Republic of the Philippines
Metropolitan Manila Development Authority (MMDA)

THE PROJECT FOR COMPREHENSIVE TRAFFIC MANAGEMENT PLAN FOR METRO MANILA

FINAL REPORT
SUMMARY

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Japan International Cooperation Agency

Almec Corporation
Oriental Consultants Global Co., Ltd.
Transportation Research Institute Co., Ltd.

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Abbreviations

3Es	engineering, enforcement, education
AADT	annual average daily traffic
AI	artificial intelligence
AT	active transportation
ATC	area traffic control
BBB	Build, Build, Build
BRT	bus rapid transit
C10	Circumferential Road 10
C5	Circumferential Road 5
CALABARZON	Cavite, Laguna, Batangas, Rizal, Quezon
CALAX	Cavite-Laguna Expressway
CavitEx	Manila-Cavite Expressway
CDP	comprehensive development plan
CO2	carbon dioxide
CBD	central business districts
CCTV	closed circuit television
CLUP	comprehensive land use plan
COVID-19	corona virus disease 2019
CPT	Counterpart Project Team
CTMP	Comprehensive Traffic Management Plan
DB	database
DENR	Department of Environment and Natural Resources
DILG	Department of the Interior and Local Government
DOH	Department of Health
DOST	Department of Science and Technology
DOTr	Department of Transportation
DPWH	Department of Public Works and Highways
DRIVER	Data for Road Incident Visualization Evaluation and Reporting
ECQ	Enhanced Community Quarantine
EDSA	Epifanio delos Santos Avenue
FIDIC	Fédération Internationale des Ingénieurs Conseils / International Federation of Consulting Engineers
FOC	factor of congestion
FS	feasibility study
GCQ	General Community Quarantine
GIS	geographic information system
HIS	household interview survey
HOV	high-occupancy vehicle
i-ACT	Interagency Council for Traffic
ICT	information and communication technology
ITR	interim report
ITS	intelligent transportation system
JAO	Joint Administrative Order
JCC	Joint Coordination Committee
JICA	Japan International Cooperation Agency
JPT	JICA Project Team
KPI	key performance indicator
LED	light emitting diode
LGU	local government unit
LiDAR	Light Detection and Ranging
LOC	level of congestion
LRT	light rail transit
LTFRB	Land Transportation Franchising and Regulatory Board
LTMS	Land Transport Management System
LTO	Land Transportation Office
MC	motorcycle
MICT	Manila International Container Terminal

MMARAS	Metro Manila Accident Reporting Analysis System
MMBP	Metro Manila Bridges Project
MMDA	Metropolitan Manila Development Authority
MMICP	Metro Manila Interchange Construction Project
MMUTIS	Metro Manila Urban Transportation Integration Study
MRT	metro rail transit
MUCEP	MMUTIS Update and Capacity Enhancement Project
MVUC	motor vehicle user's charge
NB	northbound
NAIA	Ninoy Aquino International Airport
NAIAX	Ninoy Aquino International Airport Expressway
NCTS	National Center for Transportation Studies
NEDA	National Economic and Development Authority
NGA	national government agency
NGO	non-government organization
NLEX	North Luzon Expressway
NOx	nitrogen oxide
NSCR	North-South Commuter Rail
NTP	National Transport Policy
OAGMP	Office of the Assistant General Manager for Planning
OD	origin-destination
ODA	official development assistance
OJT	on-the-job training
O&M	operations and maintenance
P2P	point-to-point
PCIEERD	Philippine Council for Industry, Energy, and Emerging Technology Research and Development
PCU	passenger car unit
PDCA	plan-do-check-action
PDP	Philippines Development Plan
PHP	Philippine peso
PM / PM10	particulate matter
PNP	Philippine National Police
PNR	Philippine National Railway
PRSAP	Philippine Road Safety Action Plan
PSA	Philippine Statistical Authority (PSA)
PUB	public utility bus
PUJ	public utility jeepney
PUV	public utility vehicle
QR	quick response
R1	Radial Road 1
R10	Radial Road 10
ROW	right of way
RFID	radio frequency identification
SLEX	South Luzon Expressway
SOx	sulfur oxide
SPM	suspended particulate matter
STRADA	System for Traffic Demand Analysis
SUV	sport utility vehicle
SVES	speed violation enforcement system
TBN	traffic bottleneck
TEAM	traffic engineering and management
TEC	Traffic Engineering Center
TED	Traffic Education Division
TDO	Traffic Discipline Office
TNVS	transport network vehicle service
TOD	Transit Oriented Development
TRC	traffic responsive control
TSES	traffic signal enforcement system
TSOMD	Traffic Signal Operations & Maintenance Division

TTC	Traffic Training Center
TTC	travel time cost
TWG	technical working group
UP NCTS	University of the Philippines's National Center for Transportation Studies
UV	Utility vehicle
UVVRP	Unified Vehicle Volume Reduction Program
V/C	volume capacity ratio
VCR	volume capacity ratio
VDS	vehicle detection system
VMS	variable message sign
VOC	vehicle operating cost

1 PROJECT INTRODUCTION

1) Project Background

Traffic congestion in Metro Manila has become a major political and social problem. According to the study entitled “Formulation of Transportation Development Roadmap to Support Sustainable Development of Metropolitan Manila and Its Surrounding Areas,” which was conducted in 2014 with the support of the Japan International Cooperation Agency (JICA), the cost of transportation to the people in Metro Manila was PHP2.4 billion a day, and if no action would be taken, this was estimated to balloon to PHP6 billion by 2030.

Therefore, it is essential to solve traffic and transportation problems through a comprehensive action that has both hard and soft aspects to support Metro Manila’s future economic development. Under such circumstances, the Philippine government requested the Japanese government to provide technical assistance to study the matter. In September 2018, the Record of Discussion was signed between JICA and the Metropolitan Manila Development Authority (MMDA) to implement “The Project for Comprehensive Traffic Management Plan for Metro Manila.”

2) Project Objectives

The project aims to achieve the following:

(i) Data-driven identification of major traffic bottlenecks in Metro Manila and their detailed characteristics based on quantitative analysis;

(ii) Setting of the traffic management goal to be pursued in five years and the formulation of the MMDA's five-year action plan;

(iii) Implementation of selected improvement measures as pilot projects to finalize the five-year action plan; and

(iv) Development of the capacity of MMDA and local government units (LGUs) in traffic management by implementing the tasks necessary to achieve the preceding objectives.

3) Project Area and Scope

(a) **Area:** The project covers the 17 LGUs comprising Metro Manila, i.e., the cities of Caloocan, Las Piñas, Makati, Malabon, Mandaluyong, Manila, Marikina, Muntinlupa, Navotas, Parañaque, Pasig, Pasay, Quezon, San Juan, Taguig, and Valenzuela, as well as the municipality of Pateros, and especially the roads managed by the MMDA.

(b) **Counterparts:** While the main counterpart in the project is the MMDA, other government agencies involved in the project include the LGUs, the Department of Public Works and Highways (DPWH), Department of Transportation (DOTr), National Economic and Development Authority (NEDA), Department of Science and Technology (DOST), Department of Environment and Natural Resources (DENR), Land Transportation Office (LTO), Land Transportation Franchising and Regulatory Board (LTFRB), and Department of Information and Communications Technology (DICT).

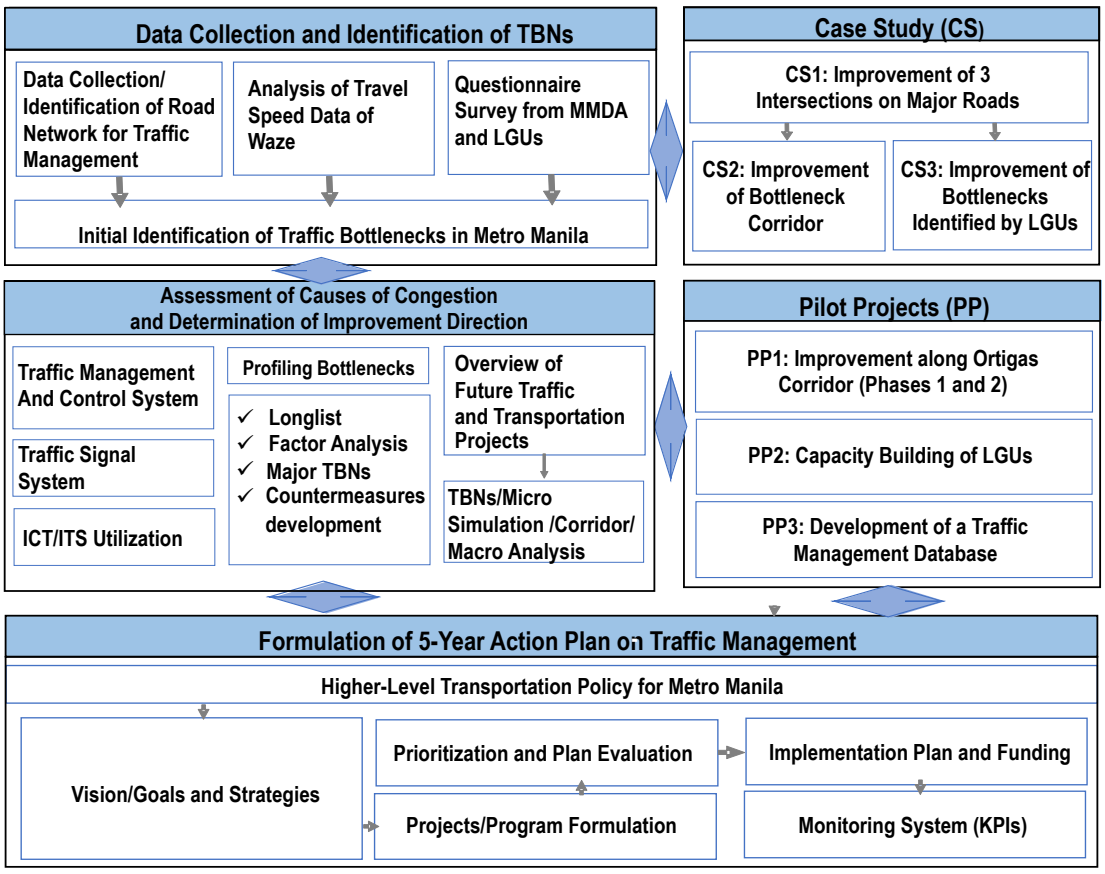
(c) **Scope:** This three-year JICA project aims to formulate a five-year action plan on traffic management for the road sector in Metro Manila and to develop the capacity of traffic management institutions and their personnel to plan, implement, evaluate, and improve traffic management measures, thereby improving mobility, connectivity, traffic environment, and safety.

4) Project Approach and Framework

The project is being implemented under the Joint Coordination Committee (JCC) which is chaired by the MMDA general manager with members coming from national government agencies (NGAs), as described in in the preceding section. Prior to holding JCC meetings, Technical Working Group (TWG) meetings are organized and chaired by MMDA's assistant general manager for operations to discuss technical issues. The Counterpart Project Team (CPT), which works closely with the JICA Project Team (JPT), comprises technical and enforcement personnel from MMDA, DPWH, DOTr, and LGUs.

The CTMP Project commenced in March 2019 with the submission and approval of the Inception Report, confirming the project objectives, approach, and expected outputs. Interim Report No. 1 (ITR1) was submitted in February 2020, the ITR2 in February 2021, and the ITR3 in March 2022. The Draft Final Report's (DFR) main text was submitted in September 2022. This Summary briefly describes the Final Report, which includes the Five-year Action Plan on Traffic Management.

Figure 1.1 illustrates the project framework, showing the CTMP Project's five (5) study components and their interrelationship. These components comprise the following: (i) data collection and identification of traffic bottlenecks (TBNs), (ii) conduct of case studies, (iii) assessment of congestion causes and determination of improvements, (iv) conduct of pilot projects, and (v) formulation of a five-year action plan on traffic management. These components are interactive, and the evaluation process is iterative.



Source: JPT

Figure 1.1: Project Framework

2 CURRENT TRAFFIC SITUATION IN METRO MANILA

2.1 Urbanization and Its Impact on Transportation

1) Growth of the Metropolitan Area

As described in Table 2.1, Metro Manila became a mega city when it breached the 10 million mark after 2000. In 2010, the population reached 12 million and 13 million in 2020. This is expected to further grow at 0.9% per year or 15 million[1] by 2030, all within 620 km^2 of land area. In 2020, population density in Metro Manila was more than 200 persons/ha as compared to Tokyo's 150[2] and Seoul's 158[3] figures. Densification has accelerated the expansion of the urban areas beyond the boundary of Metro Manila to form a city-region.

Table 2.1: Population Growth in Mega Manila, 2000–2030

City / Municipality		Area (km^2)	Population (000)				Annual Population Growth Rate (%/year)			Population Density (person/ha)		
			Actual			Projection						
			2000	2010	2020	2030	00–10	10–20	20–30	2000	2010	2020
Metro Manila		620	9,933	11,856	13,484	14,728	1.8	1.3	0.9	160	191	218
Adjoining Provinces	Bulacan	2,796	2,234	2,924	3,709	4250.2	2.7	2.4	1.4	8	10	13
	Cavite	1,526	2,063	3,091	4,345	4721.1	4.1	3.5	0.8	14	20	28
	Laguna	1,928	1,966	2,670	3,382	3919.1	3.1	2.4	1.5	10	14	18
	Rizal	1,183	1,707	2,485	3,330	3858.4	3.8	3.0	1.5	14	21	28
	Subtotal	7,433	7,970	11,170	14,766	16,749	3.4	2.8	1.3	11	15	20
Mega Manila		8,053	17,903	23,026	28,251	31,477	2.5	2.1	1.1	22	29	35

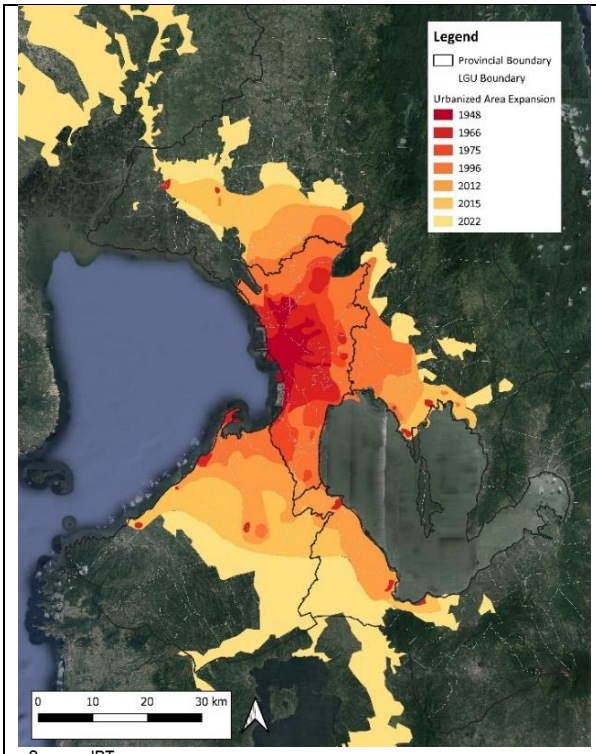
Source: Philippine Statistical Authority (PSA)

Continuous urbanization of the metropolitan region is associated with economic growth and motorization. New central business districts (CBDs) have developed along major thoroughfares, providing employment and attracting travel. On the other hand, increasing land values have become a constraint to finding homes in Metro Manila except for the higher-income groups. Majority of the people had to settle in peri-urban areas or live in cramped spaces in urban areas (Figure 2.1).

Thus, the large urban growth brings about enormous impact on land use, transportation, and the environment, threatening the sustainable development of Metro Manila and Mega Manila.

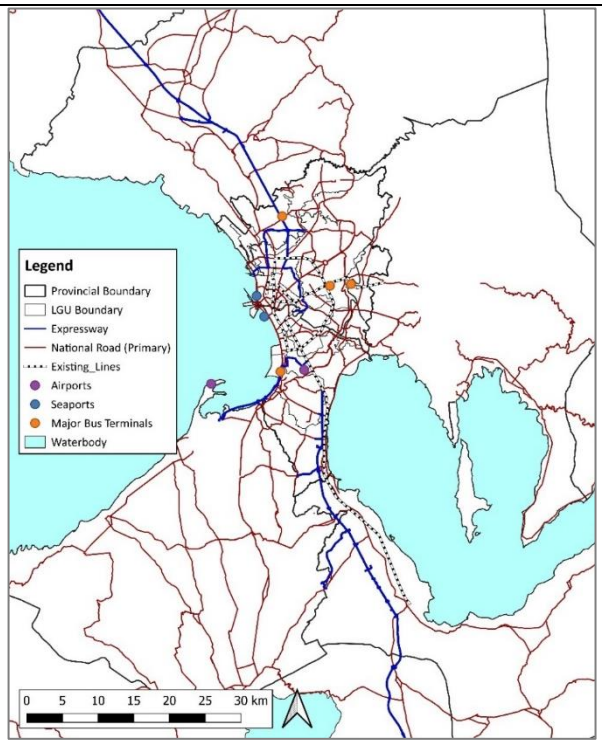
Of these issues, transportation issues are more serious because the provision of transportation infrastructure has been slow. The rapid urbanization has also increased the gap between transportation supply and demand and has substantially decreased the mobility of vehicles and people, earning for Metro Manila the negative reputation of being one of the most congested cities in the world. Traffic congestion on major roads is no longer limited to peak hours but throughout the day from 0600 to 2000. Because congestion is not limited to the CBDs, this means that the overall air quality in the metropolis has worsened.

