Towards Better Understanding of Metro Manila's Cyclists: Insights From Two Cycling Surveys in Metro Manila

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Abstract: The increased investments in bicycle infrastructure in Metro Manila due to the Covid-19 pandemic has led to a rise in cyclists. This study aims to contribute to the current understanding of Metro Manila's cycling population by sharing insights derived from two surveys. Referencing data from the MUCEP database which was established in 2012-2014, the the study provides evidence that many cyclists still come from low-income groups and are predominantly male. Moreover, many cycle to work despite the lack of bicycle support facilities and long travel times. Evidence of mode shift behavior to cycling during the pandemic was also found, mostly from public transport users. The volume count conducted showed the existence of morning and afternoon peak hours for cyclists and a high incidence of helmet use only in sites with recently-issued helmet ordinance. Deriving insights from the study's results, a discussion on important policy issues surrounding cycling as well as potential and implications for future policies are provided.

Keywords: Active Transportation, Non-motorized Transportation, Cycling

1. INTRODUCTION

The important role of cycling in improving the state of mobility especially in urban areas that are normally plagued by congestion has been well documented in literature. This is also significant in ensuring social satisfaction and quality of life. Several studies have connected longer commute times with lower levels of social satisfaction (Delmelle et.al., 2013, Hilbreacht, et.al., 2014). From the medical field, the use of active transport in commuting has been shown to improve health-related quality of life (De Geus, et.al., 2008, Neumeier,et.al., 2020). In an Australian study, cyclists have reported significantly higher levels of enjoyment in their commutes than car users (Rissel, et.al., 2015).

Following a review of numerous sustainable transport indicators in the world, the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) formulated a set of Sustainable Urban Transport Indicators for the Asia-Pacific region anchored on the UN Sustainable Development Goals (UNESCAP, 2017). The modal share of active transport (which include walking and cycling, etc.) as well as the extent to which transport plans cover infrastructure for active transport were identified as key criteria in measuring the state of urban mobility.

Even before the pandemic, cycling as a main mode of transportation has been gaining popularity among Metro Manila citizens due to worsening traffic congestion. Although non-

motorized infrastructure is recognized as important in policies and planning documents, pre-pandemic cycling infrastructure in Metro Manila was limited to a few cities and focused only on selected corridors (Gaspay, 2021). The imposed community lockdowns and limited public transportation capacities during the early months of the Covid-19 pandemic further accelerated cycling adoption, with more residents turning to their bicycles as their main mode of transport. Bicycle imports increased by 112% to 2.1 million units in 2020 (Simeon, 2021). Based on user data from cycling mobile application Strava alone, their number of users increased 6.4 times to 129,932 users in 2021 from its 2018 levels (Strava Metro, 2022).

1.1 Bicycle infrastructure: Then and Now

Before the pandemic, bicycle infrastructure projects were limited to select corridors. Extensive, city-wide bicycle infrastructure being implemented only in Marikina City since 2000. In 2015, the Metro Manila Development Authority established some 15.6 kilometers of bicycle lanes with free bicycle rental, geared especially for areas with high tourism revenue potential (MMDA, 2015). This was, however, discontinued in 2017 due to poor maintenance of bicycles (Medina, 2018).

The pandemic opened a "window of opportunity" (Sunio and Mateo-Babiano, 2022) for accelerating the implementation of sustainable transport policies, among which is the promotion of cycling. As part of the Covid-19 response and recovery interventions for the Philippine economy, the House of Representatives in September 2020 passed Republic Act (R.A.) Number 11494 or the Bayanihan to Recover As One Act which provided Php 1.1 Billion funding for the establishment of bicycle lane networks in metropolitan areas and Php 200 Million for bicycle sharing. The Department of Transportation (DOTr) together with the Department of Public Works and Highways (DPWH) consulted stakeholders and civil society organizations in the development of the design guidelines for bicycle lanes. In July 2021, the DOTr announced that it had completed a bicycle lane network in the National Capital Region (NCR) spanning 313 kilometers. In April 2022, DOTr and DPWH inaugurated another 66.10 kilometers of bicycle lanes in NCR. Meanwhile, Local Government Units initially opened pop-up bicycle lanes in their areas and many went on to implement their own bicycle infrastructure projects. For example, the Quezon City government also opened 93 kilometers of intra-city bicycle lanes (Abadilla, 2021). A map showing the expansion of the bicycle lane network across Metro Manila's cities is shown in Figure 1.

Given the recent support for cycling infrastructure coupled by challenges in daily commuting due to the Covid-19 pandemic and rising fuel costs, the question of whether the shift to cycling will be sustained in the future remains to be answered. It is also unclear how much of car users have shifted to cycling. Looking at multi-year data, Cervero, et.al. (2013) argue that the saying, "build it and they will come" holds for bicycle improvements as much as for other transportation infrastructure. In order to begin answering questions on sustainability, it is important to understand the nature of cycling behavior in the Philippine context.

1.2 Bicycle Surveys and Data Collection in Metro Manila

Several studies of varying scales have recently been conducted in an attempt to measure and understand cyclists. These efforts have provided evidence of the increasing use of bicycles as compared to the period before the pandemic especially for essential trips. The Social Weather Stations (SWS) to date has already conducted around nine (9) nationwide surveys and over time has observed an increase in the number of bicycle-owning households. They also found evidence of challenges in accessing bicycles as a significant number of respondents were only

using borrowed bicycles. The surveys have also established the respondents' support for cycling as a main mode of transport. The Institute of Labor Studies (Tacadao and Villena, 2021) delved into more detailed questions about trip characteristics and asked questions on socio-economic characteristics, trip distances, and user perceptions on motivators and barriers.

