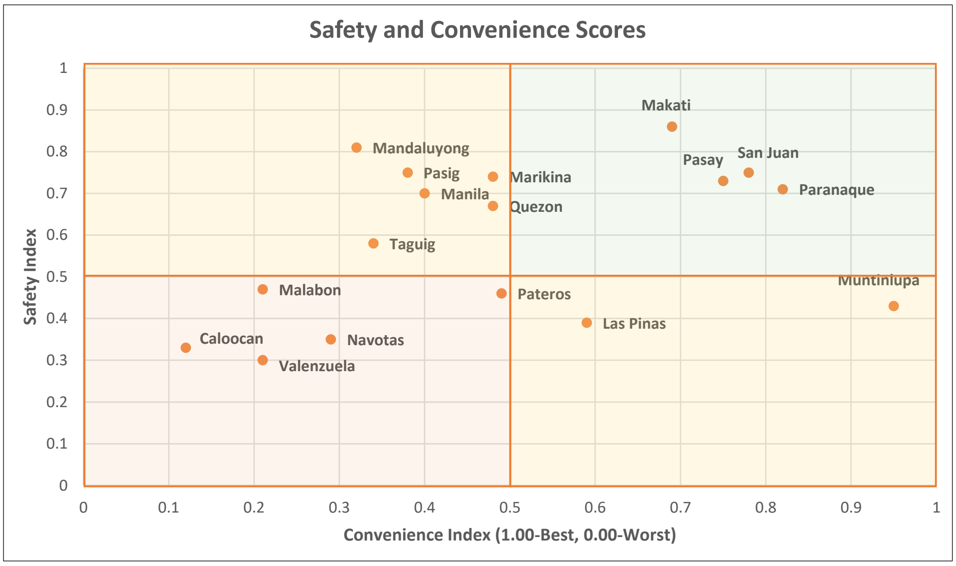
Source: JPT

Just to give an idea of the walkability parameters, the guidelines were shown above. Note that in the computation of the walkability index, the scores were normalized and that an index of 0.5 does not necessarily mean linearly half, but it means that the score is near the average scores of the dataset. The Figure 4.3 and Figure 4.4 shows the walkability index results. The scores were normalized using the standard Z-score computation in statistics to determine the walkability indices. The individual scores were added for each LGU first and after that, the walkability indices were computed based on the mean and the standard deviation of the whole dataset.

Table 4.12: Walkability Index of Major Roads per LGUs

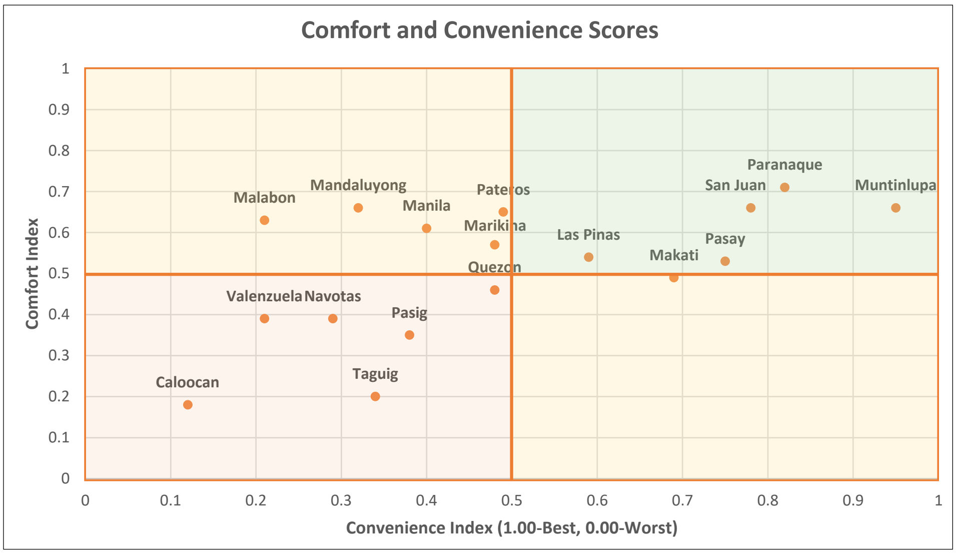
LGU	Convenience Index	Safety Index	Comfort Index	Walkability Index	Rank
Caloocan	0.12	0.33	0.18	0.21	17
Las Pinas	0.59	0.39	0.54	0.51	11
Makati	0.69	0.86	0.49	0.68	4
Malabon	0.21	0.47	0.63	0.44	13
Mandaluyong	0.32	0.81	0.66	0.60	6
Manila	0.40	0.70	0.61	0.57	8
Marikina	0.48	0.74	0.57	0.60	7
Muntinlupa	0.95	0.43	0.66	0.68	3
Navotas	0.29	0.35	0.39	0.35	15
Paranaque	0.82	0.71	0.71	0.75	1
Pasay	0.75	0.73	0.53	0.67	5
Pasig	0.38	0.75	0.35	0.49	12
Pateros	0.49	0.46	0.65	0.54	10
Quezon	0.48	0.67	0.46	0.54	9
San Juan	0.78	0.75	0.66	0.73	2
Taguig	0.34	0.58	0.20	0.37	14
Valenzuela	0.21	0.30	0.39	0.30	16

Source: JPT



Source: JPT

Figure 4.3: Convenience Index and Safety Index of LGUs



Source: JPT

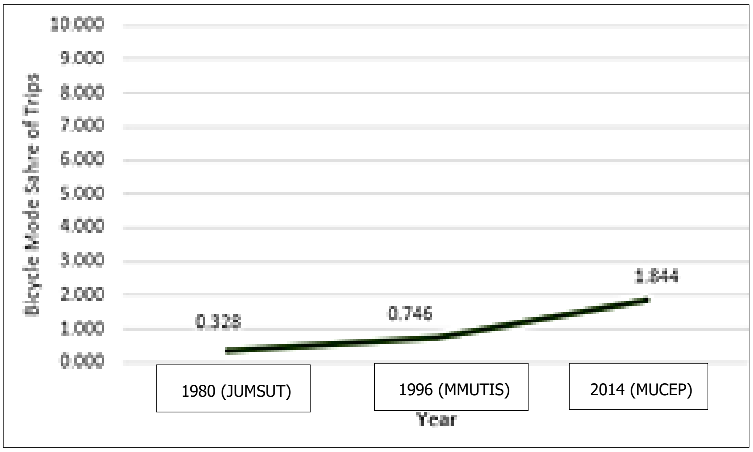
Figure 4.4: Convenience Index and Comfort Index of LGUs

5 BIKE LANES AND THEIR USERS BEFORE THE PANDEMIC

There is a lack of studies and data that delve into bicycle lanes and the biking habits of Filipinos. It is safe to say that bicycle lanes and their users have been ignored since the 1980s. The lack of exclusive lanes for bicycle users made biking a non-significant mode choice for commuters since there is no space for bicycles on the road, even on sidewalks. Moreover, the inattention to biking and bicycle lanes impeded the cultivation of active mobility in transportation planning and traffic management. Unlike walking, not most can bike. It requires a certain level of physicality which cannot be achieved by all members of society. Moreover, every trip cannot also be accomplished by biking per se. Since it is efficient for short trips, bikers in Metro Manila usually bike around 3km or less, and usually for work, and recreation.