[1] 2010 Census-Based Population Projections of Philippines Statistical Authority (PSA).
[2] Tokyo metropolitan area.
[3] 2020 Population and Housing Census in South Korea.



Source: JPT

Figure 2.1: Expanding Urban Areas in Mega Manila



Source: JPT

Figure 2.2: Transportation Network in Mega Manila

2) Existing Transportation System

Metro Manila is provided with different kinds of transportation modes and functions being the international and national hub for transportation and urban services. The network comprises an international airport, international ports, intercity expressways and arteries, secondary roads, interprovincial railroad and urban rails (MRT/LRT), together with an extensive road-based public transportation. Passenger ferry is also available to a limited extent (Table 2.2, Figure 2.2).

Table 2.2: Transportation Services

Mode	Overview of Service
Port System	• It consists of three port groups: (i) Manila North Harbor; (ii) Manila South Harbor; and (iii) Manila International Container Terminal (MICT). In addition to these three ports, there is a nearby private commercial port called the Manila Harbor Centre. The Manila ports have been identified by traffic authorities as another source of traffic congestion. For this reason, there is a growing clamor to relocate them to the under-utilized ports of Subic and Batangas. However, the Port of Manila is still expanding.
Airport System	• The Ninoy Aquino International Airport (NAIA), which is located in Metro Manila, caters to international and domestic flights. • A new international airport is undergoing construction in Bulacan, Bulacan province, led a private firm. • The number of international passengers exceeded that of the domestic passengers, accentuating congestion on the runway where aircraft movements already exceed capacity.
Railways in Mega Manila	• The railway system in Mega Manila consists of the Philippine National Railway (PNR) for inter-urban services and three urban railways for intracity movements. The PNR currently provides infrequent train services (1 train per hour) from Tutuban in the City of Manila to Cabuyao in Laguna province. The three urban railways are LRT-1 (Roosevelt, Quezon City–Baclaran, Pasay City), LRT-2 (Antipolo, Rizal–Recto, Manila), and MRT-3 (North Avenue, Quezon City–Taft Avenue, Pasay City). Many railways are planned for future implementation. • The aggregate number of railway ridership in 2013 was approximately 340 million passengers.
Expressways and Roads	• Metro Manila is linked by expressways to CALABARZON with a total length of 246.7 km (SLEX, NLEX, Cavitex, CALAX, Skyway, NAIAX). • While expressways provide interprovincial services, Metro Manila has well-articulated radial (R-1 to R-10) and circumferential (C-1 to C-5) roads, which function as the principal trunk roads within the metropolis. Overpasses and underpasses provide grade separations at several intersections of these roads. There are 1,018 km of national roads and about 8,500 km of local roads in Metro Manila. • Gated communities and the Pasig and Marikina rivers limit road-based movement and the road capacity in Metro Manila.
Road-based Public Transportation	• Provincial and city buses, the EDSA Carousel, PUJs, UV Express, tricycles, taxis, and ride-hailing services are in operation. Also plying Metro Manila's roads are e-jeepneys and e-tricycles.

Source: JPT

2.2 Public Transportation Services in Metro Manila

1) Existing Road-based Public Transportation Systems

There are various road-based public transportation services, such as public utility buses (PUBs), EDSA Carousel, PUJs, tricycles, pedicabs, UV Express, and P2P buses, which operate in Metro Manila. Besides these, there are taxis, transportation network vehicle services, and motorcycle ride-hailing services.

The share of buses and jeepneys among the total number of vehicles involved in traffic accidents in Metro Manila are 5% and 4%, respectively[4].

According to the LRT/MRT Users Survey by a central business district study in 2014,[5] the satisfaction level with road-based public transport services is not high. About 50–60% are not satisfied with the different aspects of the public transport services, particularly the satisfaction level of drivers (i.e., the driver's attitude and driving manner/skills) are lower.

Based on the survey[6], convenience and safety or security influence private car users when choosing their travel mode. In other words, these factors need to be improved to encourage shifting to public transport modes.

2) Issues on Road-based Public Transportation Systems in Metro Manila

It can be summarized that the safety, security, convenience, and comfortability of road-based public transportation systems need to be improved to encourage a modal shift from private travel modes to public ones.

Dangerous and selfish driving behavior almost always lead to traffic accidents and traffic congestion. Traffic safety education is also needed for the passengers.

Convenience of public transportation modes can be assessed through service frequency, punctuality, congestion at stops and on-board, distance to the boarding/alighting points, fare system, and transfer environment. Punctuality is difficult to achieve under the current traffic situation, but information dissemination of the travel and arrival times is possible. A detailed analysis of the demand-supply gap and dispatch considering the demand would improve operations. The waiting environment is one of the new aspects for the Philippines to address, which can improve the convenience and comfortability of passengers.

Service integration among the road-based public transportation modes and between these and railway is also one of the keys to improve the usability of the latter. This can include integrating the fare payment and providing intermodal transfer facilities, among others.

Planning for public road transportation also has several issues, such as the lack of a database to formulate plans, lack of a database on PT operators and a proper updating system, a lack of updated person-trip survey data, lack of a methodology to consider the post-COVID-19 situation, lack of route reorganization system corresponding to the changes in travel demand, and lack of personnel at the LGU level who can formulate route plans. Local public transportation route plans (LPTRPs) are supposed to be prepared by each LGU, but most of them have not yet prepared one. Moreover, the plan for Metro Manila should be formulated by the DOTr, but this is also not finalized.

[4] Metro Manila Accident Reporting and Analysis System (MMARAS) by MMDA
[5] The LRT/MRT Users Survey was conducted by the Preparatory Survey on Metro Manila Central Business Districts Transit System Project in the Republic of the Philippines in 2014.
[6] The Detailed Design Study of the Metro Manila Subway Project in the Republic of the Philippines (JICA).

2.3 Traffic Demand Characteristics

1) Overall Travel Demand in Mega Manila

From 1996 to 2019, traffic demand in Metro Manila and between Metro Manila and its adjoining provinces in terms of number of trips remains almost the same, although traffic demand within the adjoining provinces nearly doubled. In 2019, traffic demand was estimated to be 15.6 million trips in Metro Manila, 8.3 million trips in BRLC, and 2.3 million trips between Metro Manila and adjoining provinces (Table 2.3). The main purpose of traveling from the adjoining provinces to Metro Manila was "to work" in 1996 and 2014. However, its share significantly increased in this period from 31% to 45%. Thus, more people are commuting to Metro Manila from the adjoining provinces[7].

Table 2.3: Travel Demand in Mega Manila, 1996–2027

Area		No. of Trips (000)			Share in Total (%)			Ratio	
		1996	2019	2027 (estimated)	1996	2019	2027	'19/'96	'27/'19
Within Metro Manila		16,950	15,647	19,882	72.6	87.1	83.9	0.9	1.3
Between Metro Manila and Adjoining Provinces	Bulacan	718	699	1,081	3.1	3.9	4.6	1.0	1.5
	Rizal	157	955	1,726	0.7	5.3	7.3	6.1	1.8
	Cavite and Laguna	1,177	666	1,017	5.0	3.7	4.3	0.6	1.5
	Sub-total	2,052	2,320	3,824	8.8	12.9	16.1	1.1	1.6
Within Adjoining Provinces		4,357	8,345	11,413	19	46	48	1.9	1.4
Mega Manila		23,358	17,968	23,706	100	100	100	0.8	1.3

Source: Prepared by JPT based on Metro Manila Urban Transportation Integration Study (MMUTIS) (JICA, 1999) and MMUTIS Update and Capacity Enhancement Project (MUCEP) (JICA, 2015) data

2) Travel Demand in Metro Manila

Comparing the travel demand in Metro Manila, the total number of trips in 2020 was about 1.26 times more than the 2012 figure. Also, the person-kilometer decreased, while the person-hour increased. This means that people traveled shorter distances, but they spent more time traveling due to traffic congestion. A similar trend can be seen for vehicle travel. PCU-kilometer in 2020 increased 1.09 times in 2012, but the PCU-hours increased 2.76 times (Table 2.4).

Table 2.4: Travel Demand in Metro Manila, 2012 and 2020

Travel Demand		2012	2020	20/'12
Person	No. of Trips (mil./day)	12.8	16.2	1.26
	km (mil.)	132.0	126.8	0.96
	hours (mil.)	15.0	40.8	2.72
PCU	No. (mil.)	5.1	5.5	1.07
	km (mil.)	39.3	43.0	1.09
	hours (mil.)	4.9	13.5	2.76

Source: 2012: Roadmap for transport infrastructure development for Metro Manila and Its Surrounding Areas (Region III & Region IV-A) in the Republic of the Philippines (Roadmap1) (JICA, 2014), 2020: JPT

In Metro Manila, the total transportation demand in 2020 was 12.3 million/day excluding trucks, walking and cycling. Of the total demand, 7.6 million (59.9%) and 5.1 million (40.1%) trips were made by public and private transportation, respectively. On the other hand, when translated into vehicle traffic, the total demand was four million PCU, of which private transportation shared 75.7% while public transportation was only 24.3%. The share of urban rail in 2020 was still limited, and road-based public transportation modes, such as

[7] Prepared by the JPT based on MMUTIS and MUCEP data.

buses and jeepneys, played a major role. It is very clear that road space is occupied more by private transportation. In addition, the average number of passengers per private vehicle (i.e., vehicle occupancy) is 1.7, as compared to that of PT vehicles which was 46.5 for buses and 15.1 for jeepneys (Table 2.5).

Table 2.5: Travel Demand in Metro Manila, 2017 and 2020

Mode	2017				2020				2020/2017	
	Person Trips		PCU		Person Trips		PCU		Person Trips	PCU
	No. (000/day)	%	No. (000/day)	%	No. (000/day)	%	No. (000/day)	%		
Private Transportation	4,430	38.6	2,767	74.0	5,120	40.1	3,186	75.7	1.16	1.15
Public Transportation	7,037	61.4	974	26.0	7,645	59.9	1,022	24.3	1.09	1.05
Total	11,467	100.0	3,741	100.0	12,332	100.0	4,052	100.0	1.11	1.12

Note: Private transportation includes motorcycle, car, taxi, other land modes; Public transportation covers jeepney, bus, UV Express, and rail. Freight transportation is excluded.
Source: Prepared by JPT based on the Follow-up Survey on Roadmap for Transport Infrastructure Development for Greater Capital Region (GCR) (Roadmap2) (JICA, 2019)

Traffic demand in Metro Manila is handled in large part by key corridors (C1-C6, and R1-R10). Key traffic corridors in Metro Manila comprise circumferential and radial roads, all of which are congested. This implies the following from the traffic management viewpoint:

(i) Improvement of a corridor may affect the traffic situation in another unless such improvement/upgrading is done in an integrated manner; capacity expansion of the entire road network is a fundamental issue;

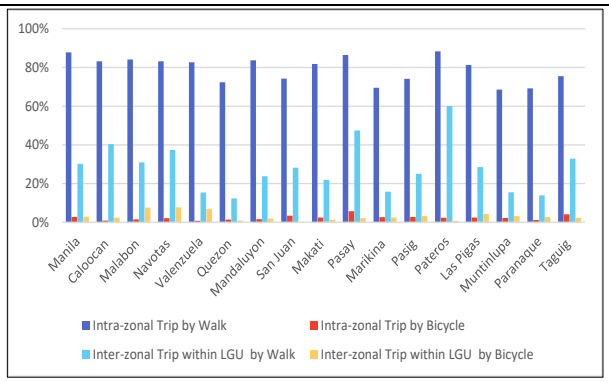
(ii) Nevertheless, traffic management remains important to optimize the efficient and effective use of limited road space; and

(iii) Road infrastructure expansion is critical but time-consuming and costly, so the main priority must be to promote public transportation use or curb private car use.

3) Trend in Active Transportation

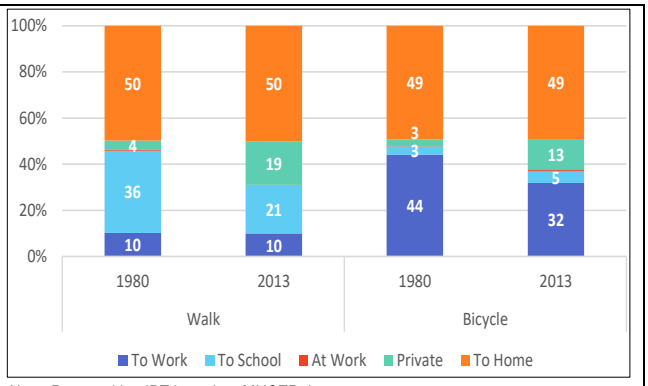
For active transportation, it is important to know the characteristics of walking and cycling. In 2014, about 80% of people walked when they traveled within a traffic zone, which is generally equivalent to the size of a barangay. However, when they traveled between traffic zones within an LGU, the modal share of walking dropped to 25% on average. The modal share of cycling for intrazonal and interzonal trips within an LGU was less than 5%. Comparing the LGUs, Quezon City, Marikina, Muntinlupa, and Parañaque had a relatively lower share of active transportation (Figure 2.3). However, during the COVID-19 pandemic and the resulting lack of public transportation, the people were forced to walk or bike.

Excluding “to home” trips, the main purpose of walking trips was “to school,” while people cycled more for “to work” trips. However, the share of “to work” and “to school” trips by active transportation decreased from 1980 to 2014, and they did more for private trips in 2014 (Figure 2.4).



Note: Prepared by JPT based on MUCEP data

Figure 2.3: Share of Active Transportation in Intra-LGU Trips in Metro Manila, 2014



Note: Prepared by JPT based on MUCEP data

Figure 2.4: Travel Purposes in Metro Manila using Active Transportation, 1980 and 2014

4) Impact of Pandemic

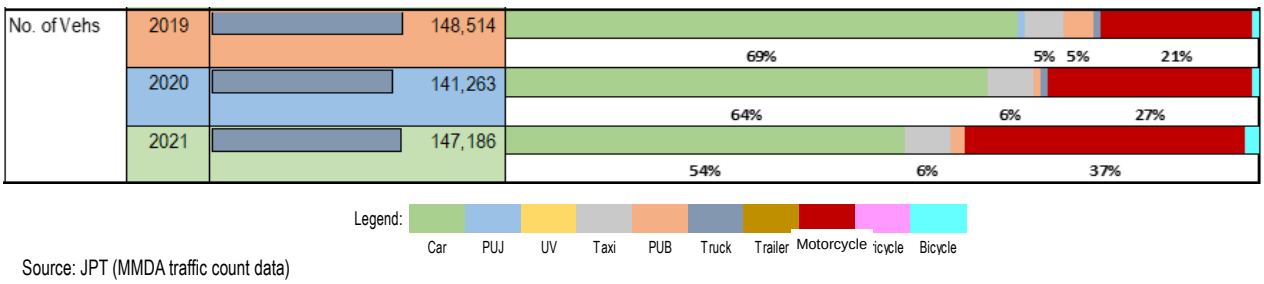
Figure 2.5 shows a comparison of the traffic counts at 10 survey stations within Metro Manila in 2019 and during the COVID-19 pandemic in 2020 and 2021. From these traffic surveys, the following observations could be made:

(a) **Traffic Volumes:** Total traffic volume at most of the survey stations in 2020 decreased from 2019 due to the restriction imposed by the ECQ and GCQ schemes. The trend in 2021 is almost the same as that in 2019.

(b) **Modal Shares:** The shares of UVEs, PUJs, and PUBs decreased in 2020 and 2021, while the share of motorcycles increased significantly. Also, the share of bicycles increased. There was a shift from public to private transportation, but the share of cars did not change significantly.

(c) **Overall Situation:** With the relaxation of travel restrictions, traffic volume picked up, but the percentage of traffic modes has not returned to that of the 2019 levels. Based on this, it could be considered that the shift to private transportation progressed because the convenience of public transportation decreased due to operational restrictions and the concern that public transportation poses a higher risk of spreading the infection. In addition, it is probable that people who used to use public transportation as their main means of transportation could not buy a car immediately and shifted to cheaper transportation modes, such as motorcycles and bicycles.