Figure 1. Metro Manila Bicycle Lane Network as of 2021

Table 1. Summary of Cycling-related Surveys and Data Collection

	Institute of Labor Studies (Tacadao and Villena, 2021)	**Social Weather Station (SWS) 2020**	**Metro Manila Counts (Institute for Climate and Sustainable Cities)**	**SWS 2022**
Data collection dates	July -August 2020	May-Sept 2020 (Mobile phone); Nov 2020-May 2021 (Face to face)	June 2021	April 2022
Survey type	Online questionnaire	3 mobile phone surveys and 2 face-to-face interviews	On-site bicycle count	Face-to-face interviews
Who were surveyed/ counted	Cyclists and non-cyclists	Cyclists and non-cyclists	Cyclists only (Pedestrians and others were separately counted)	Cyclists and non-cyclists (Employed only)
Coverage	Nationwide	Nationwide	32 locations, 4 cities	Nationwide
Number of respondents / Counts	1,164 (Nationwide), 532	1,200-4,000 (Nationwide)	38,932 cyclists counted	1440 Nationwide, 360 in Metro Manila
Notable Findings	• 58% of cycling trips are for work, 24% for recreation • Travel distances can be far: 6-10 km (29%), 11+ km (34%) • Most common deterrents to cycling are related to not feeling safe and poor road conditions • Personal safety against crimes and presence of a bicycle lane are the most important factors in route choice	• Increasing bicycle ownership among interviewed households • Increasing bicycle use compared to pre-pandemic • Most bicycle trips are for essential activities (grocery, work, etc.) • 25% of cycling households interviewed use borrowed bicycles	• Low female cyclists observed (3%) • 71% helmet users • Cyclists use footbridges to cross along major roads	• High percentage of bicycle ownership compared to car ownership (5:1 ratio) • Most bicycle trips were essential activities, followed closely by recreational activities (1:1 ratio) • 10:1 ratio of males to females cycling to work

In June 2021, the Metro Manila Counts! (MMC) Project, a citizen-led collaborative initiative conducted a bicycle and pedestrian count in 32 locations in Quezon City, Marikina City, San Juan City and Pasig City with the help of 168 volunteers. The MMC Project aimed to address the lack of data on active transport users, which make it difficult for planners and decision makers to "design the appropriate transport infrastructure and program, justify investments and value the socio-economic benefits of active transport to cities and businesses" (MMC Project Report, 2021). A summary of the features and notable findings from these studies are summarized in Table 1.

Meanwhile, the Metro Manila Development Authority (MMDA) has been continuously reporting on bicycle road crash statistics though the bicycle traffic is not included in its Annual Average Daily Traffic (AADT) reports. Moreover, the reports are aggregated at the city level which makes spatial analysis a challenge. Meanwhile, the comprehensive Metro Manila Urban Transportation Integration Study (MMUTIS) Update and Capacity Enhancement Project (MUCEP) model of the Department of Transportation (2014) has collected bicycle use information from its Household Interview Survey though this needs to be updated to reflect recent conditions.

Despite these efforts, there is yet to be a comprehensive and continuous monitoring effort to understand cyclists, pedestrians, and their needs especially in light of newly built cycling infrastructure. In partnership with the Department of Transportation, this study is part of Project KaLakBay (*Ka- Lakad at Baysikleta*), a project that is designed to promote active transport through the development of a spatial planning and collaborative decision framework for active and public transport in Metro Manila, in line with the government's priority to promote alternative, sustainable, and inclusive mobility. The project has many components, one of which is to develop a bicycle demand estimation model which models cyclist demand, route choices, and overlays them onto the bicycle network. To this end, the team has been conducting online consultations with stakeholders and researchers, conducted online and field surveys, as well as other data collection efforts using innovative technologies.

1.3 Objectives of the Study

The objective of this paper is to contribute to the current understanding of Metro Manila's cycling population so far by sharing insights gleaned from our road-side bicycle count and route choice surveys. We collected information on cyclists' socio-economic status, trip characteristics, mode-shift during the pandemic, and access to cycling infrastructure and amenities. Through this exercise, we aim to better understand cyclist profiles and contribute to the evolving discourse on active transport as well as to improvements in cycling research, policies, and infrastructure.

2. MUCEP CYCLIST DATA

The MUCEP database is one of the most comprehensive databases of transport characteristics for the Greater Metro Manila Area which encompasses all modes. Data collection was conducted between 2012-2014. Although bicycle trip data has been collected from Household Interview Surveys (HIS), bicycle demand was not explicitly included in the analyses and was categorized under "Others". The data indicates that majority of cyclists surveyed belong to low-income classes and have no access to motorized vehicles. A summary of pertinent data are shown in this section.

The socio-economic characteristics of cyclists from the MUCEP database are presented in Table 2. Around 85% of cyclists are in the working and non-retired age brackets (19-59 years old), with the median age being 39. A large share of the cycling trips are made by men,

outnumbering women in a 12:1 ratio. Heads of household cycle more than the non-heads of household. In terms of income, most trips are made by individuals with income less than Php 10,000 which is just a little over the minimum wage in year 2012.

Laborers, unskilled workers and service-oriented workers comprised majority of cyclists (75.5%) while white-collar workers comprised only 7.6% (see Table 3). Upon closer inspection, the dominant employment sectors were Construction (20.3%), Wholesale and Retail Trade, Repair of Motor Vehicles, Personal and Household Goods (15.6%), and Other Community, Social & Personal Services (10.7%).

It was found that most cyclists own at least one bicycle. There are 876 (27%) recorded cycling trips that did not declare bicycle ownership. 93% and 99% did not own cars and motorcycles, respectively.

Table 2. Socio-economic characteristics of cyclists from MUCEP (N=3233)

Factor	Count	%
Age		
18 and below	284	8.78%
19-29	508	15.71%
30-39	829	25.64%
40-49	876	27.10%
50-59	543	16.80%
60-69	167	5.17%
70 and above	26	0.80%
Sex		
Male	2988	92.40%
Female	245	7.60%
Head of Household		
Yes	2169	67.10%
No	1064	32.90%
Income Level (Personal income) in Php		
0-10,000	2161	66.84%
10,001-20,000	997	30.84%
20,001- 130,000	75	2.32%

Table 3. Occupations of Cyclists from MUCEP

Occupation	Count	%
Labor and Unskilled Worker; Service Worker; Shop and Market Worker	2094	64.8%
Trader and Related Worker, Plant & Machine Operator and Assembler, Farmer, Forestry Worker and Fisherman	345	10.7%
Official of Government or Special Interest Org, Corporate Executive, Manager; Technical and Associate Professionals; Professional; Clerical Staff	244	7.6%
Student (Elementary and Highschool)	268	8.3%
Housewife or Husband; Unemployed	213	6.6%
Others	69	2.1%