Even with Marikina and Iloilo City pioneering the promotion of non-motorized transportation in their respective LGUs, other cities have not immediately followed suit and it took the shutdown of public transportation during the pandemic for LGUs to revive the idea of establishing bicycle lanes.

The figure below shows the bicycle mode share percentage in Metro Manila increasing from 0.3% to 1.8% from 1980 to 2013. It is significant to note that the number of bicycle users grew most significantly at 1500% from 1980 to 2013 as compared to walking (247%) and motorized transport (272%) during the same period. The low percentage share of bicycle lane (1.8%) users should not justify it not being the priority over the past decades, but the larger mode share of pedestrians (30%) shows that walkways and sidewalks should be a higher priority, for the simple reason that it would benefit all road users.



Source: JPT

Figure 5.1: Biking Trends in Metro Manila from 1980–2013

5.1 Characteristics of Biking Trips

In Metro Manila, the total bicycle demand in 2014 was 362,000 bicycle trips per day. This was relatively small compared to other modes (1.8%), but an updated number of the share of trips must be conducted during, and after the pandemic to determine the effect of the 313km bike lane network on the modal shift of commuters to bicycle trips. The table below shows the age group profile of bicycle trips. As stated above, not everybody can use a bicycle. Most of the bicycle users are from the 15–65 age group.

Table 5.1: Share of Bicycle Trips by Age (%)

Share of Trips		1982 (JUMSUT)	1999 (MMUTIS)	2015 (MUCEP)
Age Group	< 15	3	9	8
	16–65	96	89	90
	> 66	1	1	2

Source: JPT

There is also a glaring disparity between men and women bicycle users. From 1980 to 2013, the share of men using bicycles has consistently been greater than that of women. This trend differs significantly from that of Japan and other countries with high bicycle use.

Table 5.2: Share of Bicycle Trips by Sex (%)

Share of Trips		1982 (JUMSUT)	1999 (MMUTIS)	2015 (MUCEP)
Sex	Male	92	94	89
	Female	8	6	11

Source: JPT

Additionally, the share of bicycle trips by income level is more distributed from the 1st to 4th quintile income groups. The 5th quintile group has had consistently lower bicycle trip share since these groups can likely afford private motorized vehicles.

Table 5.3: Share of Bicycle Trips by Income Level (%)

Share of Trips		1982 (JUMSUT)	1999 (MMUTIS)	2015 (MUCEP)
Income Level	1 Quintile	12	21	19
	2 Quintile	23	24	23
	3 Quintile	23	23	22
	4 Quintile	25	20	20
	5 Quintile	18	12	16

Source: JPT

With the increase in private motorized vehicles and motorcycles over the decades, those commuters who usually bike for work, or to school did not bike anymore. This can be seen by the significant drop in the bicycle trip share (to work, and school) from 1982 to 2015. Moreover, the average trip length decreased by more than half. Since biking is efficient for short trips, the average trip length is 3.3km, and the travel time IS 22.4 mins. In 1982, the average speed of bikers was 12.2kph while in 2015, the estimate of the average speed of bikers would be 9kph. The decrease in the speed can allude to the extent of the mode conflict between bicycle users and motorized vehicles, and as the number of motorized vehicles increases, road capacity decreases which affects the speed of bicycle users as well.

Table 5.4: Share of Bicycle Trips by Purpose (%)

Share of Trips		1982 (JUMSUT)	1999 (MMUTIS)	2015 (MUCEP)
Trip Purpose	To Work	44.2	32.7	31.8
	To School	13.2	4.7	5.1
	At Work	0.2	4.9	0.5
	Private	3.1	11.3	13.5
	To Home	49.3	46.4	49.1
Ave. Trip Length		7.09	3.88	3.27
Ave. Travel Time (min)		35.2	20.05	22.4

Source: JPT

6 CASE STUDY IN MANDALUYONG

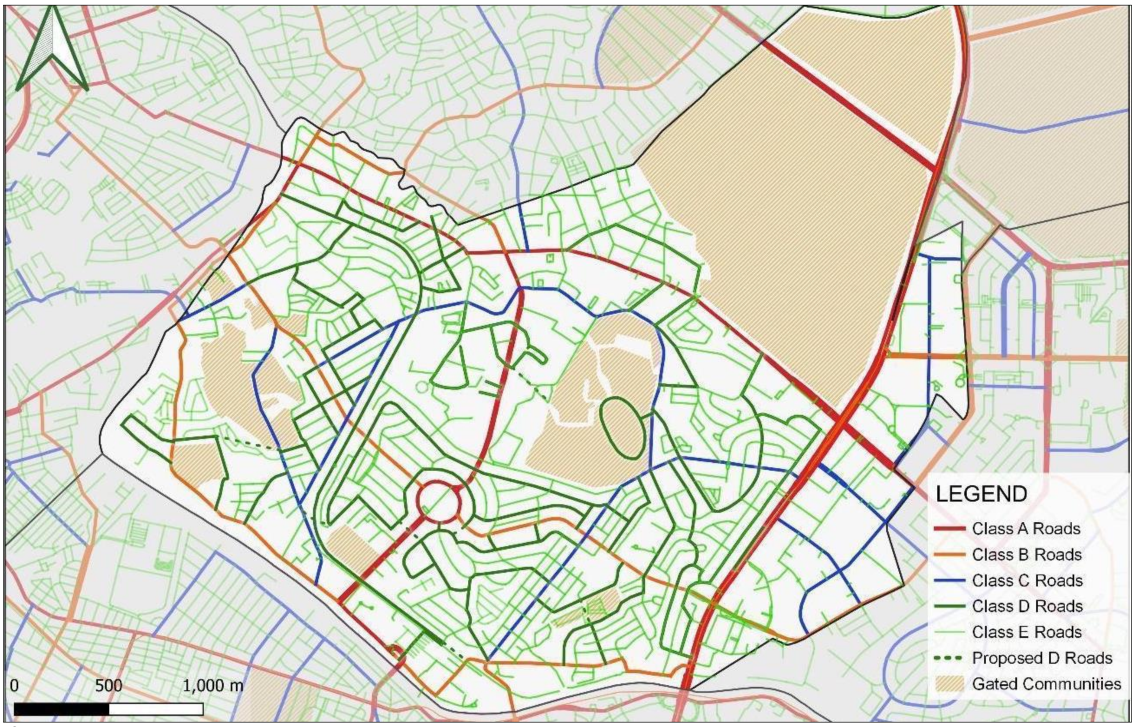
At present, roads are classified administratively as national, provincial, and city/ municipal/ barangay roads. As the level of congestion is perceived among road users by the expected function of roads, the JPT proposes to reclassify the roads by function (Table 6.1). Roads have two essential functions, that is, providing space for traffic/mobility and providing access. For example, expressways and Class A roads are primarily concerned with the faster and smooth movement of through traffic and are focused on the efficient traffic of people and goods. On the other hand, Class C, D, and E roads provide access to land use. Class B roads have mixed functions, i.e., both serving traffic and providing accessibility.

The project team conducted road inventory for walkability and bikeability scores, hence known as the "objective" part of the walkability and bikeability indices. Since the LGU of Mandaluyong has a very extensive road network, it is more practical, and economically sound to perform stratified random sampling probability sampling for the city. One road was selected for each Class C and D road per barangay to have a respectable number of roads surveyed in determining the objective features of the sidewalk and bicycle lanes in the LGU of Mandaluyong.