The Increase in the number of motorcycles can be observed from the number of registered motorcycles: About 350,000 and 390,000 new motorcycles were registered in 2020 and 2021, respectively, while only 130,000 and 150,000 new cars/uVs/SUVs were registered in 2020 and 2021, respectively.



Source: JPT (MMDA traffic count data)

Figure 2.5: Modal Shares at EDSA-P. Burgos St., 2019, 2020 and 2021

2.4 Road Network for Traffic Management

1) Current Road Network

National roads are predominantly constructed and maintained by the Department of Public Works and Highways (DPWH). Most are primary or arterial in function. Metro Manila has the highest road density in the country by area but the lowest density by population. On the other hand, local roads are under the jurisdiction of the LGUs. Almost all are secondary and function as feeders. The inventory of these roads is shown in Table 2.6. Local roads make up 83% of total roads in Metro Manila.

Table 2.6: Lengths of Roads in Metro Manila by Administrative Classification

Administrative Classification	Length (km)
Primary Roads[1]	150
Secondary Roads[1]	400
Tertiary Roads[1]	600
City/Municipal Roads[2]	2,600
Barangay Roads[2]	5,900
Total	9,650

[1] From DPWH Atlas. [2] No available data. Assumed based on Open Street Map.

The road network within EDSA is well designed and developed due to the Major Thoroughfare Plan, although a lot of improvement is needed, and missing links have to be built. On the other hand, the road network east of EDSA remains poor both in quantity and quality despite rapid urbanization. The main shortcomings of the current road network in Metro Manila include the following:

(i) Lack of roads in suburban areas;

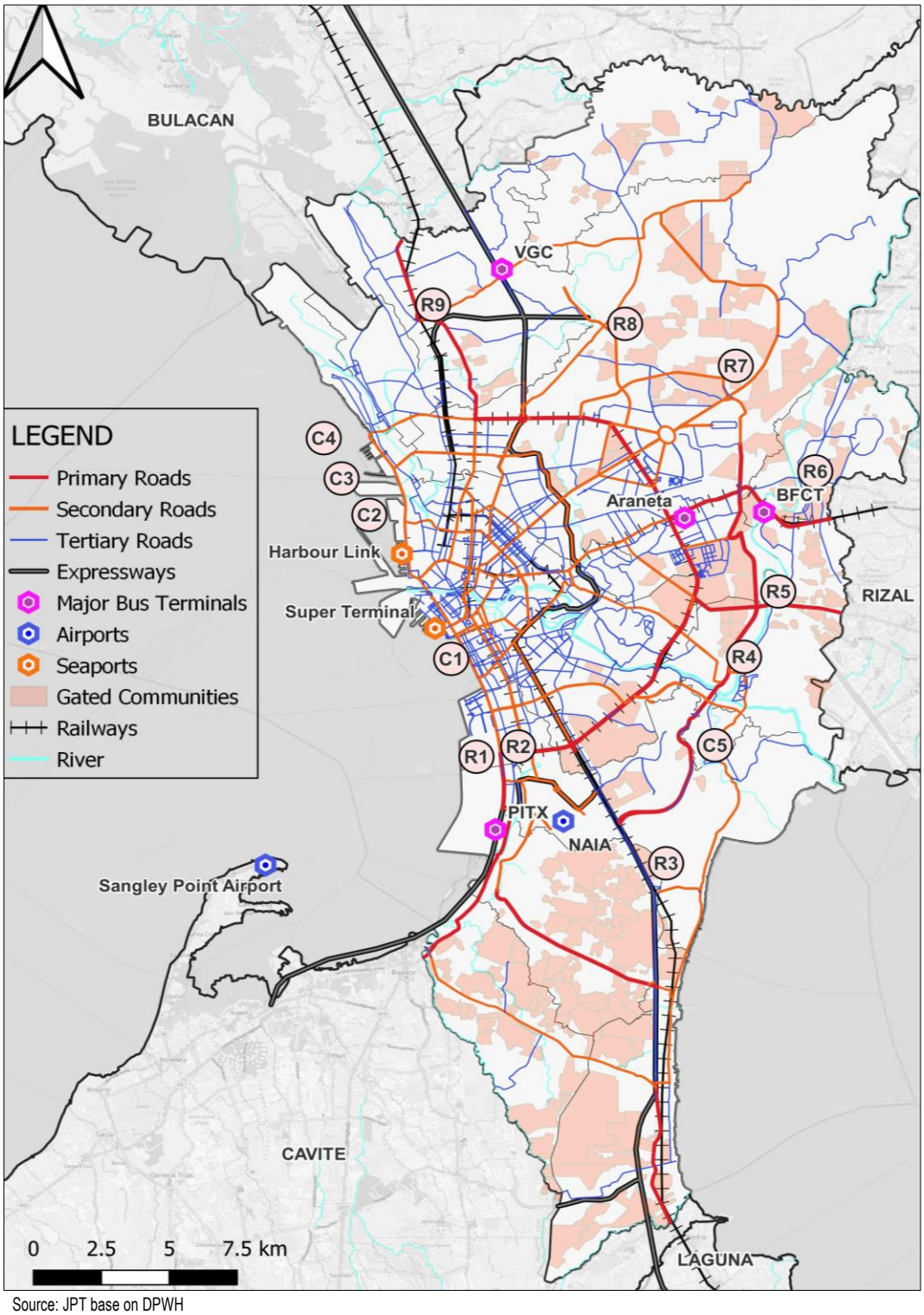
(ii) Poor network connectivity;

(iii) Wide spread of gated communities;

(iv) Poor connectivity due to missing links and lack of alternative travel routes;

(v) Poor maintenance; and

(vi) Lack of traffic management.



Source: JPT base on DPWH

Figure 2.6: Road Network in Metro Manila by Administrative Classification

2) Functional Classification of Metro Manila Roads

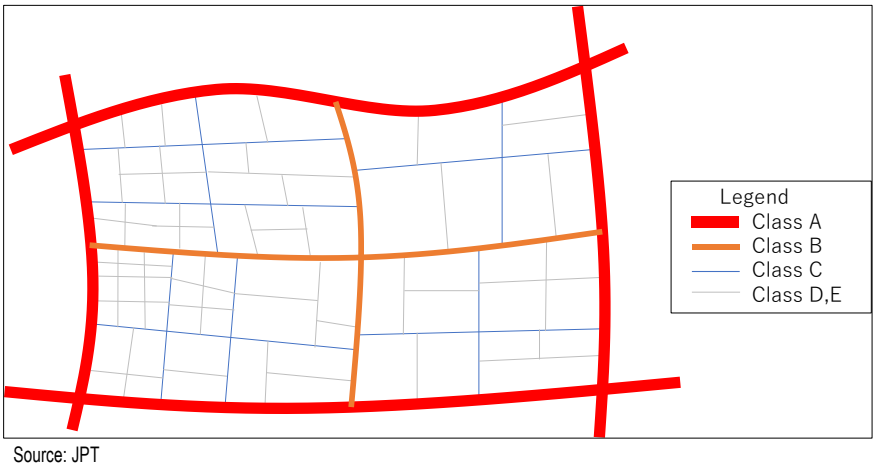
At present, roads are classified administratively as national, provincial, and city/ municipal/barangay roads. However, the level of congestion is perceived by road users based on the expected function of the roads. As a result, the JPT proposes to reclassify the roads according to function (Figure 2.7, Table 2.7). 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 smooth movement of through traffic and are focused on the efficient movement of 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 2.7 is the proposed functional classification of road network developed by both MMDA and JPT.

Table 2.7: Definitions for the Functional Classification of Roads

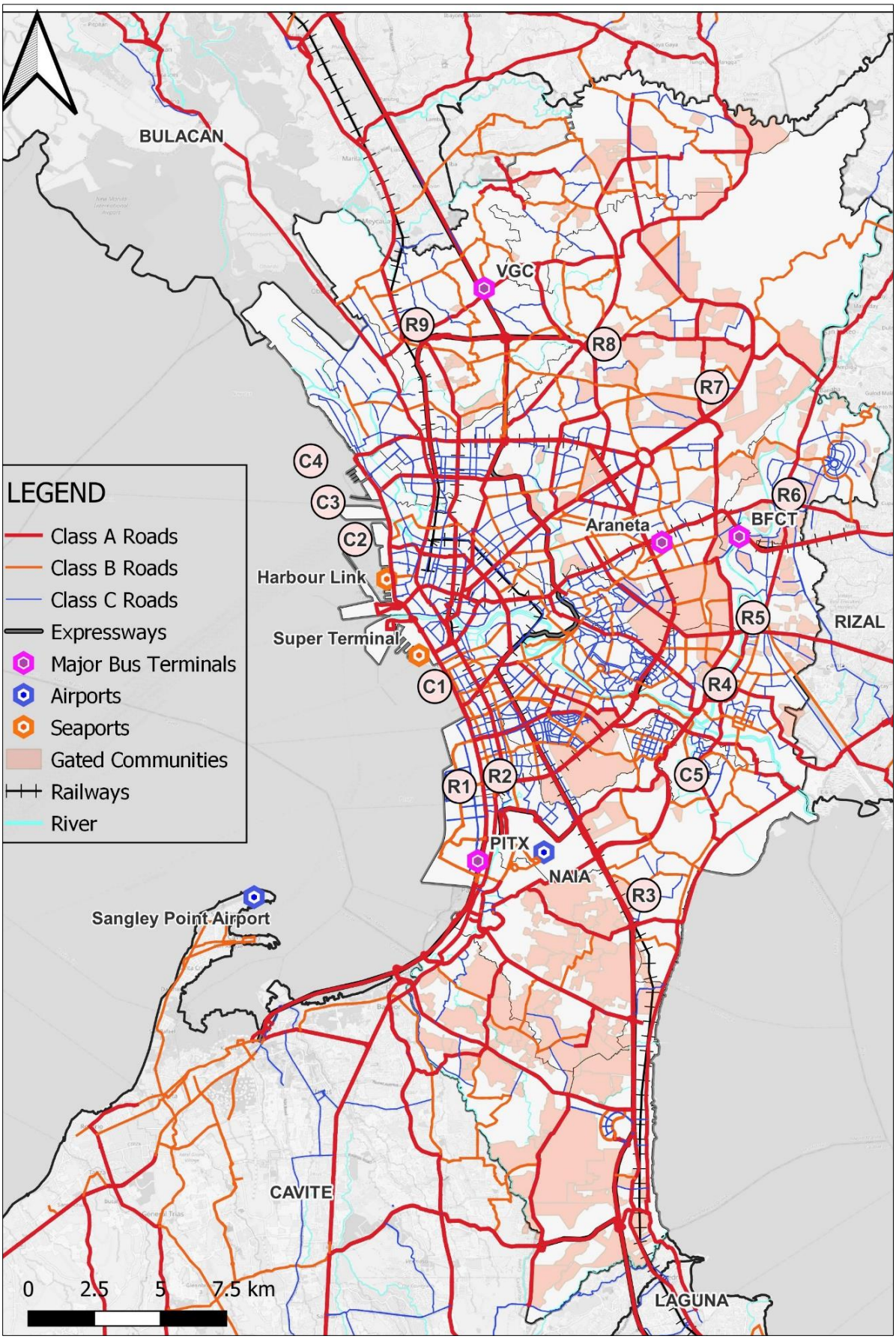
Road	Class	Definition	Function
Expressways and Major Arterials	A	• Controlled access or Limited access road with access ramps, lane dividers, etc., for high-speed traffic. • Affect basic urban space and land use. • Backbone serving major traffic flow in Metro Manila such as R1 to R10, C1-C6, and those 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 and gated villages.	Access

Source: JPT



Source: JPT

Figure 2.7: Image of the Functional Classification of Roads



Source: JPT

Figure 2.8: Proposed Functional Classification of the Road Network in Metro Manila

3) Road Network for Traffic Management by MMDA

The total length of the road network in Metro Manila is about 10,336 km (Table 2.8), of which A and B class roads share 874 km or only 8.5%. They form important traffic corridors for which MMDA should be responsible for traffic management.

While classes C, D, and E roads account for 91.5%, these are the responsibility of relevant LGUs. Class C roads connect primary and local roads. Since all the roads are connected as a network, the performance of a road affects those of other roads. This is a notable point for MMDA to take into account in comprehensive traffic management.

The JPT proposes that Class A and B roads should be taken care of by MMDA, while Class C, D, and E roads by the LGUs. Class A roads are mostly national roads, and Class B roads include road sections that connect Class A roads, thereby forming an integrated primary road network. While D and E class roads are managed by the respective LGUs, the JPT proposes that Class C roads be managed by both MMDA and the LGUs to ensure their connectivity to the primary roads.

Table 2.8: Road Lengths in Metro Manila by Functional Classification and No. of Intersections by Type

Road Class	Length (km)
A	462
B	412
C	593
D, E	8,869
-	-
Total	10,336

Type	No. of Intersections
Class A x Class A	95
Class A x Class B	224
Class A x Class C	321
Class B x Class B	111
Others[1]	>10,000[1]
Total (excl. Others)	751

[1] This consists of intersections of B x C, B x D, and C x C only. If D and E class roads are included as well and all intersections were added, the number would be more than 10,000.

Source: JPT

2.5 Transportation Issues

1) Negative Impact for Large Growth in Urban Area

The increase in traffic demand has been faster than the provision of transportation infrastructure and services. If nothing is done, there will be a significant negative impact on the economic, social, and environmental aspects of life which can lessen the function of and livability in Metro Manila. In 2027, more traffic concentration in the urban areas is expected, and traffic congestion costs the society much. Today, transportation costs of road users, comprising vehicle operating cost and travel time cost, is PHP4.9 billion per day in Metro Manila. This will increase to PHP9.4 billion a day by 2027 if nothing is done. While the demand will increase by 1.2 times from 2020 to 2027, the transportation cost will be approximately 2.0 times. Increase in traffic will also result in poor air quality (Table 2.9).

Table 2.9: Performance Indicators of the Baseline and Target Years

Indicator		2020	2027[1/]
No. of Trips (mil. /day)	Private Mode	7.6	9.3
	Public Mode	8.5	10.2
	Total	16.2	19.4
Share of Public Transportation in Travel Demand (%)		52.7	52.3
Network Performance	Volume/Capacity Ratio	1.0	1.2
	Average Travel Speed (km/h)	3.2	1.9
Transportation Cost (PHP bil./day)	VOC	1.2	1.6
	TTC	3.8	7.8
	Total	4.9	9.4
Environment	CO2 (000 tons/day)	19.2	26.0

[1/] "without" projects or "Do Nothing" scenario.
Source: JPT.

2) Necessity of Transit-oriented Development

Transportation issues cannot be solved only by improving and developing transportation infrastructure and services. The integration of urban and transportation development is the key to mitigate the current traffic situation and improve the living environment. For urban development, spatial structure and land use development must be revisited. The central idea is to recapture that old feature through compact development—and, conversely, less sprawl—of having as many amenities as needed for urban living within walking distances and to promote transit-oriented development (TOD) along railway lines.

3) For Sustainable Development

In order to develop Mega Manila sustainably, its spatial structure must shift from monocentric to polycentric. Growth centers should be developed in a hierarchical manner and in a way that they are connected to form clusters. The hierarchical development of urban centers and clusters can decentralize and complement the functions of each urban center and cluster. More specifically, the current transportation network based on the radial and circumferential roads need to be transformed to the ladder form with the north–south commuter rail (NSCR), the Metro Manila Subway, Skyway, and NLEX-SLEX Connector which will be the north–south transportation backbone of Mega Manila. To support the ladder form, the current planned alignment of the subway should be extended to Bulacan in the north and Laguna in the south to connect Metro Manila and its adjoining provinces. If the subway operates only within Metro Manila, it cannot mitigate traffic congestion due to the traffic from the adjoining provinces.

In addition to promoting big-ticket rail and expressway projects, the improvement of road-based public transportation should be pushed as it plays a huge role in mitigating traffic congestion. The development of the railway network for the entire Metro Manila is a long-term plan. While waiting for that, public road transportation needs to serve as an alternative to railways. The level of service of road-based public transportation has a lot of room for improvement including its network, driver behavior, fleet, etc. Even though private transportation users do not shift to public transportation, improving the driving behavior of PT drivers can help lessen traffic congestion.

4) Importance of Public and Active Transportation

Furthermore, the human component of traffic management should not be forgotten, such as the accessibility to public transportation and the environment for active transportation. Due to the COVID-19 pandemic, the importance of active transportation has been appreciated, as evidenced by more people walking or cycling. To sustain this trend, pedestrian and bicycle spaces, including sidewalks, cycle lanes, footbridges, and pedestrian traffic signals, should be improved.