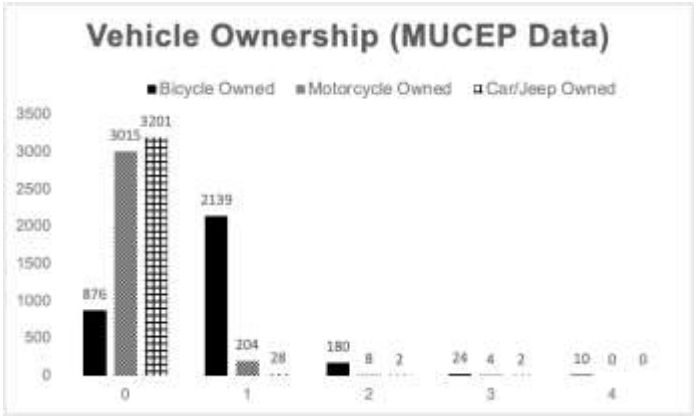

Figure 2. Vehicle ownership data from MUCEP (2012-2014)

3. METHODOLOGY

3.1 Identification of Survey sites

With the lack of recent inter-city cycling Origin-Destination (OD) data, the OD matrix generated from the MUCEP Household Interview Survey (HIS) data was used. To date, the MUCEP database contains the most widespread HIS data for the Mega Manila areas (i.e. Metro Manila, Bulacan, Cavite, Laguna, and Rizal) and has been used for the planning of various transport projects. In the MUCEP database, areas are subdivided into Traffic Analysis Zones (TAZs), each composed of a number of barangays. Each origin and destination address is given a tag corresponding to its respective TAZ. Using the CUBE software, desire lines were constructed between the Origin and Destination TAZs to determine the heavy demand OD pairs. These are illustrated in orange lines in Figure 3. The green-colored lines are the boundaries of each TAZ.

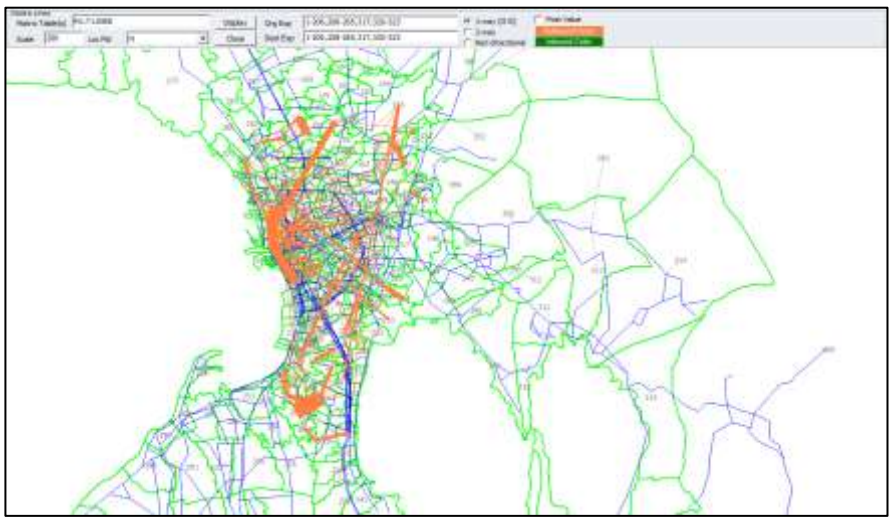
Figure 3. Cycling trip desire lines generated via CUBE

The number of survey location sites were dictated by resource constraints. To ensure that the survey sites were relatively well distributed, cities were clustered based on their geographic location and cycling trip volume, with each cluster containing around 45,000 to

60,000 cycling trips. A total of five (5) clusters were formed, and two sites were selected per cluster. The clusters and specific locations identified are shown in Table 4.

Table 4. Survey locations for identified clusters

Cluster	Trips Generated (Origin)	Location	Bicycle Lane Class*	# of Surveyors	
				Bike Count	Route Choice
Manila	49,281	Roxas Boulevard (UN Avenue)	Class II	2	2
		Espana (Approaching University Belt)	Class I	2	
Quezon City	48,382	Quirino Highway (Novaliches Proper)	Class III	2	2
		C-5 Katipunan (UPTC)	Class II	2	
East LGUs: Marikina, Pasig, Mandaluyong, San Juan	44,826	Ortigas Avenue (Rosario Pasig)	Class III	2	2
		Shaw Boulevard (SM Cherry Shaw)	Class III	2	
South LGUs: Pasay, Makati, Taguig, Muntinlupa, Pateros, Paranaque	110,266	JP Rizal (Near Guadalupe Ferry)	Class III	2	
North LGUs: Caloocan, Navotas, Valenzuela, Malabon	94,547	McArthur Highway (Governor Pascual)	Class III	2	2
		C-4 (UE Caloocan)	None	2	
Total stations				**9**	**5**
Total surveyors				**18**	**10**

From DPWH Department Order 2020-88: **Class I: Designated path completely separated from roadway that is shared with pedestrians. **Class II**: Separated bike lane using pavement marking or physical separation. **Class III**: Part of roadway that has been officially designated and marked as bicycle route but can also be used by motor vehicles.*

3.2 Bicycle count survey

The bicycle count survey was conducted in both directions of nine (9) unique locations around Metro Manila. Surveyors were deployed for sixteen (16) hours, from 5:00 AM to 9:00 PM on April 22, 2022. The survey tool used in the Metro Manila counts survey was adopted which disaggregated cyclists by gender and helmet use. The survey also took note of the number of counterflowing cyclists (i.e. travelling in the direction opposite the flow of traffic).

3.3 Route choice survey

In consideration of health and safety concerns, an online survey was initially contemplated. However, analysis of the MUCEP household interview survey revealed that many of cyclists belonged to low-income groups who may not be able to easily access an online questionnaire. A road-side face-to-face interview survey was conducted instead, based on the heavy demand clusters identified in Section 3.1. The survey was conducted on April 22 and 29, 2022 from 5 AM to 8 PM. Interviewers stood on the side of the road, hailed cyclists, and requested them if they were willing to be interviewed. In some locations, surveyors were assisted by traffic enforcers. Each interview lasted for 8-12 minutes.