Table 6.1: Road Network Length of Mandaluyong

Functional Road Class	Average Width (m)	Total Length (km)	Surveyed Roads (km)
A	23.7	12.6	12.6
B	14.0	11.6	11.6
C	8.5	15.5	15.5
D	7.0	22.6	7.8
E	6.0	99.2	10.8
Total	8.5	161.5	58.3

Source: JPT



Source: JPT

Figure 6.1: Proposed Functional Road Classification for Mandaluyong

The total length of the road network in the city of Mandaluyong is about 161km (Table 6.2), of which A and B class roads account for only 15%, while C, D, and E class roads account for 85%. Given these, walkability indices must also be measured on class C, D, and E roads so LGUs have more comprehensive and evidence-based planning on improving their cities' mobility. Below is the table showing the average width of the roads according to class functions in the LGU of Mandaluyong, and the total length of each road class as well. The surveyed roads, in kilometers, were also shown and the method of stratified random sampling was conducted in selecting the roads for the survey. For the stratified random sampling, a road was selected in each of the twenty-seven (27) barangays in the LGU. The total number of surveyed roads for classes D and E is 18.6km, which can be considered a good representation of the roads in Mandaluyong.

Table 6.2: Walkability Index Scores of Class C, D and E Roads in Mandaluyong

Road Class	Convenience Index	Safety Index	Comfort Index	Walkability Index
C	0.50	0.50	0.35	0.45
D	0.47	0.43	0.30	0.40
E	0.51	0.49	0.30	0.43

Source: JPT

Looking further at the most and least walkable roads in Mandaluyong.

(1) Class C

(a) **United Ave. (WI: 0.91)**

- Convenience Index: 1.0, Safety Index: 0.71, Comfort Index: 1.0
- The street has respectable sidewalk width (>3m), and the majority is in good condition (even slope, no potholes, etc.).
- It also has benches, waiting sheds, and traffic signs. The presence of street trees lessens the heat index as well.
- This is one of the two most walkable roads in Mandaluyong.
- To still improve this street, the provision of bike lanes would greatly increase its walkability as it would lessen the exposure of pedestrians to vehicles and increase the number of streetlights as well.

(b) **St. Francis St. (WI: 0.91)**

- Convenience Index: 1.0, Safety Index: 0.71, Comfort Index: 1.0
- The street is behind big malls and surrounding different conglomerate compounds and hotels.
- The area is highly urban and densely populated during peak hours. The sidewalk utilization is expected to be high.
- The sidewalk width is decent, and the presence of railings increases pedestrian safety along the corridor. However, one issue here is the non-functional escalators on the pedestrian bridges.

(c) **E. Pantaleon (WI: 0.49)**

- Convenience Index: 0.43, Safety Index: 0.37, Comfort Index: 0.67

- The street has narrow sidewalks, disconnected walkways and if connected, obstructed.
- The road is approaching the E. Pantaleon bridge, and pedestrian access should be given to increase the walkability and accessibility of the bridge. Traffic enforcement should ensure that walkways should be unobstructed since the carriageway is narrow.

(2) Class D

(a) **Calbayog St. (WI: 0.89)**

- Convenience Index: 0.88, Safety Index: 0.59, Comfort Index: 1.0
- The street has a mix of residential and small commercial establishments.
- The sidewalks are connected, and no obstructions were seen during the survey.
- Also, the concrete was well-maintained, and no potholes were seen.
- Overall, it's a decent sidewalk. However, it noted a 0.59 safety index which can be attributed to the modest number of streetlights and pedestrian crossings.

6.1 User Perception Survey

For most areas in urban regions, road networks are designed for vehicles, such as automobiles, trucks, motorcycles, etc. And given that the proportion of the local roads in Mandaluyong (and in Metro Manila, for that matter) is 85%, is it just logical to prioritize access provision over these roads as the majority of walking and bicycling share (intra-LGU) occurs on local roads. Moreover, it is important to determine the perception of active transportation users, such as pedestrians and bicycle lane users. Additionally, pedestrian perceptions affect the physical features of the environment and walking behaviors, and the perceived features are as important in understanding walkability as the physical features. Given the limited amount of budget coming from the government to fund active transportation infrastructure, a walkability and bikeability index that considers user perception, or subjective factors, would help determine the necessary priorities in countermeasure implementation.

For the user-perception survey, a survey team was led in Mandaluyong consisting of a survey leader, survey supervisor, and fifteen (15) surveyors. The objective of the survey is to determine the perception of active transportation users (pedestrians and bicycle lane users alike) in regarding sidewalks and bicycle lanes' convenience, safety, and comfortability. The survey was conducted in three days at fifteen (15) locations in Mandaluyong. The table below shows the location of the stations. Each of the stations required 60 respondents for pedestrian perception survey, and 30 for the bicycle lane perception survey.

Table 6.3: Station for User Perception Survey

Station	Road Name	Class
01	EDSA–Guadix Drive	A, B
02	Maysilo Circle	B, C
03	New Panaderos St.	E
04	Nueve de Pebrero St.	C
05	F. Ortigas St.	D, C
06	Shaw Blvd.	B
07	Silangan St.	E
08	San Francisco St.	D, C

09	General Kalentong St.	B
10	EDSA–Guadalupe	A, B

Source: JPT

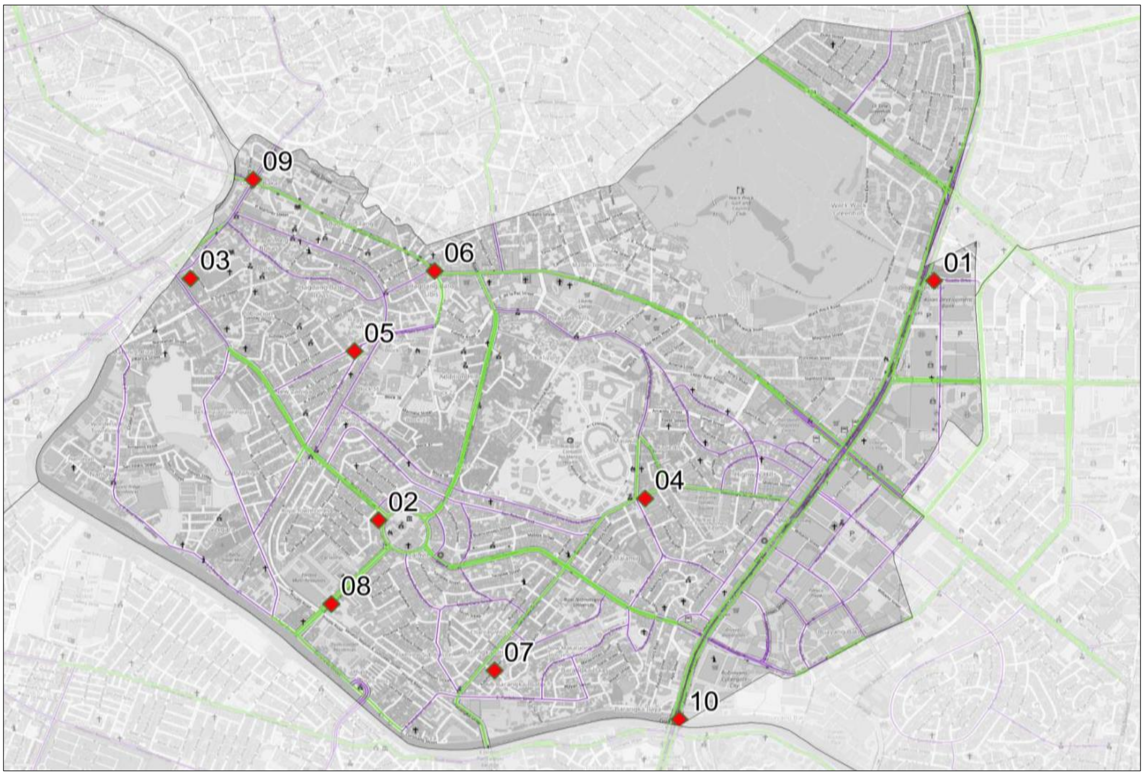
The survey was done through collaboration between national government agencies such as the DOTr, MMDA, DPWH, while coordinating with the Mandaluyong LGU for the survey preparation in the residential streets. A survey orientation was done in the ALMEC office, as part of the preparation of the surveyors before the survey proper. The briefing was successful as the supervisors and surveyors were experienced in conducting interviews, and no major issues were raised during the orientation.