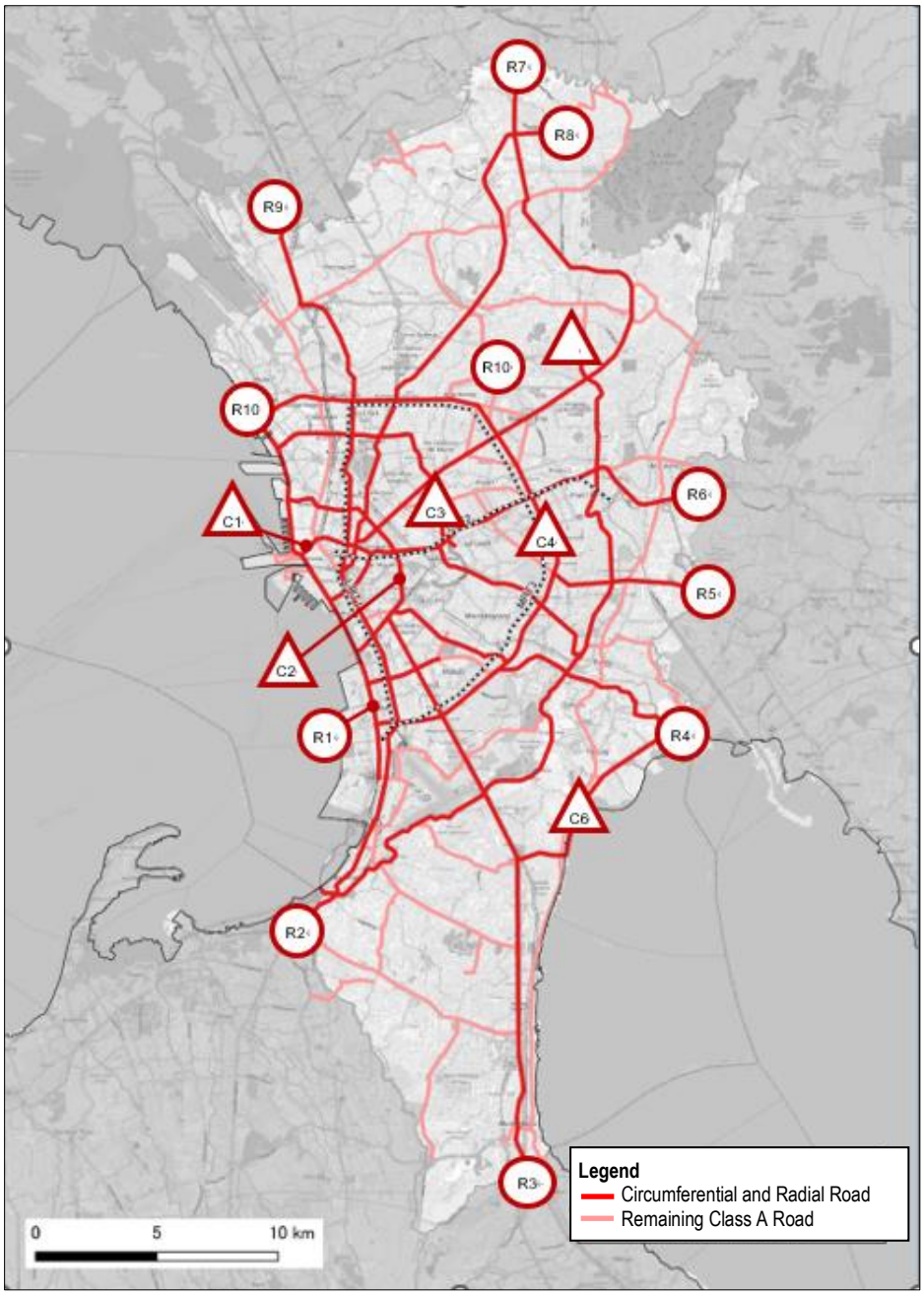
5) Traffic Safety

The low level of road traffic safety is another transportation issue in Metro Manila. Although most of the traffic incidents are not serious due to traffic congestion, it is expected that traffic incidents will increase together with the increase in the number of motorists. Though minor, such traffic incidents will still cause traffic congestion in Metro Manila. Improving the traffic safety environment will likewise bring order to Metro Manila’s roads.

3 CURRENT TRAFFIC MANAGEMENT IN METRO MANILA

3.1 Existing Traffic Corridors and Their Performance

Of the roads classified as A and B, the most important and familiar among road users are the circumferential (C1, C2, C3, C4, C5, and C6) and the radial roads (R1, R2, R3, R4, R5, R6, R7, R8, R9, and R10) (Figure 3.1). These are the main traffic corridors in Metro Manila. Traffic on these corridors impacts intersection capacity, which is the basis of traffic management. This then forms the basis of corridor management. However, with the improvement of intersections, congestion transfers to adjacent intersections, and this requires corridor management. Hence, the JPT developed a corridor database and compared the performance and characteristics of these corridors as listed on the next page.



Source: JPT

Figure 3.1: Circumferential, Radial, and Other Class A Roads in Metro Manila

(i) The corridors' respective ROW, sidewalks, bike lanes, and carriageways vary considerably, and despite being major roads, the road space is generally not enough.

(ii) Usually in the same corridor, many bottleneck sections are due to narrowing of lane widths, changing number of lanes, and narrowing or absence of sidewalks and bike lanes.

(iii) There is inconsistency among corridors, in fact, even throughout a corridor. Hence, the same level of service cannot be provided throughout a corridor despite being a major traffic artery. Improving the level of service and the management of traffic corridors is necessary.

(iv) Based on current traffic trend, the corridors can be classified into the following: (1) high public transportation share, (2) medium PT share, (3) low PT share but high freight share. However, the cross-sections of the corridors do not always match the requirements of the traffic they carry.

3.2 Traffic Management System in Metro Manila

Currently, the traffic management system in Metro Manila is composed of physical, regulatory, informative, operational, demand, and educational components which are managed by different departments and organizations. MMDA, DPWH, DOTR (including LTO and LTFRB), NEDA, and DOST are involved at the national level, while the 17 LGUs comprising Metro Manila are responsible for local traffic matters. NEDA's role is basically to approve the relevant plans, while that of various entities are shown in Table 3.1.

Table 3.1: Roles of Traffic Management Organizations in Metro Manila

Aspect	MMDA	Central Government					LGUs	Private Sectors
		DPWH	DOTr	LTFRB	LTO	I-ACT		
● Infrastructure provision	✔	✔	✔				✔	✔
● Traffic control/ enforcement	✔			✔	✔	✔	✔	
● Intersection management	✔	✔					✔	
● Active transport	✔	✔	✔				✔	
● Parking	✔						✔	✔
● Road safety	✔	✔					✔	✔
● Vehicle management	✔		✔		✔		✔	
● Public transportation	✔		✔	✔	✔	✔	✔	✔
● Traffic education/ information	✔					✔	✔	✔
● Hazard (floods)	✔	✔			✔		✔	
● Land use control	✔				✔		✔	

Source: JPT

3.3 Main Issues in Traffic Management

The main issues facing traffic management in Metro Manila lie in the following aspects:

(1) Functional Classification of Road Networks

The road network in Metro Manila is classified based on administrative responsibility (i.e., national, and city/municipal governments) as promoted by the DPWH, instead of function. While this classification is useful to road planning, construction, and maintenance, they should be reclassified based on the traffic management viewpoint to be able to address the different issues involving major and local roads.

(2) Traffic Control and Enforcement

Based on the survey, traffic violations, such as getting on and off PUJs at intersections, unruly driving behavior, and illegal roadside parking, are among the major causes of congestion. These issues are described below.

(i) MMDA has hired enforcers and traffic auxiliaries, but they are not enough. The conduct of non-contact apprehensions cannot also be done efficiently. It is crucial to utilize ICT devices or private sector participation to reduce the workload of enforcers to enable the later to focus on enforcement.

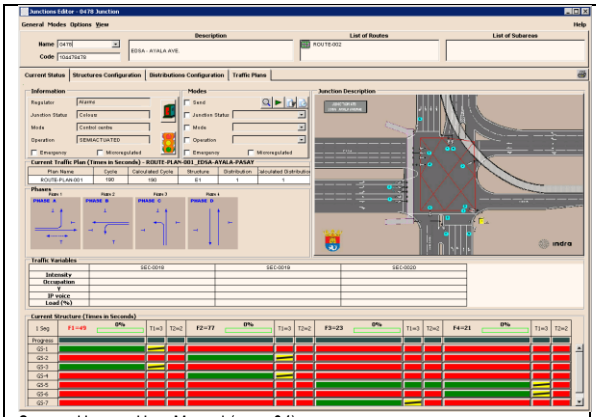
Source: MMDA Website

Figure 3.2: Training of New Traffic Auxiliaries

(ii) The LTO already introduced a demerit point system which affects the renewal of driver licenses. As of this writing, the MMDA has not yet adopted the system.

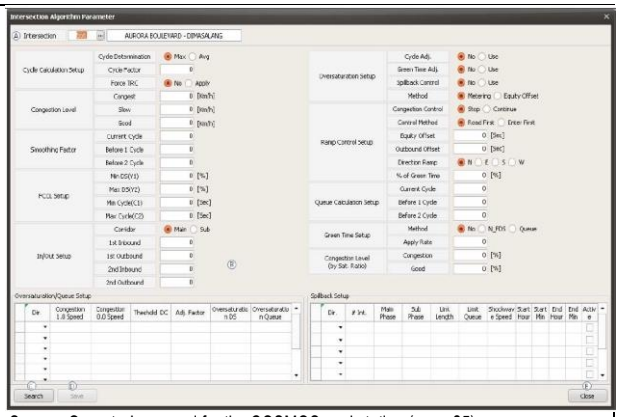
(3) Traffic Signal Operation and Maintenance

Two types of ATC systems are installed in Metro Manila. The ATC system installed under Phase I of the Traffic Engineering and Management (TEAM) Project, a traffic signalization project, is the Hermes system of Indra (Spain) (Figure 3.3), while Phases II through V have the Cosmos system of South Korea (Figure 3.4). For Phases II and III, Keon-A is the supplier of the local controllers, and COSTECH is the manufacturer. For Phases IV and V, Easy Traffic Technologies is the supplier, and the manufacturer is Road Inc. Co. Ltd. Although the local controllers are supplied by different manufacturers, both are compatible with the Korean ATC system. The following issues plague the existing signal systems in Metro Manila:



Source: Hermes User Manual (page 34)

Figure 3.3: Junction Editor under the Hermes System



Source: Operator's manual for the COSMOS workstation (page 25)

Figure 3.4: Intersection Algorithm Parameter Setting in the Cosmos System

(i) Multiple ATC systems and isolated signals which are incompatible with each other are designed, installed, and operated by separate entities, i.e., MMDA and LGUs.

(ii) Signal timing has not been reviewed and updated for a long time, resulting in inefficient operation.

(iii) The system is not responsive to traffic conditions because the detector data is not used for signal control. The reason is that the tender documents for ATC system procurement prepared by MMDA did not specify the requirements for the type of signal control algorithm to be supplied, and MMDA didn't have sufficient knowledge about the signal control mechanism of ATC systems.

(iv) The signal design procedure in MMDA is not established and standardized.

(v) Role delegation between MMDA and the contractor is unclear.

(vi) Maintenance of systems is weak, creating a situation wherein signals and vehicle detectors are not connected to the ATC systems.

(vii) The MMDA staff involved in the signal system lack enough knowledge about traffic engineering, signal control, and project management.

(4) Intelligent Transportation Systems

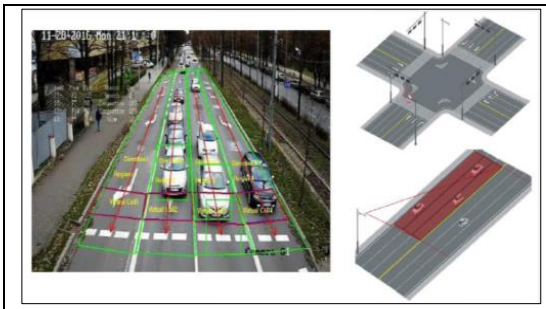
The main issues are the following:

(i) Current ITS-related facilities, partially introduced by CCTV cameras and loop coil sensors, are not fully utilized, and data collection is also limited.

(ii) Existing VMSs have not provided real-time traffic information which can help road users in choosing alternate routes.

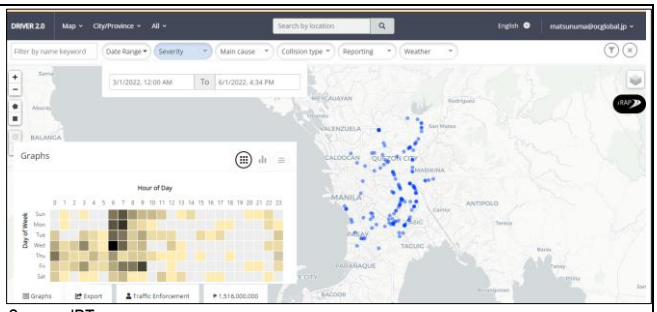
(iii) Although there is an ITS master plan in MMDA, it was created in 2014, so it does not reflect the current state of technological progress in vehicle detection system (Figure 3.5), traffic signal enforcement, speed violation enforcement, variable message sign, etc.. In addition, a realistic roadmap was not drawn. It is necessary to re-create a practical roadmap.

(iv) The ITS to be implemented by MMDA must harmonize with the ITS/ICT projects and plans being promoted by other agencies, such as DOTr, LTFRB, LTO, DPWH, DICT, DOST-PCIEERD, and LGUs.



Source: MMDA Consultancy Service for the Development of an Intelligent Transport System.

Figure 3.5: Image of a Vehicle Detection System (VDS)



Source: JPT

Figure 3.6: Platform for Road Incident Visualization, Evaluation, and Reporting

(5) Road Safety

Road crashes cause the loss of human lives and damage to properties, besides significantly causing traffic congestion. The main issues identified regarding road safety are the following:

(i) The Philippine Road Safety Action Plan (PRSAP) 2017–2022 mentioned MMDA as a support agency to be involved in a few activities, such as in road safety audit, integration of road safety facilities for vulnerable users, etc., although MMDA is the main agency for 3E (engineering, enforcement, education) activities in Metro Manila; and

(ii) MMDA manages the MMARAS data, which is prepared annually[8]. However, the data does not have information on the location (i.e., latitude and longitude) of incidents. The information source is a note from the police, and the causes of more than 90% of accidents are unknown, making it difficult to conduct effective personnel analysis or countermeasures. There are several crash databases developed by different agencies, but there is no integration among these agencies. It is important to improve traffic accident data collection and to develop a unified database for Metro Manila to come up with an appropriate accident analysis and reduce traffic accidents through 3Es.

(6) Traffic Education

MMDA focuses on traffic education for enforcers with regard to traffic safety and compliance with traffic rules. However, each LGU has its own regulations, and these are not uniform across LGUs. MMDA's Traffic Education Division holds traffic safety seminars for drivers who have overdue traffic violation tickets and for private companies on requests. Since driver education only involves listening to lectures, this may be insufficient in changing behaviors. Thus, it is highly recommended to provide traffic education to drivers and general road users.

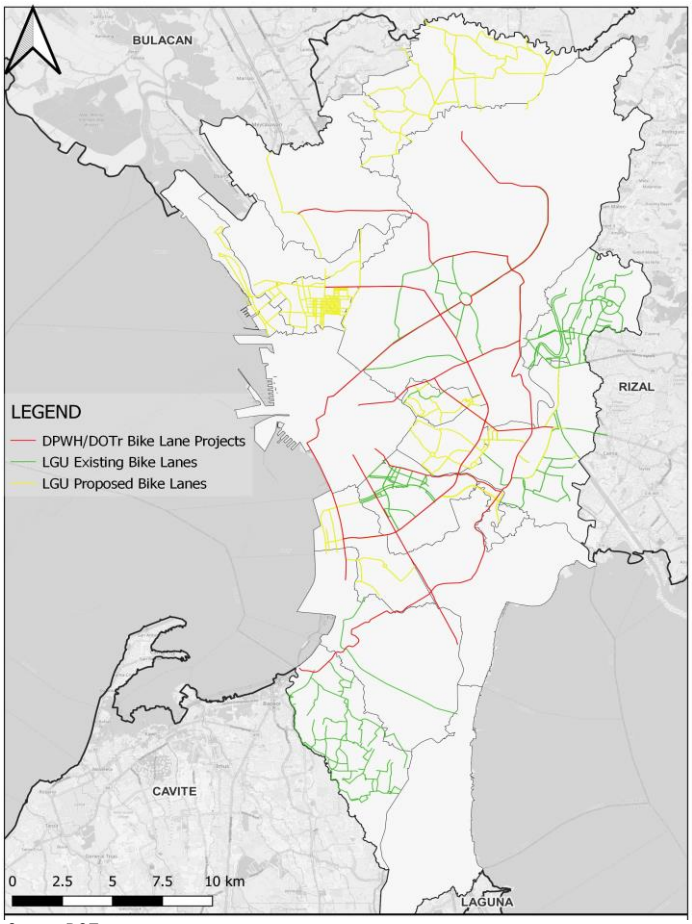
[8] In 2019, Metro Manila had 65,000 incidents (property damage: 50,230 cases; fatalities: 337 cases; injuries: 14,465 cases).