3.4 Limitations of the Survey

The site selection methodology is based on the MUCEP cyclist data. Therefore, the survey sampling distribution may capture respondents with profiles that are similar to those in the MUCEP survey. It is possible for there to be more popular routes due to recent surges in cycling demand brought about by the pandemic and the installation of bicycle infrastructure. In the

future, this study's database should be augmented by additional data as cycling demand increases and as more bicycle infrastructure is added to the network.

For the bicycle route choice survey, the responses may also be influenced by users' willingness to be interviewed. The survey team initially encountered difficulties in obtaining survey respondents during the morning peak hours as most cyclists were rushing to their destinations. One mitigation measure adopted was to lengthen the survey period until 8 PM in order to capture cyclists on their return trips who many no longer be in a rush.

Figure 4. Scenes from the route choice (left) and bicycle volume count (right) surveys

4. Bicycle Count Survey Results

4.1 Bicycle volume counts

The Table 5 summarizes the cyclist volumes during the 16-hour survey. It was noted that the peak period for cyclists lasted for 1-2 hours, where the maximum hourly volumes were observed from 6-8 AM and 5-7 PM for the majority of surveyed sites.

Table 5. Summary of bicycle count data

	City	Station	Direction	AM Peak Hour		PM Peak Hour		Total Volume			Daily Volume	Helmet %
				Volume	Time	Volume	Time	Male	Female	Not Det.		
1	Caloocan	C-4 (Samson Rd)	East Bound - Monumento	488	7:01 - 8:00	206	17:00 - 18:00	2881	81	1	2963	32.5%
2			West Bound - Malabon	175	7:01 - 8:00	402	17:00 - 18:00	2033	32	1	2066	34.5%
3	Makati	Dr. Jose P. Rizal Ave	East Bound - University of Makati	425	6:01 - 7:00	147	17:00 - 18:00	1995	39	0	2034	48.6%
4			West Bound - Rockwell Power Plant	219	6:01 - 7:00	387	17:00 - 18:00	1988	33	0	2021	50.7%
5	Manila	España Blvd	North Bound - Quezon City	116	7:01 - 8:00	198	17:00 - 18:00	1427	38	5	1470	65.0%
6			South Bound - Quiapo	175	6:01 - 7:00	168	17:00 - 18:00	1493	34	0	1527	71.9%
7		Roxas Blvd	North Bound - Divisoria	311	6:01 - 7:00	455	18:00 - 19:00	2866	838	32	3736	57.5%
8			South Bound - Mall of Asia	536	6:01 - 7:00	189	17:00 - 18:00	2347	42	3	2392	60.6%
9	Quezon	Katipunan Ave	North Bound - Maynilad	134	7:01 - 8:00	246	17:00 - 18:00	1334	14	0	1348	87.5%
10			South Bound - Berkeley Residences	398	6:01 - 7:00	210	17:00 - 18:00	1934	31	0	1965	91.3%
11		Quirino Highway	North Bound - Novaliches Proper	154	6:01 - 7:00	503	17:00 - 18:00	2201	5	0	2206	75.6%
12			South Bound - Barangay Sauyo	450	6:01 - 7:00	201	17:00 - 18:00	2051	9	0	2060	77.3%
13	Valenzuela	MacArthur Hway	North Bound - Bulacan	235	6:01 - 7:00	325	17:00 - 18:00	1683	28	4	1715	81.0%
14			South-Bound - Monumento	339	6:01 - 7:00	222	17:00 - 18:00	1950	42	1	1993	85.8%
15	Pasig	Ortigas Ave Ext	East Bound - SM City East Ortigas	189	7:01 - 8:00	577	17:00 - 18:00	2491	41	105	2637	57.1%
16			West Bound - The Medical City	525	6:01 - 7:00	156	17:00 - 18:00	2382	44	0	2426	55.7%
17	Mandaluyong	Shaw Blvd	North Bound - Pasig	164	7:01 - 8:00	226	17:00 - 18:00	1390	46	15	1451	57.3%
18			South Bound - EDSA	227	6:01 - 7:00	189	17:00 - 18:00	1492	27	0	1519	56.9%

4.2 Cyclists are mostly male

An overwhelming majority of the cyclists counted were male. Out of the 37,529 cyclists counted, only 1,424 (3.8%) were female with male to female ratio of 25:1. It was however noticed that in the Manila-Roxas Boulevard (Site 7), there was a significantly high number of female cyclists at 838 which is more than twenty times the usual volume of female cyclists counted in other sites.

4.3 Helmet use and compliance with helmet ordinance

Overall, 61.9% of cyclists were observed to have worn helmets (Table 6). For cities that have recently passed ordinances requiring helmet use, an above-average compliance rate was observed: Quezon City (82.2%) and Valenzuela (84%). The Makati survey site, however, only had 49.6% of cyclists wearing helmets despite having a helmet ordinance. It is to be noted that Makati's ordinance was issued in 2017.

Figure 5 shows the hourly helmet compliance per city, wherein cities marked in green have existing helmet ordinances. In cities with no helmet ordinances (orange lines), compliance is usually highest in the morning then gradually drops until around 1 PM, after which it slowly increases again towards the evening. For Quezon City and Valenzuela City who have recently implemented helmet ordinances, compliance is within the 70-90% range. Compliance in Makati City appears worse than most of the cities that have no helmet ordinances. The lowest compliance rate is found at the Caloocan City site which is the only site without a bicycle lane.