Table 6.4: Survey Date and Activities

Date	Activity
July 18	Orientation & Dry Run
July 20	User-Perception on Walkability Day 1
July 21	User-Perception on Walkability Day 2
July 22	User-Perception on Bikeability

Source: JPT

The DOTr provided brochures and kits for bicycle lane users, while the MMDA provided personnel and assistance in getting bicycle lane users to participate in the interview. The survey quota (900 participants) was collected at a very promising 94% rate of 860 participants. This is due to the close communication with the MMDA and LGUs in getting the necessary personnel to aid during the three-day survey. Unlike national polling agencies, there was no deliberate sampling in the survey conducted. The only sampling was five (5) participants per hour. A margin of error of 4% was computed for the survey results.



Source: JPT

Figure 6.2: Survey Station in Mandaluyong

Source: JPT

Figure 6.3: Photos of Survey

The images above show the bicycle lane users and pedestrians being interviewed for the bicycle lane perception survey. Most of them were appreciative of the interview being conducted.

6.2 Survey Results: Trip Characteristics

The survey results show almost similar results to the MUCEP study in 2014. Table 6.5 shows the share of pedestrian trips according to age.

Table 6.5: Share of AT Trips by Age (%)

Share of Trips		Pedestrians	Bicycle Lane Users
Age Group	< 15	12	6
	16–65	83	92
	> 66	5	2

Source: JPT

Table 6.6: Share of AT Trips by Sex (%)

Share of Trips		Pedestrians	Bicycle Lane Users
Sex	Male	50.5	93
	Female	49.5	7

Source: JPT

Table 6.7 shows the characteristics of the participants gathered from different road classes. This meant a significantly high share of errand trips (34). This also meant the importance of local roads as the majority of the trips in a city would most likely be for errands, which are short trips. Moreover, most bicycle trips were for work. This highlights the significance of bicycle lanes as most of the bicycle lane users were using bicycle lanes going to work.

Table 6.7: Share of AT Trips by Purpose (%)

Share of Trips		Pedestrians	Bicycle Lane Users
Trip Purpose	To Work	31	52
	To School	6	1
	Errands	34	16
	Leisure	9	6
	Exercise	3	4

	To Home	17	21

Source: JPT

Table 6.8: Share of AT Trips by Inter/Intra-LGU (%)

Share of Trips	Pedestrians	Bicycle Lane Users
Inter-LGU	14	33
Intra-LGU	86	67

Source: JPT

6.3 Survey Results: Perception Results

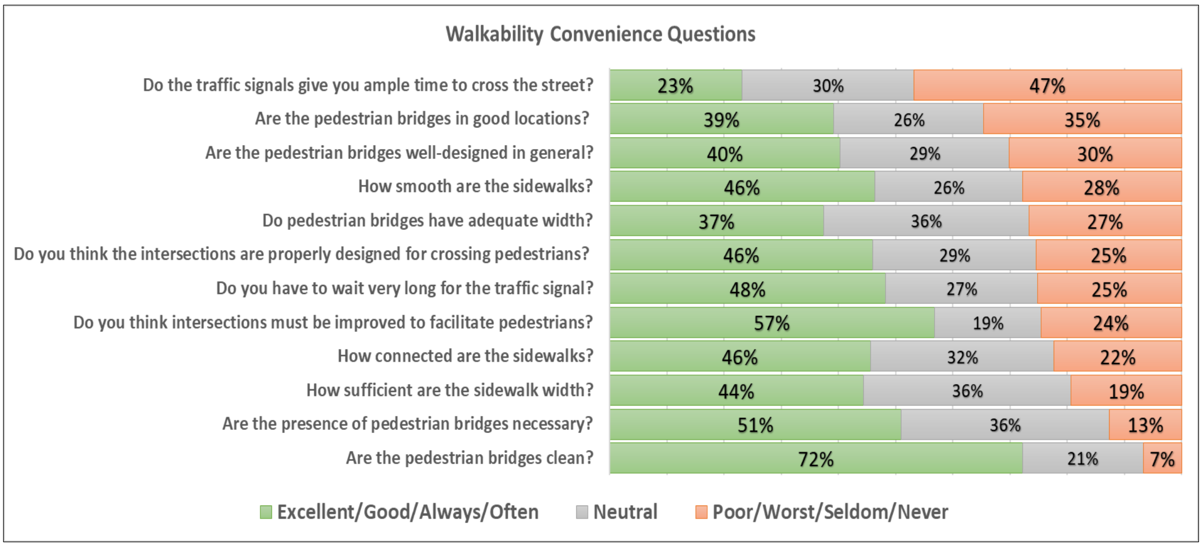
The survey results show almost similar results to the MUCEP study in 2014. The survey was conducted using face-to-face interviews with 837 (539 pedestrians, 298 bicycle lane users) participants at fifteen locations spread over three (3) days: 300 each per day and an estimated 60 per station per day. The sampling error margins are ±4.0% for Metro Manila. They were led by the project team. In the following items, net means the absolute value of the difference between the opinion (always/often subtracted by seldom/never, or vice versa). The characteristics of the participants were shown in the table below.