Source: MMDA

Figure 3.7: Traffic Education for Elementary School Children

(7) Active Transportation (Cycling and Walking)

During the COVID-19 pandemic, DOH, DOTr, DPWH, and the DILG signed a Joint Administrative Order (JAO) 2020–0001 entitled “Guidelines on the Proper Use and Promotion of Active Transport During and After the COVID-19 Pandemic.” This JAO provides guidance on the promotion and safe adoption of active transportation during and after the pandemic. It defines active transportation as physical activities, such as cycling or walking, to be used as means of transportation. Further, the JAO encourages collaboration among NGAs and LGUs to construct protected bicycle lanes, sidewalks, and supportive infrastructure like bicycle racks and changing rooms to encourage active transportation. It also provides minimum public health standards for active transportation adopters, such as the use of face masks and physical distancing.



Source: DOTr

Figure 3.8: Existing and Proposed Bike Lanes in Metro Manila

Even before the pandemic, MMDA has established an office for its bike lane program and has installed bike lanes on six routes including Commonwealth Avenue (Figure 3.8). Some LGUs, such as Pasig City, San Juan City, Marikina City, and Quezon City, have implemented bike lanes in their respective areas. In addition, the DOTr and DPWH have installed bicycle lanes along major roads. Bike racks are also available at various railway stations. However, the bike lane network has missing links, is inconvenient to use, and is not provided with sufficient safety measures. The JPT also investigated active transportation in terms of walkability and modal conflicts on covered walking paths, availability of walking paths and crossings, grade crossing safety, motorist behavior, amenities, disability infrastructure, obstructions, and security from crime. Table 3.2 shows the sidewalk conditions aggregated per LGU, from the road inventory survey conducted in the CTMP Project. At 85.2% availability, the data shows that Metro Manila has a decent sidewalk network along its major thoroughfares. This means that for every 100 m of major road in Metro Manila, 15 m have no sidewalk.

Table 3.2: Sidewalk Conditions of Major Roads by LGU, 2022

LGU	Road Geometry		Sidewalk Availability (%)	Sidewalk Condition (%)	
	Length (km)	Width (m)		Poor-Fair	Good
Caloocan	68	19.8	76	92.3	7.7
Malabon	21	15.0	85.3	93.3	6.7
Navotas	2.1	11.7	86.6	100	0
Valenzuela	53	22.3	88	94.2	5.8
Manila	105	25.2	81.7	99.88	0.12
Quezon	2.1	14.2	84	91.1	8.9
Pasig	33	37.6	76.5	91.1	8.9
Pateros	94	20.0	100	100	0
Marikina	22	25.3	84.2	96.4	3.6
San Juan	197	34.3	90.6	83.5	16.5
Mandaluyong	49	25.1	82.2	91.1	8.9
Makati	48	35.2	86.7	81.5	18.5
Pasay	62	23.3	81.7	80.2	19.8
Paranaque	2.1	11.7	91.9	84.5	15.6
Muntinlupa	37	22.1	88.1	68.40	31.6
Las Pinas	42	18.9	82.1	74.73	25.3
Taguig	8.0	22.0	65.5	87.2	12.8

Source: JPT

(8) Traffic Management during Construction Work

As the previous administration's Build, Build, Build (BBB) program is expected to continue, more construction work will be the norm in Metro Manilla's traffic scene. Hence, traffic plans with congestion countermeasures have to be submitted beforehand. In turn, MMDA will issue the following:

(a) **Traffic Clearance** for activities with no excavation work, such as regular maintenance work on the road right of way (ROW), temporary use of sidewalks, delivery of materials, temporary use of one lane for the concrete placing of building construction, and the installation of temporary safety canopy;

(b) **Simple Excavation Clearance** is provided for activities with excavation on road ROW; and

(c) **Flagship Project Excavation Clearance** for projects, such as MRTs, trains, subways, skyways, new bridges, elevated roadways, etc.

(9) Traffic Management Capacities of Related Entities

The factors of traffic congestion are complex. Areas where traffic demand exceeds infrastructure capacity must be prioritized to improve the overall situation. These are matters of concern to many organizations and encompass different stages, from planning, approval and budgeting, engineering, procurement, construction to operation and maintenance.

Capacities to be strengthened are particularly required in the following areas:

(a) **Traffic Management at Intersections:** The capacity of traffic management entities to manage the road network is constrained due to unsignalized intersections, need for channelization, and need for stricter enforcement of traffic rules in/around intersections.

(b) **Corridor Traffic Management:** This highlights the need for sufficient capacity to manage the boarding and alighting of PUV passengers especially in CBDs and LRT/MRT stations, illegal roadside parking and vendors, poor driving behavior, and jaywalking, etc.

(c) **Intra- and Inter-organizational Coordination:** Information sharing among offices within MMDA remain problematic due to the lack of a central database and tools. Likewise, coordination between MMDA and other organizations, such as the DOTr, DPWH, and LGUs, is insufficient. Coordination is crucial not only within MMDA, which is responsible for traffic management but also with the other organizations to build stronger collaboration from planning, engineering, implementation, to monitoring.

(10) Road-based Public Transportation

There are many issues for the road-based public transportation system in Metro Manila, i.e., dangerous and selfish driving behavior, poor security, inconvenient public transportation services, and low comfortability from private travel modes to public transportation.

Based on the responses of all the PUV operating companies surveyed, the number of technical staff performing various tasks related to planning/design, regulation, and monitoring/ evaluation of road public transportation facilities and services is also inadequate, and training programs in key aspects of public transportation are necessary.

Especially, developing intermodal transfer facilities to provide easier and smoother transfers between two transportation modes, has significant problems, such as lack of clear development directions, lack of ROW, insufficiency of standards, no proper public intervention to private development, and no enforcement of laws and regulations.

From traffic management aspect, MMDA has a significant role in managing the PUV drivers to follow traffic regulations. However, the latter do not always follow; additionally, the use of TM facilities is not enforced strictly.

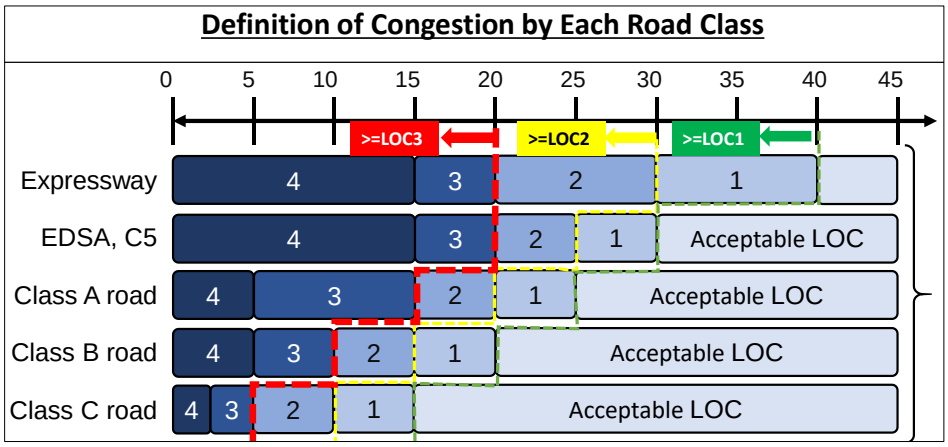
4 DETAILED ANALYSIS OF TRAFFIC CONGESTION AND TRAFFIC BOTTLENECKS

4.1 Definition of Traffic Congestion and Bottlenecks

1) Definition of Bottlenecks

To date, MMDA has identified bottleneck points not quantitatively but qualitatively. Therefore, in this Project, the intention is to redefine scientifically traffic bottlenecks based on data. Using Waze data is practically the best available way in Metro Manila because it represents real-time travel speed of vehicle users who use the application. The 2019 travel speed data (before pandemic) was collected from Waze[9] and the JPT developed a web-based dashboard to visualize the data for any given time of day, week, or month by road class.

The JPT assumed that the average travel speed can best represent traffic congestion. The acceptable congestion level was asked of road users in Metro Manila and Figure 4.1 was developed, wherein the concept of level of congestion (LOC) during busy hours on weekdays was introduced for roads classified by function. Then, it was agreed that congestion levels of 3 (LOC 3) or higher are considered congested or a key indicator of traffic congestion.



Source: JPT

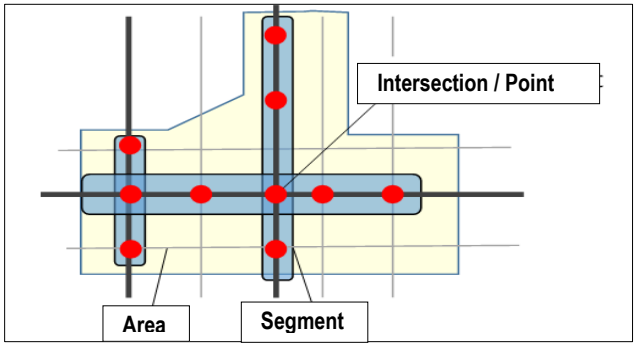
Figure 4.1: Levels of Congestion by Road Class (06:00–20:00, Weekdays)

[9] Waze crowd-sources traffic and travel speed data from commuters. The 2019 travel speed data for corridors were the most accurate model to analyze a non-pandemic scenario. Moreover, Waze uses historical data for links that lack off-peak hour speed information.

4.2 Identified Traffic Bottlenecks

1) Understanding Traffic Bottlenecks

Traffic management measures range from measures at micro-level, such as improvement of intersection geometry, to those at the macro-level, such as congestion charging. In large urban areas, the situation is complex. For example, when traffic congestion in an intersection improves, congestion would transfer to adjoining locations, forming bottlenecks. In the end, bottlenecks in Metro Manila expand from points/ segments to corridors and, often, areas. Moreover, they are also affected by cross-sector traffic management measures such as congestion charging. Basic understanding of JPT on the bottlenecks in the Project is conceptually shown in Figure 4.2.



Source: JPT

Figure 4.2: Conceptual Understanding of Traffic Bottlenecks

(1) Intersections

Intersection TBNs based on a functionally classified road network are shown in Table 4.1, of which Class A x Class A intersections (ISs) account for 61, followed by Class A x B ISs at 75, Class A x C ISs at 66, and Class B x B ISs at seven (7). The total number of major intersections is 209. Because other intersections connecting A and B roads may also become bottlenecks, they were also included in the analysis.

Of the 209 bottlenecks identified based on travel speed and the opinions of MMDA and LGU counterparts, 42 locations were deemed as serious bottlenecks facing severe congestion. They are shown in Figure 4.3.

Table 4.1: Identified Traffic Bottlenecks by Intersection Type

Intersection Type	Initially Identified TBN	TBN with >=LOC3	TBN Identified by MMDA + LGU	Overlapping Point	Non-overlapping Point	
				>=LOC3 & MMDA + LGU	>=LOC3	MMDA + LGU
A x A	61	50	36	25	25	11
A x B	75	58	41	24	34	17
A x C	66	50	30	14	36	16
B x B	7	6	2	1	5	1
Total	209	164	109	64	100	45

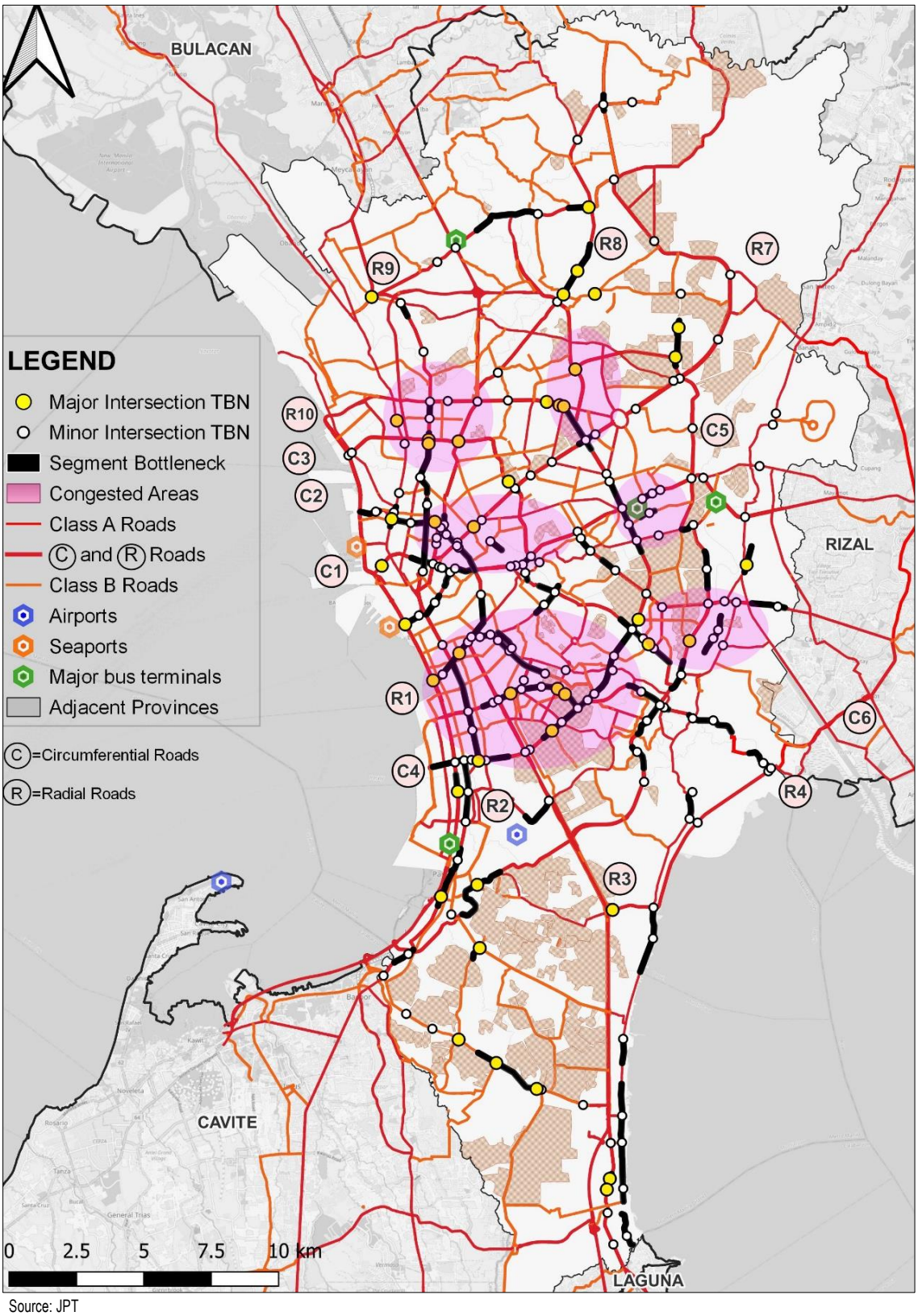
Source: JPT

(2) Road Segments

For segments involving two or more intersection bottlenecks and those with LOCs of 3 or more, they are considered as segment bottlenecks. A total of 64 segment bottlenecks were identified in Metro Manila. They are shown in Figure 4.3. Even if traffic bottlenecks at road segments and intersections are improved, this will not ensure efficiency and smooth traffic on a corridor.

(3) Areas

Bottlenecks at intersections and/or road segments may affect and spread to the level of an area. In Metro Manila, seven (7) locations were identified as area bottlenecks.