Table 6. Number of cyclists wearing helmets per city

City	With Helmet	W/o Helmet	With Helmet %	With Helmet Ordinance?
Quezon	6233	1346	82.20%	Yes
Makati	2013	2042	49.60%	Yes
Valenzuela	3100	608	84.0%	Yes
Manila	5653	3472	62.0%	No
Mandaluyong	1697	1273	57.0%	No
Pasig	2859	2204	56.0%	No
Caloocan	1677	3352	33.0%	No
Total	**23232**	**14297**	**61.9%**	

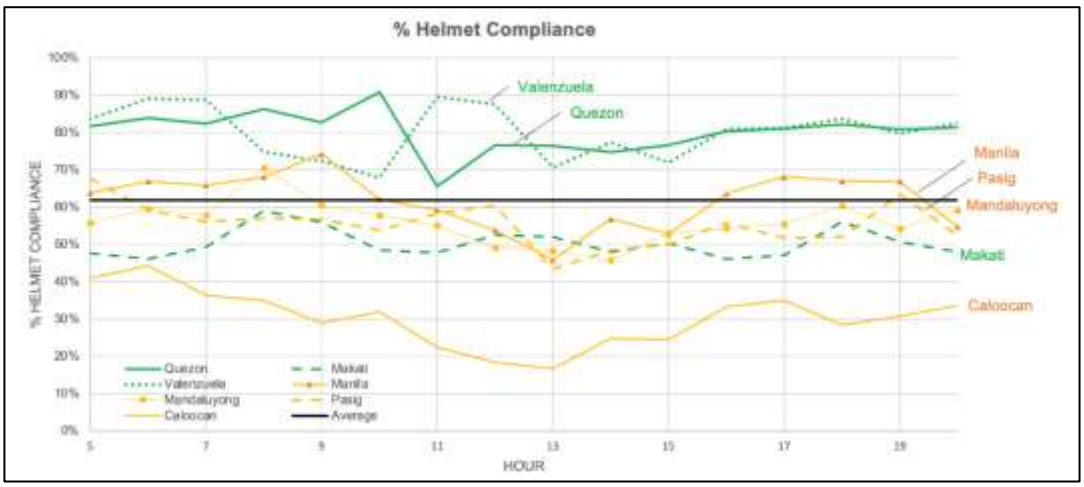

Figure 5. Helmet Compliance per City at Different Times of the Day

5. Route Choice Survey Results

The route choice survey was able to interview 748 respondents during the 2-day survey. Some challenges were encountered in hailing cyclists especially during peak hours as most of them were in a hurry. The highlights are presented in this section.

5.1 Socio-economic profiles of respondents

A summary of the socio-economic profile of the respondents is presented in Table *7*. From the data, it appears that the majority of respondents belong to the most economically disadvantaged socio-economic classes in the Philippines, similar to the MUCEP data in Section 2. Almost half (49%) were either unemployed or earning below minimum wage[1]. In total, 98% of the respondents were earning below Php 20,000 per month. 68% of respondents declared that they were the primary income sources of their respective households. In addition, only 22% were able to reach the college level or graduate from it.

A significant number of respondents (26%) identified cycling as the only mode that they used (see Figure 6). For the others, most respondents used public transport modes such as jeepney and bus when not using their bicycles.

In terms of vehicle ownership, majority of the respondents are the only bicycle users in their households, with 71.4% having only one bicycle is being used in their household (*Figure 7*). The results also showed low ownership of motorized vehicles, with 67.9% and 79.6% responding that they do not own or use a motorcycle and car, respectively, in their household. Consistent with the bicycle count survey results, only a small portion (6%) of the respondents were female.

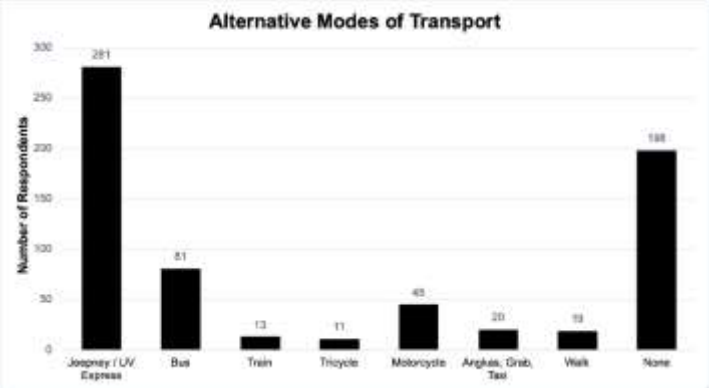

Figure 6. Alternative Modes Used When Not Cycling

5.2 Trip Characteristics

Cycle-to-Work Trips

Work trips were the most common trip purposes recorded (see *Figure 9*), with 77% (566) of respondents cycling to work at least once in a week. Majority (80.1%) of those that cycled to work did so with a weekly frequency of 6-7 times. When asked about how long each one-way trip took, 46% are within 30 minutes while 37% are within 1-2 hours (*Figure 8*). Although not

[1] Minimum wage considered based on minimum wage rates in NCR prescribed by the Department of Labor and Employment: Php 500-537 for 20 days: Php 10,000-10,740

that high, it is worth noting that some respondents cycle to work for more than 2-3 hours. Assuming an average speed of 20 kph, this would translate to more than 40-60 kilometers distance.

Only 560 respondents that cycled to work clearly indicated their Origins and Destinations and among these, 56% cycled to destinations outside of the city wherein their trips originated. This is visualized via R software in Figure 10 wherein Origin-Destination (OD) pairs are connected via desire lines. A high density of gray lines in between cities can be observed, representing inter-city trips. A cluster of O's and D's outside of the reach of the bicycle lane network is evident in the northern part of the map, particularly in Valenzuela, Caloocan, and Bulacan.

Table 7.Socio-economic Profile of Survey Respondents

Factor	Count *(n=748)*	%
Age		
18 and below	76	10.0%
19-29	170	23.0%
30-39	163	22.0%
40-49	143	19.0%
50-59	134	18.0%
60-69	57	8.0%
70 and above	5	1.0%
Sex		
Male (Lalaki)	702	94.0%
Female (Babae)	46	6.0%
Educational Attainment		
No grade completed	2	0.3%
Elementary level/ graduate	98	13.1%
Highschool level/ graduate	483	64.6%
College level/ graduate	160	21.4%
Prefer not to say	5	0.7%
Employment status		
Employed, full-time	469	66.0%
Self-employed	43	6.0%
Employed, part-time	64	9.0%
Unemployed	136	19.0%
Head of household/ Primary source of income		
Yes	509	68%
No	239	32%
Income Level (Personal income)		
0-10,000	362	49%
10,001-20,000	352	48%
20,001- 130,000	18	2%