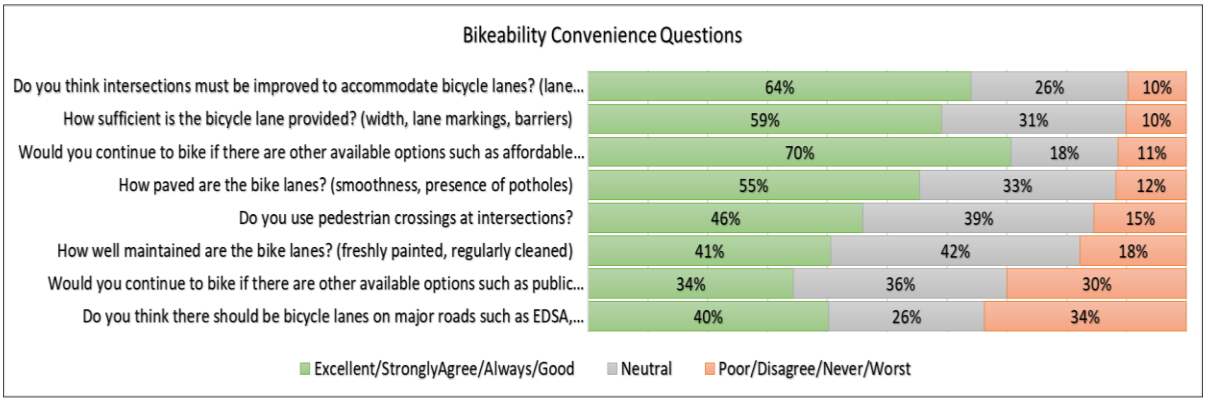
Table 6.9: Trip Characteristics of Participants

Characteristics		Pedestrians %		Bike Users%	
Age Group	< 15	12.0		6.0	
	16–65	83.0		92.0	
	> 66	5.0		2.0	
	Mean, SD	35	17.2	36	13.4
	Min, Max	11	81	10	72
Sex	Male	50.5		93	
	Female	49.5		7	
Trip Purpose	To Work	31		52	
	To School	6		1	
	Errands[1]	34		16	
	Private	12		10	
	To Home	17		21	

Source: JPT

(a) **AT Users' Perceptions on Convenience Factors:** 67% of pedestrians answered they always/often have to wait a long time for the traffic signals to turn green (51% net); 58% of pedestrians responded that they strongly/somewhat felt pedestrian bridges are unnecessary (40% net); 58% of pedestrians answered they always/often do not have enough green time to cross pedestrian crossings (40% net); 57% of pedestrians answered they strongly/somewhat disagree that the locations of the footbridges are well-placed (39% net); 71% of pedestrians answered that they strongly/somewhat agree that the sidewalks are connected (59% net); 59% of bike lane users strongly/somewhat agreed that the lane widths were sufficient (40% net); 84% of bike lanes users strongly/somewhat agree that bike lanes should still be improved (79% net); 77% of bike lane users strongly/somewhat agree that major roads should have bike lanes (66% net). 71% of bike lane users strongly/somewhat agree that they would continue to bike even if there were other options such as public transportation while 7% strongly/somewhat disagree. 69% of bike lane users strongly/somewhat agree that they would continue to bike even if they can afford to purchase private vehicles while 5% strongly/somewhat disagree. 58% of bicycle lane users strongly/somewhat agree that bicycle lanes were congested. 59% of bike lane users responded that they always/often worry about vehicles following/running alongside them.





Source: JPT

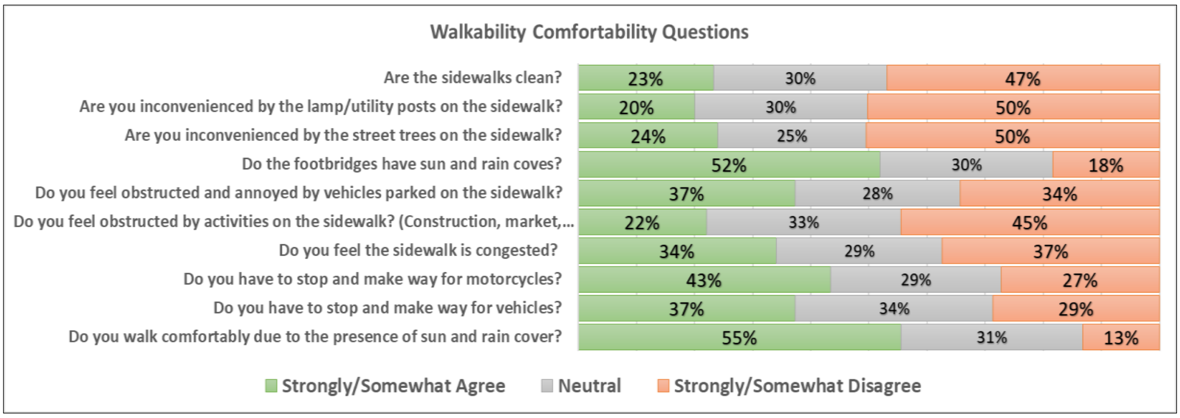
Figure 6.4: Results of Questionnaire Survey (Convenience)

(b) **AT Users' Perceptions on Safety Factors:** 54% of pedestrians responded that they almost/often get honked by motorcycles, while 37% responded they almost/often get honked by vehicles. 65% of pedestrians responded that they never/seldom feel safe from road crashes from vehicles while using the sidewalk while 27% responded that they never/seldom feel safe from road crashes from motorcycles while using the sidewalk. 51% of pedestrians found they are secured from crime (robbery, holdup, etc.) while using the sidewalk. 71% of pedestrians strongly/somewhat feel that the sidewalks are safe for children to use while 41% of pedestrians strongly/somewhat feel that sidewalks are safe for PWDs to use.

Source: JPT

Figure 6.5: Results of Questionnaire Survey (Safety)

(c) **AT Users' Perception on Comfortability:** 60% of pedestrians responded that they are always/often inconvenienced by vehicles parked on the sidewalks. 54% of pedestrians felt always/often needed to give way to motorcycles while walking while 37% felt they always/often needed to give way to vehicles while walking. 54% of pedestrians felt the sidewalks were always/often congested due to different activities (construction, vendors, etc.). Last, 44% of pedestrians preferred sidewalks with cover (for sun and rain).



Source: JPT

Figure 6.6: Results of Questionnaire Survey (Comfortability)

Table 6.10: Walkability Index Scores from User-Perception Survey

Road Class	Convenience	Safety	Comfort	Walkability Index
A	0.49	0.50	0.48	0.49
B	0.49	0.51	0.48	0.49
C	0.48	0.52	0.51	0.51
D	0.47	0.48	0.47	0.47
E	0.50	0.49	0.46	0.48

Source: JPT

Table 6.11: Bikeability Index Scores from User-Perception Survey

Road Class	Convenience	Safety	Comfort	Bikeability Index
A	0.68	0.71	0.74	0.71
B	0.57	0.63	0.70	0.63
C	0.51	0.59	0.63	0.58
D	0.44	0.41	0.56	0.47
E	0.30	0.40	0.44	0.38

Source: JPT

At first glance, there are no significant differences among the road classes. However, when the values are compared against the objective factors of the same roads, there lies the results warranting discussions. The discussion now would focus not on the differences in walkability and bikeability among different road classes, but on whether the scores from the road inventory results were related to the user-perception survey results as well.

Correlation Analysis is a method of statistical evaluation used to study the strength of the relationship between two numerically measured variables. This is employed if the researchers wanted to establish a connection between the two variables. The results of the correlation between the objective and the subjective factors of walkability and bikeability are shown below:

Table 6.12: Correlation Scores for Objective and User-Perceived Factors

Walkability Index Components	Correlation Score
Convenience	0.94*
Safety	0.96**
Comfortability	0.83*

* significant at 0.05 level, ** significant at 0.01 level
Source: JPT

Table 6.13: Correlation Scores for Objective and User-Perceived Factors

Bikeability Index Components	Correlation Score
Convenience	0.91*
Safety	0.91*
Comfortability	0.93*

* significant at 0.05 level
Source: JPT

Correlation results showed that all the factors from the objective part were significantly correlated with the user-perceived scores. Moreover, this proves that there is a relationship between the user-perceived walkability and bikeability components, and the objective factors are arbitrarily set at the beginning of the chapter. This makes the planning on promoting AT more targeted and effective because urban planners can specifically target which facet, whether convenience, comfortability, or safety, is the walkability, or bikeability, lacking on a specific part of the road, or area.