Source: JPT

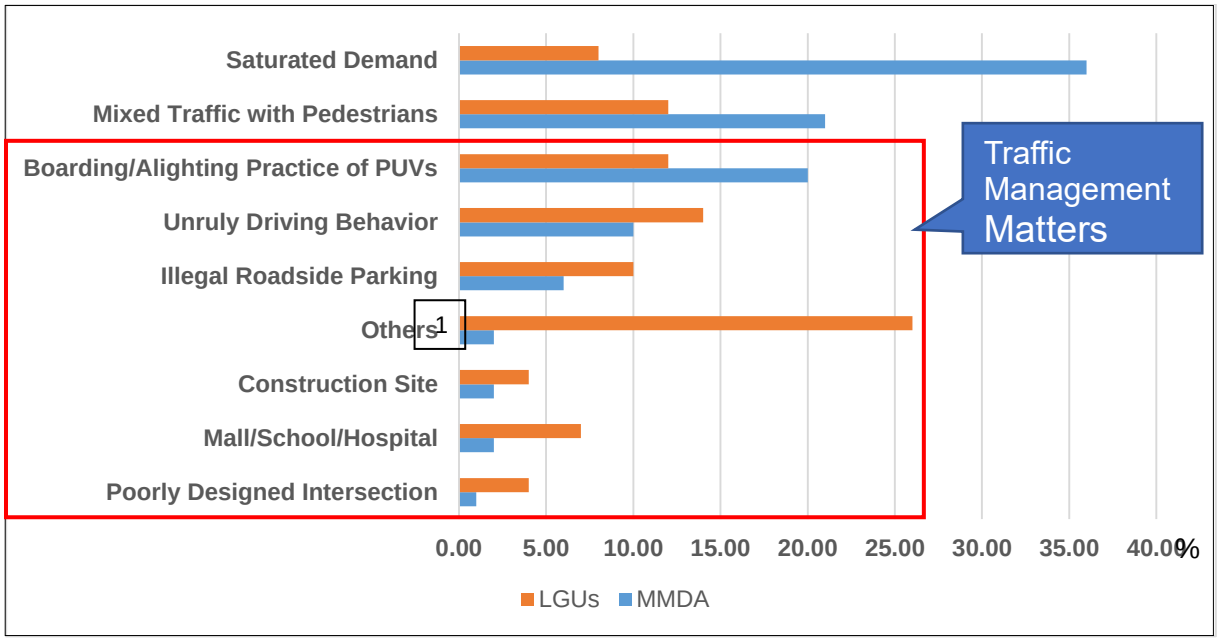
Figure 4.3: Location of Identified Traffic Bottlenecks in Metro Manila

4.3 Causes and Factors affecting Traffic Bottlenecks

1) Identification by MMDA and LGUs

Based on the results of the questionnaire surveys conducted among MMDA and LGU CPTs (Figure 4.4), the major causes of traffic bottlenecks, accounting for 35% for MMDA and 43% for LGUs are: PUJs stopping at intersections, non-compliance with traffic rules, and illegal parking.

And the questionnaire survey results showed that there are some differences in the causes of traffic congestion as perceived by MMDA and LGU counterparts. The LGU counterparts did not consider saturated demand as a top cause which could be explained by their jurisdiction mainly being concerned with local roads with less traffic volume relative to major roads. Second, the causes identified by MMDA counterparts are those attributed to the traffic bottlenecks at major roads, whereas those by LGU counterparts are causes that can be associated with traffic bottlenecks on local streets.



[1] "Others" include: manual overriding of traffic signals, obstruction by illegal vendors, and poor signal phase timing.
Source: Questionnaires conducted among MMDA and LGU CPTs.

Figure 4.4: Traffic Congestion Causes Identified by MMDA and LGUs

2) Factors of Congestion

Factors affecting traffic congestion in Metro Manila have been specified based on local traffic characteristics and on experience, then categorized based on traffic congestion measures practiced in Japan. Based on these, the JPT analyzed each bottleneck.

(1) Road Infrastructure

In particular, this refers to: (i) the number of lanes (insufficient number of lanes, insufficient road widths); (ii) intersection layout (wrong geometric intersection layout, inappropriate medians at intersections, inadequate corner cutting, and improper location of road facilities [pavement markings]); (iii) inappropriate road alignment (sharp curves and gradient changes [sag point], steep slopes); and (iv) wrong layout of tunnels/ underpasses (entrance of underpasses).

(2) Traffic Regulations

In particular, this factor refers to: (i) signal timing (inadequate traffic control in case there is no traffic signal); (ii) inadequate traffic signal control (in case ISs are signalized) or poor visibility of traffic signals; (iii) left-turning or oncoming vehicles (lack of left-turn lanes, insufficient left-turn lane lengths, conflict between a left-turning car and an oncoming through car); (iv) right-turning vehicles (right-turning vehicles blocking vehicles through traffic, improper stop line position, improper channelization); and (v) traffic signs (improper/lack of traffic signs or inadequate location).

3) Traffic Situation

In particular, this refers to conflicts by specific traffic, i.e., speed reduction due to the presence of large vehicles, motorcycles/bikes are obstructed by other modes, inadequate pedestrian facilities.

4) Environment of Roadsides and Intersections

In particular, this refers to: (i) railway crossings (stopping traffic at railway crossings); (ii) bridge section (difference in cross-sectional configuration between bridge and approaches, concentration of traffic on bridges); (iii) traffic flow from/to roadside establishments, connecting streets, etc. (traffic flow in/out of driveways of roadside shops, of intersections and narrow streets, and of interchanges at expressway); (iv) PUJs/PUBs (speed reduction due to PUB/PUJ stops, lane reduction due to dedicated bus and priority lanes); and (v) obstruction of traffic due to on-street parking.

5) Traffic Demand

This refers to demand exceeding capacity (excess traffic at intersections, excess traffic at non-intersections) and concentrated traffic (concentration of traffic at specific times, concentration of traffic on roadside establishments at specific times and periods, concentration of traffic during specific periods during events or incidents).

6) Others

This includes construction work (lane blockage due to construction) and clogging downstream.

Table 4.2: Factors of Congestion

Aspect		Factor of Congestion
Road Infrastructure	Number of Lanes	Insufficient number of lanes
		Insufficient road width
	Intersection Layout	Wrong geometric intersection layout
		Inappropriate for center point of intersection
		Inadequate corner cutting
		Improper location of road facilities (road markings)
	Road Alignment	Sharp curve
		Gradient change point (sag point)
		Steep slope
	Tunnels, Underpass	Entrance of underpass
Traffic Control and Regulation	Signal Timing	Inadequate traffic control (in case of without traffic signal)
		Inadequate traffic signal control (in case of with traffic signal)
		Poor visibility of traffic signal
	Left-turning or Oncoming Vehicles	No left-turn lane
		Insufficient left-turn lane length
		Conflict between a left-turning car and an oncoming through car
	Right-turning Vehicles	Right-turning vehicles blocking vehicles proceeding through ahead
		Improper stop line location
		Improper channelization
	Traffic Sign	Improper / lack of traffic sign or inadequate location
Traffic Characteristic	Conflict by Specific Traffic	Speed reduction due to large vehicle
		Motorcycle is obstructed by other modes
		Bike is obstructed by other modes
		Inadequate pedestrian facilities
Environment of Roadside and Intersection	Railway Crossing	Stopping traffic at railway crossing
	Bridge Section	Difference in cross-sectional configuration between bridge and approaches
		Concentration of traffic on bridges
	Traffic Flow from/to Roadside Land Use, Connecting Streets, etc.	Traffic flow in/out at driveway along road side shop
		Traffic flow in/out from intersections and narrow streets
		Traffic flow into/out from at expressway interchange
	PUJ, PUB	Speed reduction due to PUV stop
		Speed reduction due to PUJ stop
		Lane reduction with dedicated bus and priority lanes
	On-street Parking	Obstruction of movement by on-street parking
Traffic Demand	Exceeding Capacity	Excess traffic demand at intersections
		Excess traffic demand at non-intersections
	Concentrated Traffic	Concentration of traffic at specific time
		Concentration of traffic on roadside establishment at specific times and periods
		Concentration of traffic during specific periods during events or incidents
Others	Construction Work	Lane blockage due to construction
	Clogging of Downstream	Clogging with congestion of downstream

Source: JPT

5 CONSIDERATIONS FOR THE FIVE-YEAR ACTION PLAN

5.1 Higher-level Plans and Policies

1) Philippine Development Plan (2017–2022) and National Transport Policy

The Philippine Development Plan (PDP) 2017–2022 (formulated in Oct 2016) is the first medium-term plan anchored on *Ambisyon Natin 2040*. It takes off from the administration's socioeconomic agenda and was formulated with inputs from a cross-section of stakeholders and the public. The infrastructure component of this development plan has four main strategies, as follows: (i) increase spending on public infrastructure; (ii) implement strategic infrastructure for various infrastructure subsectors; (iii) ensure asset preservation; and (iv) intensify R&D on technologies that are cost-effective over the whole project life cycle.

Strategic infrastructure includes strengthening the efficiency of an adequate, accessible, reliable, and safe transportation sector and improving short-term road transportation measures by addressing traffic congestion through the 3Es, while upgrading the road network and building to the highest quality standards in the long term. Short-term measures include appropriate traffic management and the introduction of engineering solutions in urban areas through ITS. The development plan also specifies that passenger and logistics services should be given priority over private vehicles, taking into account the efficient use of road infrastructure. To encourage the desired shift from private cars to public transportation, along with strengthening mass transportation, it stipulates that public transportation should be accessible, available, affordable, accurately operated, convenient, and reliable (rail transportation and BRT).

Previously, the absence of a single, encompassing policy for the transportation sector has manifested recurring challenges, including the lack of integrated and coordinated transportation network, overlapping and conflicting functions of transportation agencies, transportation safety and security concerns, and inadequate transportation facilities, particularly in conflict and underdeveloped areas. Under these circumstances, "the National Transport Policy (NTP) and its Implementing Rules and Regulations (IRR)" was adopted by the NEDA Board. The NTP was formulated to help achieve a "safe, secure, reliable, efficient, integrated, intermodal, affordable, cost-effective, environmentally sustainable, and people-oriented national transport system that ensures improved quality of life of the people." As regards traffic management, the NTP states the following:

(i) Moving more people than vehicles, preference for cost-effective mobility management measures, and development of local transportation and traffic management plans in accordance with land use plans;

(ii) Shifting greater responsibility for the delivery of transportation services to local government, including metropolitan authorities, over the long term;

(iii) Requiring LGUs to prepare transportation sector plans as part of their respective Comprehensive Development Plans (CDPs);

(iv) Promoting inclusive mobility wherein public transportation and shared transportation modes will have priority in the use of public assets, including roads of all kinds. The inclusion of non-motorized and active transportation, i.e., walking and cycling, is to be incorporated in the design and implementation of transportation projects;

(v) Establishing and maintaining database systems for transportation-related data in all government agencies, data repositories, research institutions, and members of the academe, particularly those that are involved in the collection and management of transportation-related data.

2) Traffic Management Proposed in the JICA Roadmap Study 2

While the Roadmap Study 2's Dream Plan suggests future mass transportation-oriented urban structure to solve current urban issues and in the long term, traffic management is an urgent issue that should be tackled immediately. The Roadmap Study 2 suggests a traffic management agenda as shown in Table 5.1.

Table 5.1: Proposed Traffic Management Roadmap

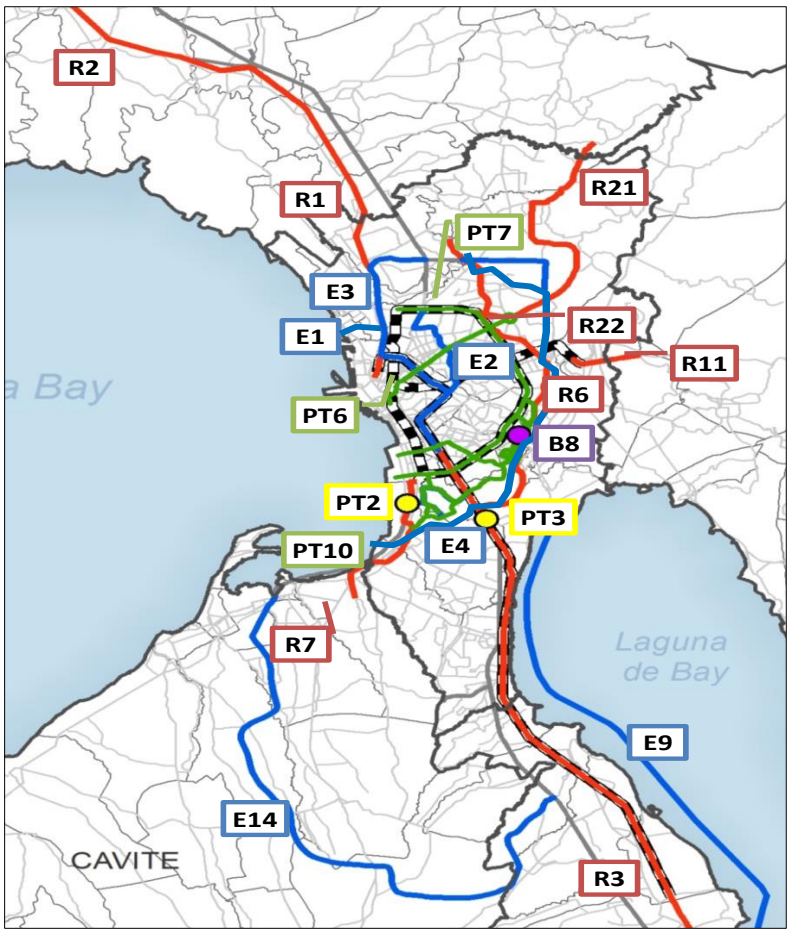
Item	Phase 1	Phase 2	
	2018–2022	2023–2029	2030 and Beyond
1. Objective of Traffic Management	• More vehicle/lane/hour and priority to HOVs, particularly buses.	• People throughput (more persons moved per hour per lane of road) in major roads.	• Urban mobility (short travel time from origins to destinations) in entire network.
2. Digital Technology	• Smart traffic control system.	• Intelligent traffic control.	• Intelligent transportation system.
3. Traffic Management Scope	• Management of traffic flow using historical data and pre-set response. • Manual traffic enforcement. • Fleet management system for bus and jeepney operators.	• Management of traffic flow using current data and dynamic response. • Automatic traffic enforcement. • Automatic signal priority for bus transit and HOVs.	• Management of traffic flow using real-time data and dynamic response with prediction. • Public transportation dispatching guided by real-time passenger demand.
4. Road Sensors	• Inductive loop detection that counts number of vehicles within a unit of time.	• Multiple detection devices including bluetooth, audio and video, RFIDs for vehicles.	• Data fusion from multiple sensors; LiDAR technology detects moving & static objects, as well as discriminate.
5. Motorists	• Passive recipient of traffic status; no interaction with traffic control system.	• Navigation through the road network is recommended. • Interaction between in-vehicle and roadside devices.	• Motorists become active participants in optimizing mobility; dynamic traffic light sequence; active priority to emergency and special vehicles; collision avoidance system.

Source: JICA Roadmap2 Study.

5.2 Infrastructure and Traffic Management Plans/ Projects

1) Build, Build, Build Program

The Build, Build, Build (BBB) program is expected to continue further; more infrastructure construction will be the norm in Metro Manilla's traffic scene, as shown in the figure below. The program includes all transportation subsectors, i.e., road, railway, seaport, airport, and road public transportation. At present, some of projects are being implemented, while some have been delayed. BBB program implementation requires nearly PHP2.4 trillion.



Source: Roadmap2

Figure 5.1: Location of Big-ticket Projects of the Build, Build, Build Program

2) Large-scale Transportation Development Projects to be Implemented by 2027

Transportation infrastructure projects to be implemented by 2027 are summarized in Table 5.2. Large-scale projects include highways, bridges, railways, grade separations, new roads, etc. which will create significant impact on existing traffic congestion and their distribution depending on where the projects are constructed[10]. Unless the projects are properly implemented, new traffic bottlenecks might appear during and after construction.

3) Ongoing / Committed Traffic Management Projects of MMDA and LGUs

MMDA and the LGUs have several ongoing projects to improve traffic management, as follows:

[10] About the impact of TBN removal, Corridor further development and Missing Link which this project suggested later, and following Large-scale Transportation Development, the transportation cost would have decreased by PHP 3.3 billion/day in 2027.

(a) **Traffic Signalization:** Phase V Signalization Project includes 50 new warranted intersections and Integration to the existing Traffic Signal Control System including Installation of LED Lightings at intersections.

(b) **Installation of Fiber Optic Communication Network:** Installation of Fiber Optic Communication Network: There are 15 signalized intersections under Phase V Project that is scheduled for the installation of fiber optic communication network.