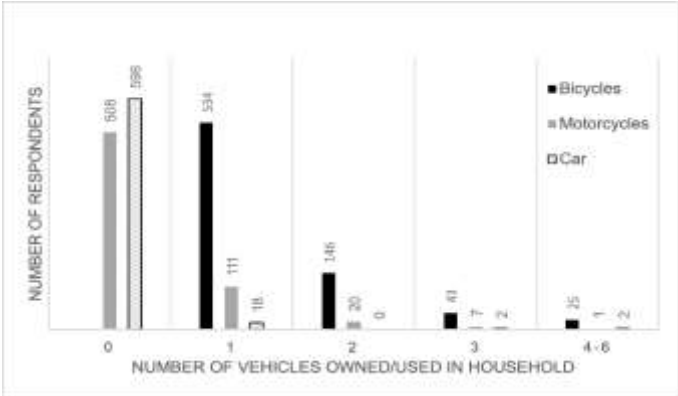

Figure 7. Number of Vehicle Owned/Used in Household

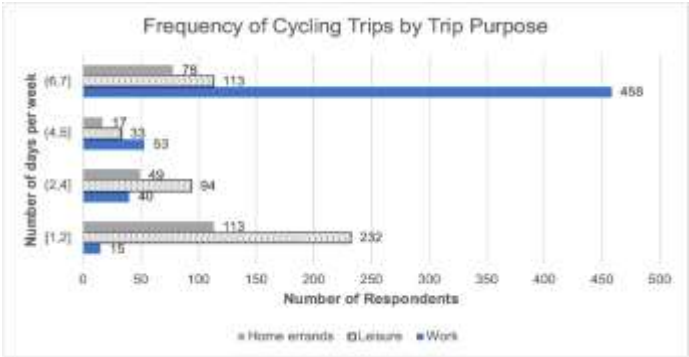

Figure 9. Frequency of Cycling Trips

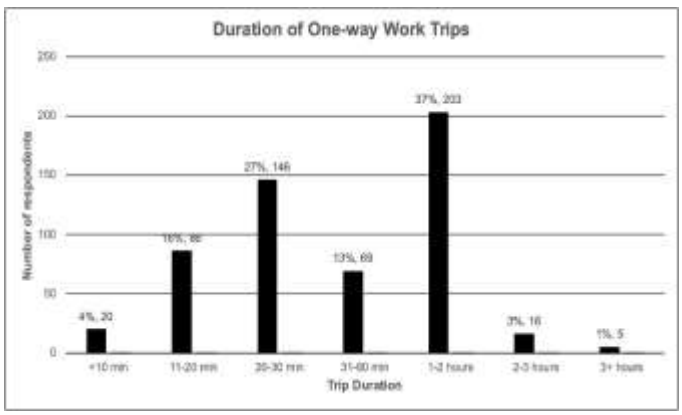

Figure 8. Duration of One-way Work Trips

Other Trip Purposes

64% of respondents cycled for leisure at least once a week, with 1-2 times a week being the most common frequency. Meanwhile, only 35% of the respondents cycled to accomplish home-related errands.

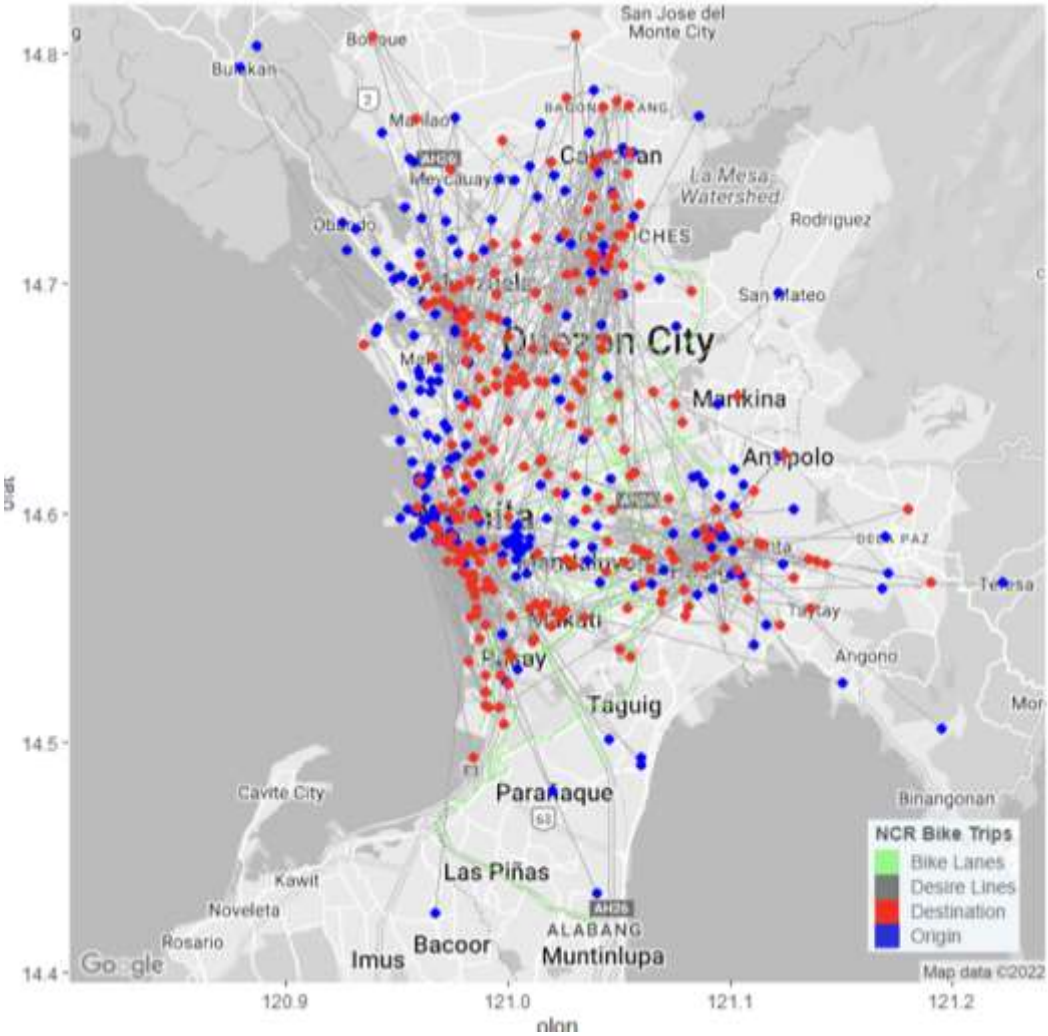

Figure 10. Bike-to-Work Origin-Destination pairs

Covid-19 impact/ Mode-shift behavior

Most of the respondents have already been cyclists even before the pandemic. From the survey, only 35% (257) have just begun cycling in the past two years (i.e. during the pandemic). Many of these "new" cyclists have a mix of trip purposes (work, leisure, home errands) but majority appear to be using bicycles as their main transport mode. Among the "new" cyclists, 71.6% (184) are cycling to work at an average of 5.8 days per week. Majority of these new cyclists do not own a car (245 or 95%) or motorcycle (200 or 78%).