Moving forward, it is important to determine which sidewalks, and how long of these pathways and bicycle lanes should be improved. There is a lot of work to be done for AT, but we cannot improve what we do not have. Building and erecting sidewalks and bicycle lanes should be the priority for AT and its users. Table 6.14 shows the existing sidewalk width per direction and conditions. The length to be improved and constructed was also shown in the rightmost column.

Table 6.14: Gap between Existing Situation and Benchmark in Sidewalk

Class	Existing Sidewalk Characteristics (One Direction)				% Gap on Sidewalk Width	Length to be Improved (km)
	Width (m)	%	Good (%)	Fair-Poor (%)		
A	None	26.4	0	100	-26.4	131.74
	<2m	55.2	25.6	74.4	-/-	0
	>2m	18.3	26.5	73.4	41.7	208.08
B	None	10.9	0	100	-10.9	37.61
	<2m	61.7	8.2	91.2	-/-	0
	>2m	27.4	10.7	89.3	22.6	77.97
C	None	12.1	0	100	-12.1	60.14
	<2m	66.4	4.6	95.4	-/-	0
	>2m	21.6	17.6	82.3	1./4	96.42
DE	None	16.2	0	100	-16.2	1380.24
	<2m	69.4	4.1	95.9	0.6	51.12
	>2m	14.1	19.5	81.5	15.9	1354.68

Source: JPT

Table 6.15: Gap between Existing Situation and Benchmark in Bicycle Lanes

Class	Existing Bicycle Lane Characteristics (One Direction)		Lane Width Benchmark (%)	Gap
	Width (m)	%		
A	None	37.4	0	-37.4
	<2.5m	61.5	40	-/-
	>2.5m	1.1	60	58.9
B	None	77.8	0	-77.8
	<2.5m	21.2	60	39.8
	>2.5m	1.0	40	39
C	None	87.1	0	-87.1
	<2.5m	12.9	80	67.1
	>2.5m	0	20	20

Source: JPT

7 CONCLUSIONS AND RECOMMENDATIONS

The promotion of walking and bicycle trips, including other non-motorized transportation has long been overdue in Metro Manila. It took a public transportation shutdown during a worldwide pandemic, for decision-makers to be in the right senses to finally assent and recognize the necessity to establish dedicated bicycle lanes and improve sidewalks for pedestrians. Even then, evidence-based planning on the bike lane network has yet to be done in Metro Manila. Between 1980 and 2020, while hundreds of kilometers of carriageways and expressways have been built in Metro Manila, sidewalks and bicycle infrastructure have been lagging, except for Marikina City which started its bikeways program in 2002. On the other hand, sidewalks have been in dismal conditions, usually obstructed, inadequate in width, and unsafe for pedestrians. The multiplicity of challenges suggests the situation of AT in Metro Manila would stagnate and languish to an abject failure without sweeping countermeasures, starting from institutional arrangements, being undertaken.

The conclusions of the chapter are preliminarily listed below

(a) **Current Undertaking of Active Transport:** The chapter successfully undertook the situation of active transport in Metro Manila given the lack of data. The studies from the JUMSUT (1982), MMUTIS (1999), and MUCEP (2015) were used as a snapshot of the state of active transportation to provide a bigger picture of AT across four decades.

(b) **Development of Walkability Index:** The chapter fortuitously developed a walkability index that was based on convenience, pedestrian safety, and comfort. The scores were ranked and analyzed for the major roads (Class A and B) in Metro Manila.

(c) **Case Study of Roads in Mandaluyong:** A case study of roads (Class A to E) in Mandaluyong City was conducted to evaluate the walkability of sidewalks. It was seen that all the road classes had poor walkability. Among all the factors, all road classes obtained low scores (0.30) on pedestrian comfort which was based on street trees, benches, sheds, etc.

(d) **Need for Inter-agency Coordination:** Since AT is complex and involves various interacting factors, there should be stronger coordination among national government agencies, and LGUs. DOTr, DPWH, and MMDA have separate fronts on promoting AT, and a coherent collaboration should be facilitated to properly advance AT in Metro Manila.

Recommendations:

(a) **Encourage Academic Papers on AT:** Given the current hype during the pandemic, there should be more data and information on AT (walking and bicycle, etc.) and with the provisions in the National Transport Policy, there should be an effort by the government to encourage research and publication of more academic papers involving AT.

(b) **Prioritize the Welfare of Pedestrians:** AT should primarily be concerned with the welfare of pedestrians. 30% of all inter-zonal trips in Metro Manila are by walking trips while that of bicycle trips is 2%. The number of AT (walking and bicycle) trips has decreased over the decades with the increase in the number of private motorized transportation (vehicles and motorcycles). Since the distances of walking trips and bicycle trips are short, at 1.3km and 3.3km respectively, sidewalks and bicycle lanes should be the top priority on local roads, where LGUs have jurisdiction.

(c) **Strengthen Land Use Planning:** AT and land use are very much correlated. The access points to residences, schools, and institutions should be important for AT since most of the trip’s ingress and egress are here. Moreover, AT should be integrated with the route rationalization system of public utility vehicles for better accessibility.

(d) **Integrate with Public Transportation:** AT is involved in public transportation. The national government should acknowledge the role of pedicabs (public transportation mode of AT) in promoting sustainable transportation and find ways to integrate them into the first-and-last mile trips of commuters.

(e) **Institutionalize AT to Subnational Level:** LGUs, in cooperation with DOTr, DPWH, and MMDA, should enact ordinances on the promotion and development of improving AT infrastructure including walkways and bicycle lanes. The ongoing/planned road projects are concentrated in the existing national/primary, already-congested areas. In formulating a pragmatic master plan for active transport, the focus should be on collectors and local roads supporting those major arterials and their accessibility to public transportation stops and interchanges.

8 WAY FORWARD

The lack of data is a major challenge in active transportation. The walkability index formulated did not consider the amenities for PWDs and other self-perceived factors. However, it was a good starting point for urban planners from the national government agencies, and LGU counterparts to consider.

Planning for active transport should start with the existing road hierarchy. The activities should be part of a large and long-term roadmap for a people-focused approach that prioritizes moving people and not moving vehicles. Future programs and policies should incorporate an element promoting these kinds of strategies notwithstanding improving public transportation, modernizing traffic signal systems, and other traffic elements. The project recommends streamlining active transport initiatives to promote a more coherent advancement of pedestrian transportation space and facilities. Moreover, the promotion of active transport goes beyond improving sidewalks, and erecting bike lanes. The formulation of the development plan should involve the creation of more open spaces for recreation, and leisure. With the formulation of the transportation space and development plan, we can make sidewalks more walkable, and our cities more accessible. First, we must construct sidewalks of adequate width to start the promotion of active transportation in Metro Manila. It is estimated that the total cost would be around 34.0B pesos. It should be noted though, that the estimates were ball-park figures, and only tackles those roads without sidewalks, and some pathways with negligible width. Most of the sidewalks should still be improved, and costs should be computed correspondingly.