Table 5.2: Major Infrastructure Projects Considered in Forecasting Traffic

Subsector	Project
Railway	1. MRT 7
	2. MRT 3 Capacity Expansion Project
	3. MRT-LRT Common Station Project
	4. LRT Line 1 South (Cavite) Extension Project
	5. Line 2 East Extension Project
	6. LRT 2 West Extension Project
Roads	7. Metro Manila Bus Rapid Transit Line 1
	8. South East Metro Manila Expressway (C6-Phase 1) Project
	9. Metro Manila Skyway Stage 3 Project
	10. C5 South Link Expressway Project
	11. Construction of Flyovers/ Interchanges/ Underpasses/ Long span Bridge: C-5- Quirino Flyover
	12. Construction of Bridge across Parañaque River Adjacent to Parañaque Integrated Terminal Exchange, Don Galo, Parañaque City
	13. Sen. Gil Puyat Ave./Makati Ave.–Paseo de Roxas Vehicle Underpass Project
	14. Bonifacio Global City-Ortigas Center Link Road Project, Phase I and IIA
	15. Binondo-Intramuros Bridge
	16. Estrella-Pantaleon Bridge
	17. Metro Manila Priority Bridges for Seismic Improvement Projects
	18. Pasig River and Manggahan Floodway Bridges Construction Project (5 Bridges)
	19. Marikina River and Manggahan Floodway Bridges Construction Project
	20. Metro Manila Bridges Project (MMBP)
	21. NLEX–SLEX Connector Road Project
	22. MMICP

Source: JPT based on the project list from project counterparts.

(c) **Retrofitting and New Installation of Streetlights:** LED streetlights were to be retrofitted or installed at various locations in Metro Manila including at black spots.

(d) **Promotion of Active Transportation:** *Bayanihan 2* or Republic Act 11494 funded the bike lane network in Metro Manila to aid recovery from the effects of the pandemic by promoting alternative means of transportation. Along with the EDSA Carousel and lane dieting, the bike lanes can be found along EDSA. As of July 2021, 313 km of the bike lane network has been completed, passing through 12 cities including Pasig, Marikina, Quezon City, and Caloocan.

(e) **Truck Ban:** Truck ban in Metro Manila is still suspended except along EDSA. Light trucks are not allowed to run on EDSA from Magallanes, Makati to North Avenue, Quezon City in both directions during weekdays from 05:00 to 21:00, except holidays. These trucks are defined by the MMDA as vehicles with gross weight capacities lower than 4,500 kg with more than two axles. However, garbage trucks, fuel trucks, and those carrying essential and perishable goods are exempted.

(f) **Prohibition of Provincial Buses:** Provincial buses are now allowed to enter Metro

Manila. However, the LTFRB has a new policy for the operation of bus terminals, i.e., they can only operate from 22:00 to 05:00. Beyond this "window," their origin and destination must be in designated integrated terminal exchanges.

(g) **Modification of Unified Vehicular Volume Reduction Program (UVVRP):** Number coding is currently implemented, banning private vehicles with specific plate numbers from 7:00 to 10:00 and 17:00 to 20:00 along arterial roads in Metro Manila. However, Makati City enforces this scheme from 07:00 to 19:00, while Muntinlupa City implements it along Alabang-Zapote Road only. This traffic management scheme does not cover ambulances, fire trucks, police cars, military vehicles, private vehicles used for health emergencies, diplomatic vehicles, government vehicles, motorcycles, official media vehicles, and other vehicles granted the number coding exemption. Moreover, this scheme is lifted during holidays, weekends, and during natural calamities. Violators have to pay a fine of at least PHP300, which has to be settled within seven (7) days from the date the violation ticket was issued, or other charges may apply.

In MMDA, projects under request for funding include Phase VII of the traffic signalization project; traffic signal preventive and corrective maintenance; further installation, rehabilitation, and maintenance of LED streetlights; in-house installation of traffic signals; and supply and installation of VDS, VMS, TSES, SVES, and fiber optic communication networks, and their integration with the traffic control system and the Smart City Platform.

5.3 Community Quarantine during Pandemic Period

In the Philippines, there were two main levels of community quarantine measures against the COVID-19 pandemic: enhanced community quarantine (ECQ) and general community quarantine (GCQ). Variations of ECQ and GCQ have been introduced over time, such as the modified enhanced community quarantine (MECQ) and the modified general community quarantine (MGCQ). The capacity restriction for passengers is dependent on the community quarantine level (Table 5.3), and the modal share of each vehicle type has changed because of this.

Table 5.3: Transportation Guidelines by Community Quarantine Level

Coverage	ECQ	MECQ	GCQ	MGCQ
	Period Implemented in Metro Manila			
	(17 Mar–15 May 2020) (29 Mar–11 Apr 2021) (6 Aug–20 Aug 2021)	(16 May–31 May 2020) (4 Aug–18 Aug 2020) (12 Apr–14 May 2021) (6 Aug–31 Aug 2021)	(1 June–3 Aug 2020) (19 Aug–28 Mar 2021) (1 Sep 2021–)	(Not applied)
General	100% stay at home	100% stay at home	21 to 59 years old are allowed to go out	No restriction
Work/ Business	Only essential workers	Some businesses can be added to open with 50% capacity	All business can be opened with specified capacity	100% open
School	Close	Close	Online classes	Limited face-to-face classes
PUJ/PUB/UVE	No Service	No Service	Limited capacity (PUJ/PUB: 50%)	All modes allowed
Train	No Service	No Service	Phase I (June 1–21) at limited capacity: LRT1: 12%, LRT2: 10%, MRT3: 13%, PNR: 20%–30% Since October: 30 %	
Private vehicles	Only Person in permitted sectors	Restricted no. of passengers	Allowed	
Taxi/ Bicycle/ Motorcycle/ Tricycle, etc.	Restricted no. of passengers	Restricted no. of passengers	Restricted no. of passengers	

Source: Compiled by the JPT based on DOTr information and news articles.

6 PROPOSED FIVE-YEAR ACTION PLAN ON TRAFFIC MANAGEMENT

6.1 Approach

Based on the aforementioned analysis, the JPT has worked out a five-year action plan in cooperation with the MMDA, DPWH, and DOTr. During plan formulation, consideration was given to the following:

(a) **Participatory Planning Process:** Counterpart staff of relevant departments of MMDA were involved, and meetings and joint field work have been held. LGU counterparts were mainly involved in the case studies.

(b) **Data-driven Analysis:** Traffic congestion and bottlenecks were not defined explicitly in Metro Manila. In this project, they have been defined more clearly.

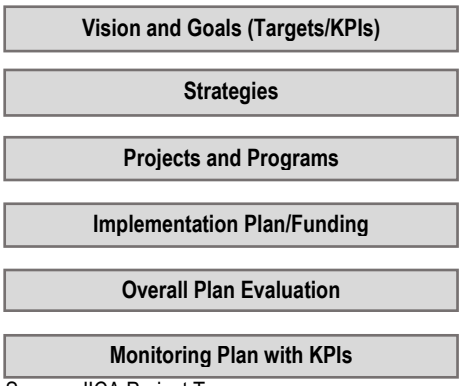
(c) **Use of PDCA Cycle:** Through case studies and pilot projects, the planning concept of plan-do-check-act was learned by the CPT.

(d) **Comprehensive and Integrated Planning:** Piecemeal solutions were avoided. Since traffic management involves cross-sectoral issues, strategic solutions were worked out.

(e) **Approach to Identification of Traffic Bottlenecks:** Traffic bottlenecks are identified as the traffic situation changes due to varied reasons. Therefore, importance was placed in the identification of traffic bottlenecks.

(f) **Rolling Plan and Plan Monitoring:** The proposed five-year plan is not rigid but must be modified yearly based on an agreed method of plan monitoring. In this project, a set of monitoring indicators is suggested. MMDA must be the center of the of the traffic management plan monitoring and management database in coordination with related organizations. A common understanding of the aforementioned strategies will help this process.

The planning process is shown in Figure 6.1 and briefly explained below.



Source: JICA Project Team

Figure 6.1: Planning Process of Five-year Action Plan on Traffic Management

(a) **Step 1**: Vision and goals must comply with higher-level policies and plans. Goals, together with key indicators, define the vision more clearly. They must be quantified and easy to understand by the public and governments.

(b) **Step 2:** Strategies translate the goals into implementable projects and actions.

(c) **Step 3:** Strategies are translated into projects which must be implementable institutionally and financially. Projects can be packaged into programs, when and where necessary. Projects and programs must undergo preliminary economic, social, and environmental assessment.

(d) **Step 4:** Plans/Programs are organized into an implementation plan. Priority and funding opportunities need to be considered.

(e) **Step 5:** A comprehensive evaluation of the plan is important.

(f) **Step 6:** A plan must be monitored yearly with specific performance indicators, based on which necessary modifications of the plan must be made.

6.2 Vision and Goals

1) Vision

As stated in the NTP, the transportation vision for the country is to pursue a "safe, secure, reliable, efficient, integrated, intermodal, affordable, cost-effective, environmentally sustainable, and people-oriented national transport system that ensures improved quality of life of the people.*"* When facilitating overall transportation, which is a particularly major issue, efficient mobility should be ensured for all users of the transportation infrastructure, which should be developed sustainably. The vision of the five-year action plan should thus be towards enabling an "inclusive, people-oriented mobility.

2) Goals and Target Indicators

The overall goal is "to maximize the mobility of all transportation infrastructure users in a sustainable manner by establishing an appropriate transportation management system". Goals translate the vision to promote common understanding among stakeholders, including government organizations and civil society. To support the overall goal of the NTP, the five-year action plan on traffic management for Metro Manila should thus aim to:

(iv) Improve the efficiency of public and private vehicular traffic;

(v) Optimize the movement of people to include barrier-free transportation;

(vi) Ensure road traffic safety for people and vehicles;

(vii) Ensure environment-friendly transportation (reduce air pollution); and

(viii) Promote capacities to realize transportation plans (plan implementation).

The above five goals must be translated into key performance indicators (KPIs) which are easy to understand and practical to enable traffic management organizations to monitor them and at the same time facilitate public understanding. The following preliminary indicators are selected:

(a) **Efficiency of Vehicular Traffic:** Congestion costs in Metro Manila and average running speed of vehicles by corridor.

(b) **Optimization of the Movement of People:** To focus on human mobility, bikeability and walkability indices (i.e. convenience, safety, and comfortability were determined based on sidewalk widths, pavement status, street lights, roadside trees, etc.) were evaluated considering the existing information[11]

(c) **Road Traffic Safety:** Number of traffic accidents and fatalities.

(d) **Traffic Environment:** Air pollution indices, such as emissions of CO2, SPM, and Nox.

(e) **Project Administration Capacity:** Progress of the five-year action plan.

For indicators of bikeability and walkability, it would be preferable to use bicycle utilization rates and pedestrian counts, but since these are difficult to measure due to their wide area in Metro Manila, indicators using data obtained from infrastructure facilities that define the environment will be used.

[11] The number of pedestrians and cyclists should be considered as the index, but the data is limited.

6.3 Traffic Management Strategies

1) Role of Strategies in Planning

Strategies are important steps in planning to further concretize ideas and develop specific projects and/or actions. Development of strategies is to think of traffic management in a more holistic manner. Although sectoral and piecemeal countermeasures are needed badly in the short-term, it is equally important to address the fundamental traffic management agenda for the future in Metro Manila. Based on the analysis and activities so far done in the project 12 areas below have been identified as proposed strategies.

2) Description of the Strategies

(a) Strategy 1: Urgent and Continuous Improvement of TBNs

Immediate, low-cost actions to improve the 209 TBNs identified in this Project will be effective. A total of 113 bottlenecks, comprising 42 major or priority TBNs at intersections, 64 on road segments, and seven (7) areas, have been prioritized. This initiative should not end even if measures for identified TBNs have been implemented. the road network must be monitored regularly to identify new ones because the traffic situation changes.

(b) Strategy 2: Improvement and Upgrading of the Traffic Signal System

Metro Manila has almost 500 units of signals and most of them are connected with and controlled by an area traffic control (ATC) system operated and maintained by MMDA. The system is, however, not exhibiting its potential performance fully. Currently, signals operate with time-of-day control, in which signal timing is set by time of day. This must be upgraded to traffic-responsive control, which select most suitable timing plan based on traffic flow data measured by vehicle detectors.

In addition, the signal timing plans must be reviewed and updated based on traffic demand, which changes over time. If necessary, the signal phase sequence should also be reviewed and modified. Signal retiming is a cost-effective way to improve the road network's performance as no additional hardware is required, and improvement is possible just by modifying the timing plan database.

(c) Strategy 3: Further Improvement of Intersections and Traffic Corridors

Although Strategy 1 is important as a short-term and routine measure, it is important to think of the future role of intersections. Intersections provide good locations for traffic surveillance and data collection and opportunities for ICT development. At present, CCTV cameras and sensors are installed at selected intersections, though they are not fully utilized nor operated. In upgrading the intersections further, including ITS (Strategy 4) in the plan, as well as the surrounding areas, is important to improve the quality of infrastructure and traffic environment for both people and vehicles.

(d) Strategy 4: Enhancement of ITS

Current ITS-related facilities, partially introduced with CCTV cameras and loop coil sensors, are not fully utilized and data collection is also limited.

Although there is an ITS master plan in MMDA, it was created in 2014 so it does not reflect the current state of technological progress and a realistic roadmap was not drawn. It is necessary to create a practical roadmap again wherein role-sharing related

organizations, cooperation with the private sector, and the operational capabilities of MMDA must be considered.

ITS to be implemented by MMDA must support traffic management action plans. Also, it is necessary to collaborate with ITS/ICT projects and plans promoted by other agencies such as the DOTr, LTFRB, LTO, DPWH, DITC, DOST-PCIEERD, and LGUs.

(e) **Strategy 5: Strengthening of Traffic Regulation and Enforcement**

While MMDA is hiring a total of about 1,100 enforcers and traffic auxiliaries in 2022 to assist with traffic guidance, they still lack human resources. To address this issue, MMDA has installed more than 200 CCTV cameras on major arterial roads to identify traffic violators and conduct non-contact apprehensions. However, due to limited manpower, not all violating vehicles are adequately policed. To reduce the burden of traffic enforcers and enhance efficient and effective traffic enforcement, as a supplement to ICT, the utilization of private sector vitality is recommended.

Despite the existence of national laws and regulations, such as Republic Act 4136 (Land Transportation and Traffic Code) and Ordinance enacted by each LGU regarding traffic regulations in the Philippines, their enforcement is not standardized nor coordinated. To change road user behavior (mindset), it is necessary to harmonize traffic regulations and ordinances issued by stakeholders and provide the same message for road users.

(f) **Strategy 6: Enhancement of Road Safety**

In 2019, there were 126,556 accident cases and 394 fatalities in Metro Manila. Traffic accidents not only cause damage to properties and loss of human lives but they also cause a significant impact on traffic congestion when they occur. To reduce traffic accidents, 3E (Engineering, Enforcement, Education) solutions must be considered based on proper accident analysis.

Currently, MMDA has a crash accident database called Metro Manila Accident Reporting and Analysis System (MMARAS), which is based on excel spreadsheets. But since there are many missing data (when, where, who, what, how, why) from police blotters, such as junction type, junction control, gender, age, cause of the accident, and location data (no coordinates), the MMDA cannot analyze enough and implement measures to prevent accidents.

Strengthening the accident database will be primarily important to develop and implement safety measures properly. MMDA should be the main body for road safety in Metro Manila and will be the database center for road safety of both vehicles and pedestrians. MMDA should also be actively involved in road safety enhancement, such as enforcement, education, and engineering while collaborating with the Philippine National Police (PNP), DOTr, DPWH, and LGUs.

(g) **Strategy 7: Promotion of Active Transportation**

Active transportation is becoming more and more important not only as a major mode of transportation for short trips within communities but also as a mode for the last mile in public transportation. The National Transport Policy is also determined to move the focus from moving vehicles to moving people.

The lack of data in this area is more problematic than in the other areas needed to formulate a plan. Similarly, the data on bicycles is also limited, while bike lanes are being constructed initially by MMDA and currently by DPWH along main roads. As both modes have relatively short trip lengths and involve different socio-economic characteristics planning guidelines based on more appropriate data must be worked out. Moreover, institutional responsibilities among the DOTr, DPWH, and MMDA including LGUs based on the data have to be made clear.

(h) **Strategy 8: Development of a Comprehensive Traffic Management Database**

An in-depth review of existing databases related to traffic management was made in the project. Currently, there is almost no integrated database available for traffic management in Metro Manila. Even if it exists, it is not open to the public and is often limited to the department in charge without sharing with related organizations.

Justification and explanation for traffic management works are not enough, sharable and explainable information are necessary based on the database.

Initial work has been made on the project regarding traffic congestion based on Waze data and road inventory. The concept of a comprehensive and coordinated traffic management database system is proposed in the project.

(i) **Strategy 9: Strengthening of MMDA's Capacities in Traffic Management**

Strengthening capacity in traffic management is an urgent issue for MMDA. The areas are diverse, from planning, engineering, procurement, project implementation, and maintenance. Monitoring is also a critical area to attend to. Moreover, there are many cross-sectoral issues in traffic management that MMDA should coordinate with other related departments and organizations internally and externally. As general organizational reforms are beyond the scope of the project, improvements and practical recommendations are instead made regarding the implementation of proposed priority projects and actions.