When the new cyclists were asked whether they plan to continue cycling to work, there appears to be a generally non-negative outlook among them. Only 1% answered that they plan on decreasing their cycling frequency. Meanwhile, majority do not intend to change (161 or 61%) and some even desire to increase (30 or 12%) their cycling frequencies.

This result is consistent among the entire population of respondents, majority of whom plan to continue cycling to work without changing their current frequency (see Table 8). Among the reasons given for planning to increase their cycling frequencies are health/exercise, less exposure to Covid-19, desire to enjoy more, and to save on transport costs. On the other hand, the reasons given for wanting to reduce cycling frequencies were: desire to shift to a motorcycle, physical ailments, and warm weather.

Table 8. Respondents' Plans to Change Bicycle Frequency

Plans to change bike frequency to work	**Count**	**%**
No change.	536	90.69%
Yes, I want to bike more to work.	44	7.45%
Yes, I want to bike less to work.	11	1.86%

5.3 **Cycling and Other Support Infrastructure**

When cycle-to-work respondents were asked about the availability of bicycle support facilities in their respective workplaces, only bicycle parking emerged as the most common facility available with 92% responding that their workplaces had this. As illustrated in Figure 11, only a small percentage had access to a locker room (29%), air compressor (15%) and shower (15%) at the workplace.

Figure 11. Availability of Bicycle Support Facilities at the Workplace

Following the factors considered in Tacadao and Villena (2021), the respondents were asked to rate their satisfaction with regards to various elements of their chosen route. Figure 12 shows the result for selected route elements. In general, the respondents expressed satisfaction over the elements identified, especially with the bicycle lanes. When asked to rate the overall quality of the routes they chose (see Table 9), around 85% (633) expressed overall satisfaction.

Table 9. Rating of Overall Satisfaction of Cyclists' Route

Overall Satisfaction of Route		
Greatly satisfied	396	53%
Satisfied	237	32%
Neutral	105	14%
Dissatisfied	6	1%
Greatly dissatisfied	4	1%

Figure 12. Satisfaction of Various Route Elements Encountered by Respondents

6. DISCUSSION: IMPLICATIONS FOR FUTURE PLANNING

6.1 Bicycle Demand and Route Choices

From the bicycle volume count survey, results show consistencies in cycling demand across the survey sites wherein peak volumes were observed between 6-8 in the morning and 5-7 in the afternoon/evening. Data from MMDA's bicycle accident reports show that bicycle-related accidents also peak around these times (7 AM and 5 PM). Although accidents are site-specific, this information is useful in allocating enforcement staff to manage safety of cyclists, informing traffic management plans, and further improving cycling infrastructure. The survey was also able to determine the dominant directions of cycling demand at different times of the day which could also guide traffic enforcement. For example, cycling traffic demand in the C-4 (Samson Road) site indicated that more people were travelling towards the East-Bound direction in the morning (see Table 5, row 1). Also, the daily cycling demand in these sites (Sites 1 and 2) were above-average yet these sites did not have bicycle lanes. Furthermore, matching accident and demand data can also help determine the need for safety improvements.

6.2 Requirement for Helmets

Cities with recently-issued helmet ordinances saw a higher rate of cyclists wearing helmets at all times of the day while for other sites, helmet-use was observed to be higher only in the early part of the morning or later part of the evening. Helmet use appears to be lower during warmer times of the day. In terms of ordinances, emphasis is placed on "recent" since the Makati City site had one of the lowest helmet users despite the city having a helmet ordinance. Although helmet use is important for safety, social concerns also come into play. In Quezon City for example, the implementation of their helmet ordinance was delayed by 15 days after concerns have been raised by residents that individuals could not comply as they have prioritized food and health needs over helmets (PNA, 2021). This prompted the local government to give free helmets.

On the other hand, some groups are advocating that helmet use be made optional. Transportation Alternatives and Families for Safe Streets, two New York-based organizations that actively promote safe cycling, are in favor of making helmet usage voluntary. They found that mandatory helmet laws, while having the best intentions, have negative consequences such as exposing vulnerable populations to unnecessary interactions with the police, reduction in the number of cyclists on streets, and lower patronage for popular bike sharing systems (Devito,

2020). In effect, they argued that lowering cyclist numbers reduce the "Safety in Numbers" effect, wherein more cyclists create safer cycling conditions. In the Philippine context, consideration for discomfort especially during high temperatures should also influence the design of bicycle infrastructure.

6.3 Socio-economic and trip characteristics of cyclists

A look at the socio-economic and trip characteristics of cyclists was enabled by the route choice survey. The data obtained were compared with the 2012-14 MUCEP study (see *Table 10*) to determine similarities or potential trend variations. The study found that majority of cyclists are still from financially disadvantaged classes as evidenced by income level (49% unemployed/below minimum wage), educational attainment (78% were high school graduates and below), and car ownership (79.6% do not own a car).

This study saw a higher percentage of work trips (77%) compared to the MUCEP database wherein work trips only comprised 35.6%. From the MUCEP data, 75% of work trips ended in the same city as the origin. Possibly owing to the more expansive bicycle network, this study observed more inter-city work trips (56%) as shown in Figure 10. Despite the lack of bicycle support facilities such as locker rooms, showers, and air compressors in the workplace, respondents still wanted to continue cycling to work in the future.