APPENDICES

ANNEXES

Appendix A: Sidewalk and Bike Lane Inventory Survey Form

Segment Code			ex) LA001
Class (Administrative/ Functional)			ex) National/ Primary
Location Management	Location (LGU)		ex) Makati
	Ownership		ex) DPWH
	Maintenance		ex) DPWH
Coordinate (Longitude, Latitude)		Begin of Point	ex) 14.562519, 121.043057
		End of Point	ex) 14.563837, 121.044271
Observation Direction (From/ To)			ex) SW/ NE
Structure			ex) Elevated
Length (m)			ex) 500
Availability of Walking Paths	Length with SW (m)		ex)
	Length without SW (m)		ex)
	Average width of sidewalk (considering only those with SW) (m)		ex)
	Sidewalk Pavement Condition (1-10)		ex)
Walking Path Modal Conflict	Bike Lane Provision (Y/N)		ex)
	Length of road with bike lane provision (m)		ex)
	Is the road along a PUB route? (Y/N)		ex)
	If yes, specify route:		ex)
	Length of extent (m)		ex)
	Is the road along a PUJ route? (Y/N)		ex)
	If yes, specify route:		ex)
	Length of extent (m)		ex)
Availability of Crossings	Number of Pedestrian Crossings		ex)
	Condition of Pedestrian Crossings (1-10)		ex)
	Number of Pedestrian Bridges		ex)
	Condition of Pedestrian Bridges (1-10)		ex)
	Underground Passage (Yes/ No)		ex)
	Condition of Underground Passages (1-10)		ex)
	Average length between pedestrian crossings (m)		ex)
Grade Crossing Safety	Traffic Lights for Pedestrians (Number)		ex)
	Number of traffic signs for pedestrians		ex)
	Length of railing (m)		ex)
	Average green time allotted for pedestrians along the corridor (s)		ex)
	Average green time allotted for vehicles (s)		ex)
Amenities	Number of benches		ex)
	Number of waiting sheds		ex)
	Number of streetlights/lamp posts		ex)
	Number of street trees		ex)
	Number of public toilets, urinals, etc.		ex)
Disability Infrastructure	Number of ramps		ex)
	Average slope of ramps (Ratio)		ex)
	Average width of ramps (m)		ex)
	Length of tactile pavement (m)		ex)
Obstructions	Degree of obstruction on the road (1-10)		ex)
	Length of road that are majorly obstructed (m)		ex)
	Indicate obstructions observed (2-3 items)		ex)
Parking Facilities	Parking Slot (Number)	On-street	ex)
		Off-street	ex)
	Parking Slot by Build.	Number	ex)
		Facility Name	ex)
Regulation	Speed Limit (km/ h)		ex)
	One-Way (Yes/ No)		ex)
	Prohibition of U-Turn (Yes/ No)		ex)
	Truck Ban (Yes/ No)		ex)

	Parking Prohibition (Yes/ No)	ex)
	Load/ Unload Prohibition (Yes/ No)	ex)
Roadside Land Use	Commercial (roadside shop or small) (Yes/ No)	ex)
	Commercial (medium or shopping mall) (Yes/ No)	ex)
	Industrial (Yes/ No)	ex)
	Residential (Yes/ No)	ex)
Bike Lane	Bike Lane (0=None, 1=1 lane only, 2=both lanes)	ex)
	Bike Lane Width, both directions	ex)
	Bike Lane Class (I,II,III)	ex)
	Bike Racks (Number)	ex)
	Traffic Signs for Bicycle Users (Number)	ex)
	Access Ramps on Pedestrian Bridges (Y/N)	ex)
	Drainage Inlet Design (0=Parallel to carriage way, 1=Perpendicular)	ex)

Appendix B: Walkability Index of Class C Roads in Mandaluyong

Road Class	Convenience	Ped. Safety	Comfort	Walkability Index
Bank Drive	0.97	0.73	0.35	0.68
Barangka Drive	0.73	0.81	0.33	0.62
Dansalan	0.62	0.43	0.35	0.47
Domingo M. Guevara	0.79	0.43	0.35	0.52
Dr. J. Fernandez Ave.	0.49	0.59	0.35	0.48
F. Blumentritt	0.08	0.78	0.35	0.40
E. Pantaleon	0.43	0.37	0.17	0.32
Estrella-Pantaleon Br.	0.42	0.37	0.35	0.38
F. Ortigas	0.52	0.43	0.35	0.43
Guadix Drive	0.79	0.59	0.35	0.58
J Salinga Street	0.34	0.59	0.35	0.43
Jose Fabella	0.43	0.59	0.33	0.45
Kanlaon	0.22	0.59	0.35	0.39
Madison	0.60	0.43	0.35	0.46
Nueve de Febrero	0.43	0.59	0.33	0.45
Primo Cruz	0.54	0.59	0.35	0.49
Reliance Street	0.44	0.59	0.35	0.46
Rev. Gregorio Aglipay	0.27	0.59	0.30	0.39
Saint Francis	1.00	0.73	0.35	0.69
Sheridan	0.78	0.59	0.35	0.57
United Avenue	1.00	0.73	0.35	0.69

Source: JPT

Appendix C: Walkability Index of Class D Roads in Mandaluyong

Road Class	Convenience	Ped. Safety	Comfort	Walkability Index
Arayat Street	0.20	0.59	0.30	0.36
Nueve de Febrero	0.34	0.59	0.29	0.41
Pinatubo	0.72	0.59	0.30	0.54
Calbayog	0.88	0.59	0.30	0.59
Connecticut	0.72	0.59	0.30	0.54
Sacrepante	0.46	0.59	0.30	0.45
San Rafael	0.58	0.59	0.30	0.49
Santo Rosario	0.42	0.43	0.29	0.38
Sen. N. Gonzales III	0.26	0.21	0.30	0.26
Sergeant Bumatay	0.74	0.59	0.30	0.54

Source: JPT

Appendix D: Walkability Index of Class E Roads in Mandaluyong

Road Class	Convenience	Ped. Safety	Comfort	Walkability Index
A. Bonifacio	0.20	0.59	0.30	0.36
Acacia Lane	0.21	0.59	0.30	0.37
Balagtas	0.35	0.59	0.30	0.41
Mariveles	0.59	0.37	0.30	0.42
Mayflower	0.81	0.35	0.30	0.49
Pag-asa Street	0.22	0.37	0.30	0.30
Pines	0.90	0.59	0.30	0.60
R. Policarpio	0.20	0.37	0.27	0.28
San Roque Street	0.44	0.59	0.30	0.44
Sierra Madre	0.64	0.59	0.30	0.51
Sikap	0.61	0.43	0.30	0.45
Silangan	0.08	0.21	0.15	0.15
Villarica Street	0.08	0.37	0.06	0.17
P. Burgos	0.09	0.75	0.24	0.36
Kayumanggi	0.60	0.75	0.30	0.55
Pinagtipunan	0.08	0.75	0.21	0.35
Malapantao	0.56	0.78	0.30	0.55
M. Lerma	0.60	0.75	0.30	0.55
Private Road	0.12	0.75	0.24	0.37
Romualdez	0.72	1.00	0.30	0.67
G. Enriquez	0.35	0.43	0.30	0.36
S. Laurel	0.69	0.59	0.30	0.53
Sultan	0.34	0.43	0.30	0.36

Source: JPT

Appendix E: User-Perception Survey Forms

Survey on Pedestrians' Perception of the Walkability of Sidewalks

Location/Station:				
Time Started Interviewing:				
Age:			Sex at birth (M/F):	
Occupation (Nurse, Student, N/A, etc):				
Trip Purpose:		□Work □School □Home □Exercise □Leisure □Errands		
Address:	Street/Landmark:			
	Barangay:		Municipality/City:	
Origin (Blank if from Home):		(Landmark/Barangay/City)		
Destination (Blank if from Home):		(Landmark/Barangay/City)		
Estimated Total Walking Time (min):				

Please answer the following questions regarding the **sidewalks** that you use for your trip. Indicate from 1 (Very Poor), 2 (Poor), 3 (Fair/Neutral), 4 (Good), 5 (Excellent).

1. How sufficient are the sidewalk widths?	
0. How connected are the sidewalks? Are there gaps along the way?	
0. How paved are the sidewalks? (smoothness, presence of potholes)	
0. How well maintained are the sidewalks? (freshly painted, regularly cleaned, no defects)	
0. How clean are the sidewalks?	
0. How does the sidewalk cater to persons with disabilities? (space, handrails, ramps)	

Please answer the following questions regarding the sidewalks that you use for your trip. Indicate from 1 (Never), 2 (Seldom), 3 (Sometimes), 4 (Often), 5 (Always).

0. Do you think the sidewalk is congested? (Is there enough space for pedestrians?)	
0. Do you have to stop and make way for vehicles?	
0. Do you have to stop and make way for motorcycles?	
0. Do you get honked at by vehicles when walking on the sidewalk?	
0. Do you get honked at by motorcycles when walking on the sidewalk?	
0. Do you feel obstructed and annoyed by activities on the sidewalk? (construction, market, garbage collection)	
0. Do you feel obstructed and annoyed by vehicles parked on the sidewalk?	
0. Do you feel safe from vehicles?	
0. Do you feel safe from motorcycles?	
0. Are you inconvenienced by the lamp posts or utility poles built on the sidewalk?	
0. Are you inconvenienced by the street trees on the sidewalk?	
0. Do you feel secured from road crashes from vehicles while walking?	
0. Do you feel secured from road crashes from motorcycles while walking?	
0. Do you feel secured from crimes? (robbers, snatchers, kidnappers, holduppers, etc.)	
0. Are the streets well-lit, especially at night? (street lights, lights from establishments)	

0. Do you prefer to walk on covered sidewalks?	
0. Is the sidewalk safe for kids and senior citizens?	
0. Is the sidewalk safe for persons with disabilities?	
0. Do you check the surroundings before walking on the sidewalk? (awareness)	
Please answer the following questions regarding the **intersections** that you use for your trip. Indicate from 1 (Never), 2 (Seldom), 3 (Sometimes), 4 (Often), 5 (Always).	
0. Do you think the current intersections are properly designed for crossing pedestrians? (Are there pedestrian crossings, footbridges, signals, etc.?)	
0. Do you have to wait very long for the traffic signal?	
0. Do the traffic signals give you ample time to cross the street?	
0. Do you think intersections must be improved to facilitate pedestrians?	
0. Do you feel secured from crimes (robbers, snatchers, kidnappers, holduppers, etc.) while crossing the intersection?	
Please answer the following statements regarding the **footbridges** that you use for your trip. Indicate from 1 (Very Poor), 2 (Poor), 3 (Fair/Neutral), 4 (Good), 5 (Excellent).	
0. Are the pedestrian bridges in good locations?	
0. Are the pedestrian bridges well-designed in general? (materials, structure, presence of electric wires)	
0. Do pedestrian bridges have adequate widths?	
0. Do pedestrian bridges have sun and rain cover?	
0. Are pedestrian bridges necessary?	
0. Are the pedestrian bridges designed/located to avoid the risk of crimes occurring (robbers, snatchers, kidnappers, holduppers, sexual predators, etc.)?	
0. Are the pedestrian bridges clean?	

Please indicate the names of the roads that you use during your trip and rate them according to their walkability. Indicate from 1 (Very Poor), 2 (Poor), 3 (Fair/Neutral), 4 (Good), 5 (Excellent).	
R1:	
R2:	
R3:	
R4:	
R5:	

Appendix F: Survey on Bicycle Lane Users' Perception of the Bikeability of Bicycle Lanes

Location/Station:				
Time Started Interviewing:				
Age:			Sex at birth (M/F):	
Occupation (Nurse, Student, N/A, etc):				
Trip Purpose:	□Work □School □Home □Exercise □Leisure □Errands			
Address	Street/Landmark:			
	Barangay:		Municipality/City:	
Origin (Blank if from Home):	(Landmark/Barangay/City)			
Destination (Blank if from Home):	(Landmark/Barangay/City)			
Estimated Total Cycling Time Using Bicycle Lane Time:				

Please answer the following questions regarding the bike lanes you use for your trip. Indicate from 1 (Very Poor), 2 (Poor), 3 (Fair/Neutral), 4 (Good), 5 (Excellent).	
1. How sufficient is the bicycle lane provided? (width, lane markings, barriers)	
0. How connected is the bicycle lane network to your destination? (Are there gaps?)	
0. How paved are the bike lanes? (smoothness, presence of potholes)	
0. How well maintained are the bike lanes? (freshly painted, regularly cleaned, no defects)	
0. How clean are the bicycle lanes?	
0. Are there bicycle racks at your origin and destination?	
Please answer the following questions regarding the bike lanes you use for your trip. Indicate from 1 (Never), 2 (Seldom), 3 (Sometimes), 4 (Often), 5 (Always).	
1. Do you feel the bicycle lane is congested? (Is there enough space for cyclists?)	
0. Do you think bicycle lanes must be separated from vehicles?	
0. Do you think bicycle lanes must be shared with motorcycles?	
0. Do you feel any danger when using bicycle lanes?	
0. Do you have to worry about vehicles following or running alongside you?	
0. Are you inconvenienced by obstructions on the bicycle lanes?	
0. Do private vehicles use and block bicycle lanes?	
0. Do motorcycles use and block bicycle lanes?	
0. Do you feel secured from crimes while biking? (robbery, hold-up, sexual assault, etc.)	
Please answer the following questions regarding the **intersections** you use for your trip. Indicate from 1 (Never), 2 (Seldom), 3 (Sometimes), 4 (Often), 5 (Always).	
0. Do you know the rules on crossing intersections?	
0. Do you observe traffic lights when crossing intersections?	
0. Do you have to wait for a long time to cross intersections?	
0. Do you use pedestrian crossings at intersections?	

0. Do you think intersections must be improved to accommodate bicycle lanes? (lane markings, traffic signals)	
0. Do you think there should be bicycle lanes on major roads such as EDSA, Commonwealth Ave., etc.?	
0. Would you continue to bike if there are other available options such as public transportation?	
0. Would you continue to bike if there are other available options such as affordable private vehicles?	

Please indicate the names of the roads that you use during your trip and rate them according to their bikeability. Indicate from 1 (Very Poor), 2 (Poor), 3 (Fair/Neutral), 4 (Good), 5 (Excellent).	
R1:	
R2:	
R3:	
R4:	
R5:	