The results point the obvious: travel costs play a significant role in the decision to use a bicycle. The necessity of providing safe cycling infrastructure should therefore not just be tied to high cyclist demand. More importantly, it should also be seen as a lifeline for many low-income Filipinos. This raises questions on whether enough poor people have access to bicycles and how those without access to bicycles nor public transport travel. This was also reflected in a 2020 SWS survey which showed that 25% of respondents were using borrowed bicycles.

Table 10. Comparison with MUCEP 2012-14 data

	MUCEP (2012-14; N=3233)	**This study (2022; N=748)**
Age		
18 and below	8.8%	10.0%
19-29	15.7%	23.0%
30-39	25.6%	22.0%
40-49	27.1%	19.0%
50-59	16.8%	18.0%
60-69	5.2%	8.0%
70 and above	0.8%	1.0%
Gender		
Male	92.4%	94.0%
Female	7.6%	6.0%
Income Level		
0-10,000	66.8%	49.0%
10,001-20,000	30.8%	48.0%
20,001- 130,000	2.3%	2.0%

	MUCEP (2012-14; N=3233)	**This study (2022; N=748)**
Bicycle Ownership		
0	27.1%	
1	66.2%	71.4%
2	5.6%	19.5%
3	0.7%	5.7%
4+	0.4%	3.3%
Motorcycle Ownership		
0	93.3%	81.4%
1	6.3%	14.8%
2	0.2%	2.7%
3	0.1%	0.9%
4+	0.1%	0.1%
Car Ownership		
0	99.0%	97.1%
1	0.9%	2.4%
2	0.1%	0.0%
3	0.1%	0.3%
4+	0.0%	0.3%

6.4 Covid-effects and threats to sustainable transport

The survey results also showed evidence of mode shift to cycling during the pandemic, with 35% of respondents having just started cycling in the past two years. It is important to note that among these "new" cyclists, majority are not car (95%) or motorcycle (78%) owners. Therefore, the mode shift to cycling was likely from public transport, possibly due to the lower public transport reliability and capacity brought about by Covid-19 restrictions. From the perspective of environmental sustainability, cycling motivators and barriers from the perspective of car users warrant a deeper look in order to gain insights on how to encourage mode shift. Although not a substantial number, some respondents of the survey have also entertained the possibility of shifting to motorcycles when the opportunity arises (i.e. when they can afford to buy one), perhaps tempted by the ability of motorcycles to skirt through traffic and potential for door-to-door travel. MMDA's Annual Average Daily Traffic data has seen a 41% increase in motorcycle trips from 2018 to 2020 alone. This could be seen as a potential threat to cycling viability in the future.

On the opposite side, 65% of respondents were already cycling before the pandemic regardless of the absence of cycling infrastructure. These respondents may have already been acclimated to not being prioritized on the road which could explain the high levels of satisfaction with the bicycle route and infrastructure in Section 5.4. Meanwhile, some cyclists have complained about Metro Manila's bicycle lane on social media (Interaksyon, 2021), with one netizen saying that "bike lanes are meant to protect vulnerable bicycle users, not cage them so they can no longer use other lanes". Cyclists pointed various reasons for not using bicycle lanes, among which are encroachment of motorists, presence of barriers and metal sheets, and too narrow space allotted, among others.

6.5 Cycling for underrepresented groups

The low percentage of women cyclists should also be an indicator that women continue to face challenges socially, culturally, and environmentally. The work of Cruz (2017) has extensively reviewed literature on women and cycling and found three key dimensions to promoting women's cycling in order to make Metro Manila and cycling more inclusive and responsive to women: safety of roads and public spaces, material and symbolic access to cycling, and women's participation in transport governance. In the Philippines, women cyclists have reported experiencing harassment from bystanders, car users, and even online (Fragante, 2021; Osmena, 2021)

Moreover, the 9% of respondents who were senior citizens should be given due attention, especially since cycling can also offer health benefits for them. In a report by the League of American Cyclists, a nationwide travel survey in the U.S. showed that bicycling and walking are very common forms of exercise and older adults are more likely to take three or more exercise trips per week. However, only three states have identified strategies to improve safety for older adults. A study in 33 urban neighborhoods in China found that living in a neighborhood with a compact urban form and safe cycling environment was strongly connected to more cycling trips among the urban elderly (Zhang, et. al., 2016). The well-being of the 800 thousand senior citizens (PSA 2015 Census) in Metro Manila should not be disregarded in the context of cycling.

7. MOVING FORWARD: TOWARDS SUSTAINABLE URBAN TRANSPORT

This paper has so far presented its findings obtained from two bicycle surveys conducted. Overall, this paper does not claim to have conducted the most comprehensive and most representative cycling surveys in Metro Manila but it is hoped that the study has provided a glimpse of who Metro Manila's cyclists are and demonstrated the implications of understanding them on cycling infrastructure planning.

As recommended by Cervero (2013), pro-active partnerships between transit agencies, local municipalities, and bicycle advocacy organizations are critical to ensuring improvements to cycling infrastructure. Employers can also contribute by adding bicycle support infrastructure in workplaces. The role of cycling in interconnecting modes as in the case of bike and ride systems in other countries should also be taken into account.

Given the social, economic, and political realities in the Philippines, cycling behavior will surely evolve and there will be a need to continuously study and monitor cyclists in a comprehensive manner. To this end, there is a need to leverage innovative technologies such as crowd sourcing applications and artificial intelligence as an alternative to traditional survey methods. Considering the socio-economic profile of this study's survey respondents, cycling promotion must not stop at improving infrastructure but studies on accessibility to bicycles should also be explored at the short term, especially for the poor. Lessons from the implementation of Public Bicycle Sharing Programs (Mateo-Babiano, 2015) in other Asian cities can be explored. Cycling motivators and barriers for car-users should also be looked into to determine mode-shift potential. A study in the Netherlands has shown that having a strong car-commuting habit decreases the probability of mode shift to a new alternative (De Krujif, 2018). A similar study considering the Philippine context may provide useful policy and planning insights. For the medium to long term horizons, the increasing motorcycle and car use are very potent threats to sustainable urban mobility in Metro Manila. Getting ahead of this threat requires a comprehensive menu of solutions, with cycling being one of the strategies.

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