Practical and doable actions to commence capacity building include the following:

(i) Traffic management database development as explained in the aforementioned Strategy 8;

(ii) Traffic bottleneck analysis process conducted in this Project;

(iii) Use of microcomputer simulation as explained in the Pilot Project 2; and

(iv) Overall planning process for the CTMP five-year action plan.

(j) **Strategy 10: Enhancement of MMDA's External Coordination with Traffic Management Organizations**

Many issues are related to traffic management policy and projects of other organizations of central government organizations, especially DPWH in terms of road infrastructure and DOTr in terms of rail infrastructure and road-based public transportation facilities and services. The lack of integrated and data-based transportation development plans has caused inconsistent policies or ineffective project design and implementation. The following are the main points in need of attention:

(i) MMDA should be the center of integrated transport plans and policies

(ii) There is a need for a more harmonized and synchronized approach toward transport policies.

(iii) Under a systems paradigm, which would take a holistic view of the traffic problem and existing interventions, public resources can be allocated more efficiently, and the duplication or clashing of efforts between different agencies can be avoided.

(iv) Like suggestions to overhaul the MMDA, however, such proposals to abolish and consolidate existing bodies, albeit forward-looking, typically attract significant pushback.

(v) Instead of looking to completely overhaul the MMDA, efforts would be better spent looking at ways to enhance the existing system and identifying incremental, but effective, changes that can be introduced.

(vi) Instead of entertaining proposals to create new traffic management committees and councils, efforts should focus on strengthening existing initiatives such as I-ACT and taking advantage of existing channels, such as the Metro Manila Council.

(vii) I-ACT is an ad hoc and purely collaborative initiative. For it to become more effective, institutionalization is required. Sustaining the current arrangement of JCC will be an alternative. Under this enhanced council, it will be important to shift away from ad hoc coordination practices by identifying specific areas of and avenues for coordination. Protocols must be established to ensure that inter-agency exchanges are systematic and operationalized.

(viii) As part of the initiative, a centralized database accessible to all member agencies, which tracks meaningful performance indicators, can be established.

(k) **Strategy 11: Promotion of Comprehensive Transportation/Traffic Management Planning by LGUs**

Many transport/traffic issues are under the LGUs' mandate because the usual origins and destinations of trips are within LGUs. MMDA's concern is mainly Class A and B roads, while for LGUs, it is important to look into all road classes. Active transportation is also a matter of increasing concern for LGUs. However, there is hardly any available approach to local transportation/traffic management planning.

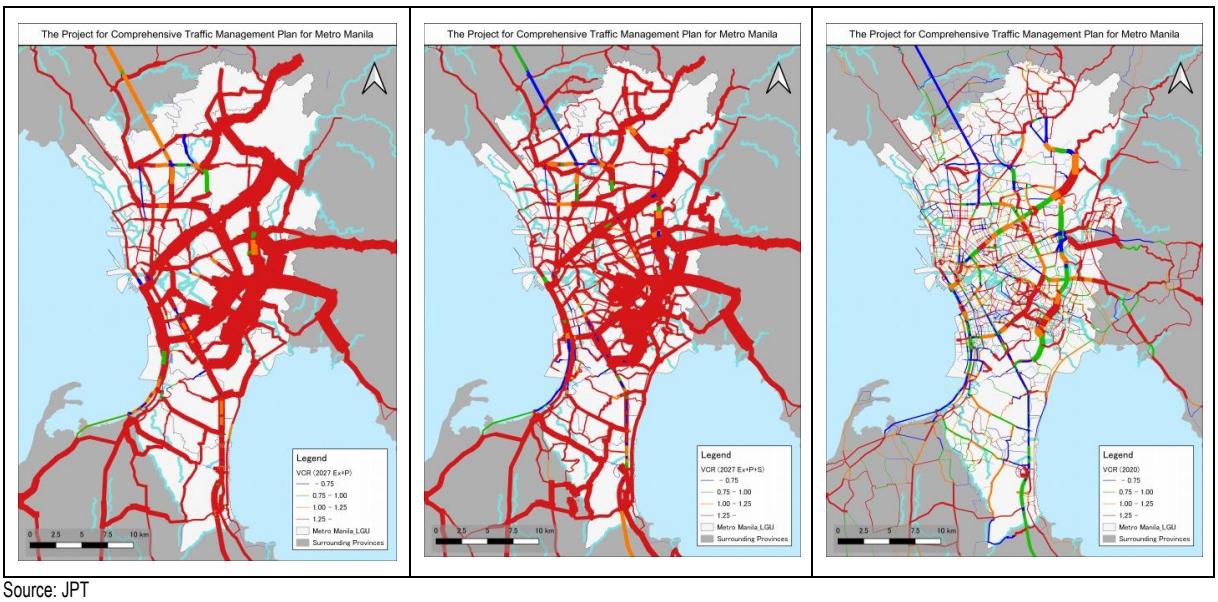
It is important that LGUs comply with metro-wide TM policies especially when addressing certain issues specific to them. Within the framework of a metro-wide traffic management orientation, LGUs must also work out their own traffic management plans. For this, MMDA should provide LGUs with a common planning format and approach together with metro-wide plans/policies. With this, plans prepared by LGUs and the MMDA can be integrated. While LGUs are required to formulate their respective CLUPs, it is recommended that transportation planning be included there because the interaction between transportation/traffic and cannot be ignored. UP NCTS would be a help in formulating plans of LGUs as well.

(l) **Strategy 12: Strengthening of the Transportation Network**

The current situation of traffic congestion cannot be improved only with traffic management, as transportation infrastructure and services are insufficiently provided for the size of Metro Manila. Although it is not a primary objective of the CTMP Project, an exercise was made on the following scenarios:

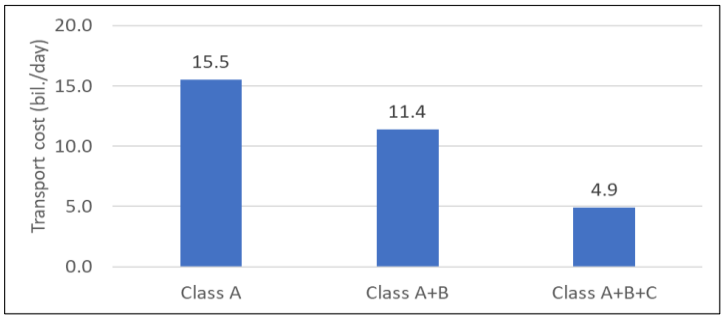
(i) **Promotion of an Integrated Road Network:** Based on 2017 data collected in the Roadmap 2 project, congestion causes Metro Manila to lose PHP4.3 billion per day. The cost is expected to have increased since then because of further congestion. To visualize possible scenarios, traffic demand was forecast, and the results are

shown in Figure 6.2. Results show that if traffic is concentrated on Class A roads only, the volume and VCR would be large, and the total transportation cost would be PHP15.5 billion/day. On the other hand, if traffic is distributed to Class A and B roads, the volume and VCR would decrease and the total transportation cost would be PHP11.4 billion/day, which is still quite high. However, if traffic would be distributed to Class A+B+C roads, the congestion would be dispersed, the total transportation cost would be PHP4.9 billion/day, and the volume would just be a third of that under the Class A scenario. Therefore, the result indicates the need to disperse traffic to various levels of road networks to bring about significant traffic improvement.



Source: JPT

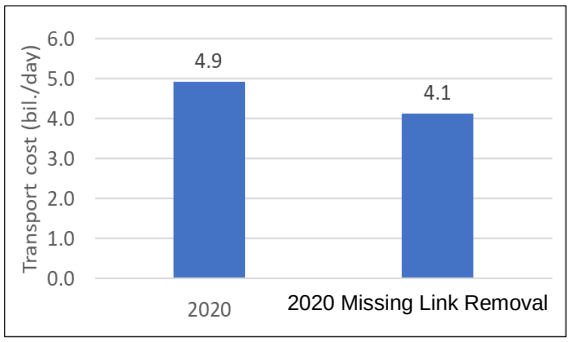
Figure 6.2: Scenarios of Traffic Distribution by Road Class



Source: JPT

Figure 6.3: Estimated Transportation Costs by Road Class

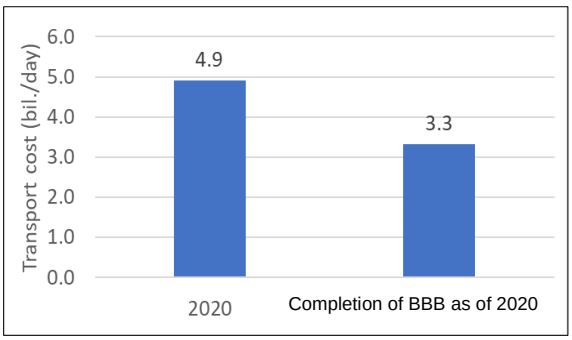
(ii) **Removal of Missing Links:** There are several road links that if constructed can strengthen the primary road network. As seen in Figure 6.4, the estimated economic impact of missing links is estimated to be PHP4.9 billion/day in 2020. The removal of missing links will reduce this figure by PHP0.8 (i.e., from PHP4.9 to PHP4.1) billion/day. The construction and O&M costs are expected to be large, but considering the reduction of PHP292 billion/year in transportation cost, the investment may not be so large anymore.



Source: JPT

Figure 6.4: Transportation Costs after Removing Missing Links

(iii) **Completion of Large-scale Transportation Projects:** This scenario assumes that all large-scale transportation infrastructure projects, such as those under the BBB program, are in place by 2030. The estimated economic impact of BBB projects is shown in Figure 6.5. The implementation of BBB projects will decrease the transportation cost by PHP1.6 (from PHP4.9 to PHP3.3) billion/day; therefore, not only traffic management improvement but also large-scale projects should be implemented without delay.



Source: JPT

Figure 6.5: Transportation Costs after Completing Large-scale Transportation Projects

6.4 Proposed Traffic Management Projects for MMDA

While attending to current traffic congestion and existing bottlenecks is a serious concern for Metro Manila, and while low-cost countermeasures are required immediately, it is also important to improve the overall mobility of vehicles and people, that is, while road users may be inconvenienced by several bottlenecks, in the end, their concern is the overall travel time between their origin and destination. In order to deal with traffic management issues and concern, 10 traffic management projects are proposed based on the strategies described in the previous section.

Table 6.1: Proposed Traffic Management Projects by Strategy

No.	Strategy / Proposed Project	Strategy 1: Urgent and Continuous Improvement of TBNs	Strategy 2: Improvement & Upgrading of the Traffic Signal System	Strategy 3: Further Improvement of Intersections and Traffic Corridors	Strategy 4: Enhancement of ITS	Strategy 5: Strengthening of Traffic Regulation and Enforcement	Strategy 6: Enhancement of Road Safety	Strategy 7: Promotion of Active Transportation	Strategy 8: Development of a Comprehensive TM Database	Strategy 9: Strengthening of MMDA's Capacities in TM	Strategy 10: Enhancement of MMDA's External Coordination with Traffic Management Organizations	Strategy 11: Promotion of Comprehensive Transportation/ TM Planning by LGUs	Strategy 12: Strengthening of the Transportation Network
1	Traffic Bottleneck Improvement	✓	✓		✓				✓	✓		✓	
2	Further Improvement of Traffic Corridors			✓	✓			✓	✓	✓	✓	✓	✓
3	Further Improvement of Intersections			✓	✓			✓	✓	✓	✓	✓	✓
4	Improvement of the Traffic Signal System		✓		✓			✓		✓		✓	
5	Enhancement of Traffic Control and Enforcement					✓	✓	✓		✓		✓	
6	Enhancement of Traffic Safety and Education					✓	✓	✓	✓	✓		✓	
7	ITS Development for Traffic Management				✓				✓	✓	✓	✓	
8	Development of a Database System								✓	✓	✓	✓	
9	Strengthening of Traffic Management Planning and Implementation Capacities of MMDA								✓	✓	✓	✓	
10	Strengthening of External Coordination of MMDA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: JPT

1) Project 1: Traffic Bottleneck Improvement

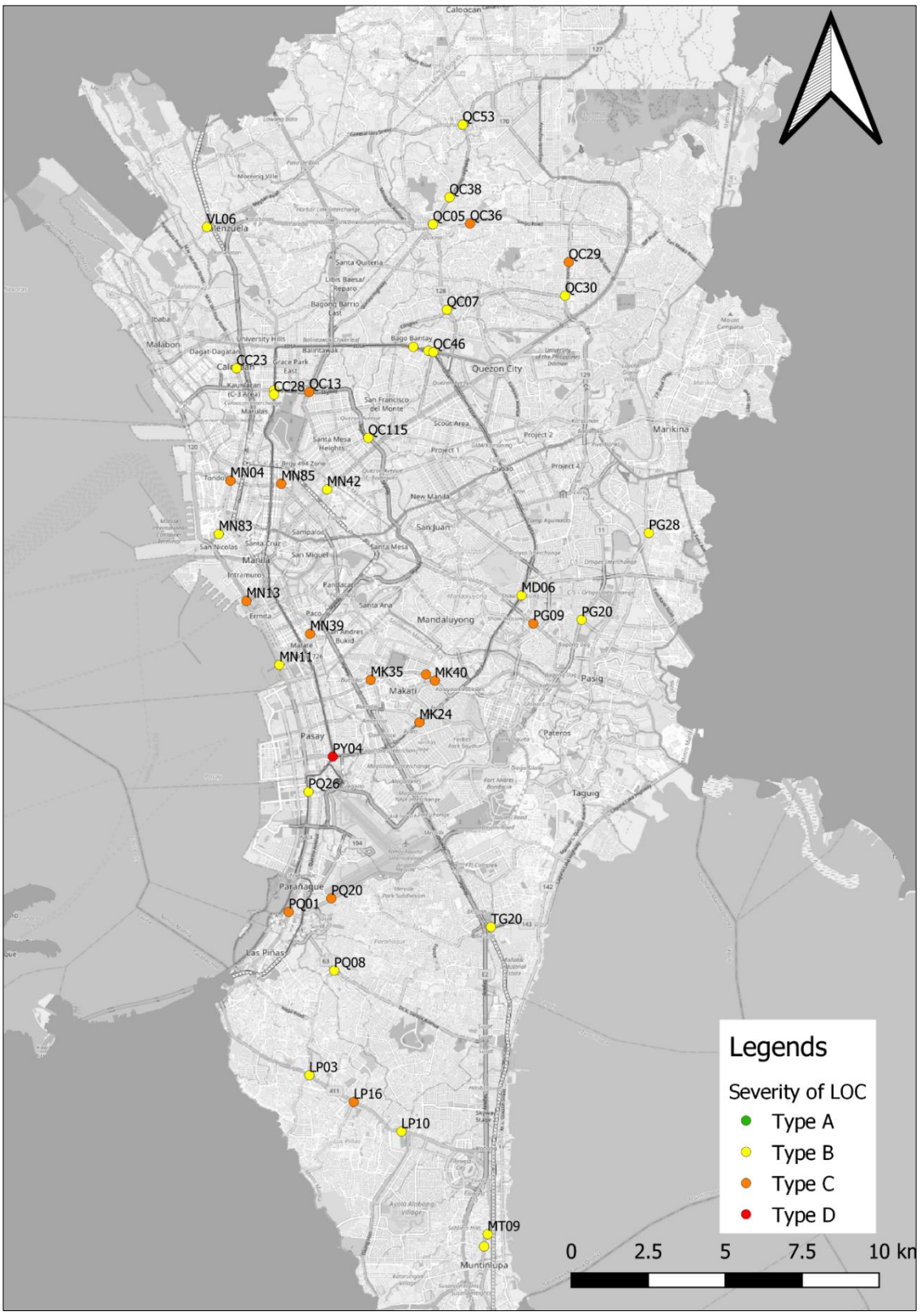
Project Objectives: Project 1 has the following objectives: (i) to improve the identified priority TBNs (42 intersections and 64 road segments) for immediate action; (ii) to continue actions for identification and improvement of emerging TBNs; and (iii) to establish a unit in MMDA to monitor, identify and improve emerging TBNs.

(1) Component 1-1 Urgent Improvement of Major Intersection Bottlenecks

The project aims to mitigate the congestion at major bottlenecks. A total of 42 locations were identified as major bottleneck by the project, as shown in Figure 6.6.

Scope of Work: The improvement plan for bottlenecks comprises various measures

including: (i) retiming of existing signals, installation of new signals, (ii) modification of intersection geometry within the existing right of way, (iii) reapplication and/or modification of pavement markings; (iv) installation of traffic signs; (v) relocation of bus stops; and (vi) other traffic management measures. The proposed countermeasures for major intersection bottlenecks are listed in Table 6.2.



Source: JPT

Figure 6.6: Location of 42 Major Intersection Bottlenecks in Metro Manila

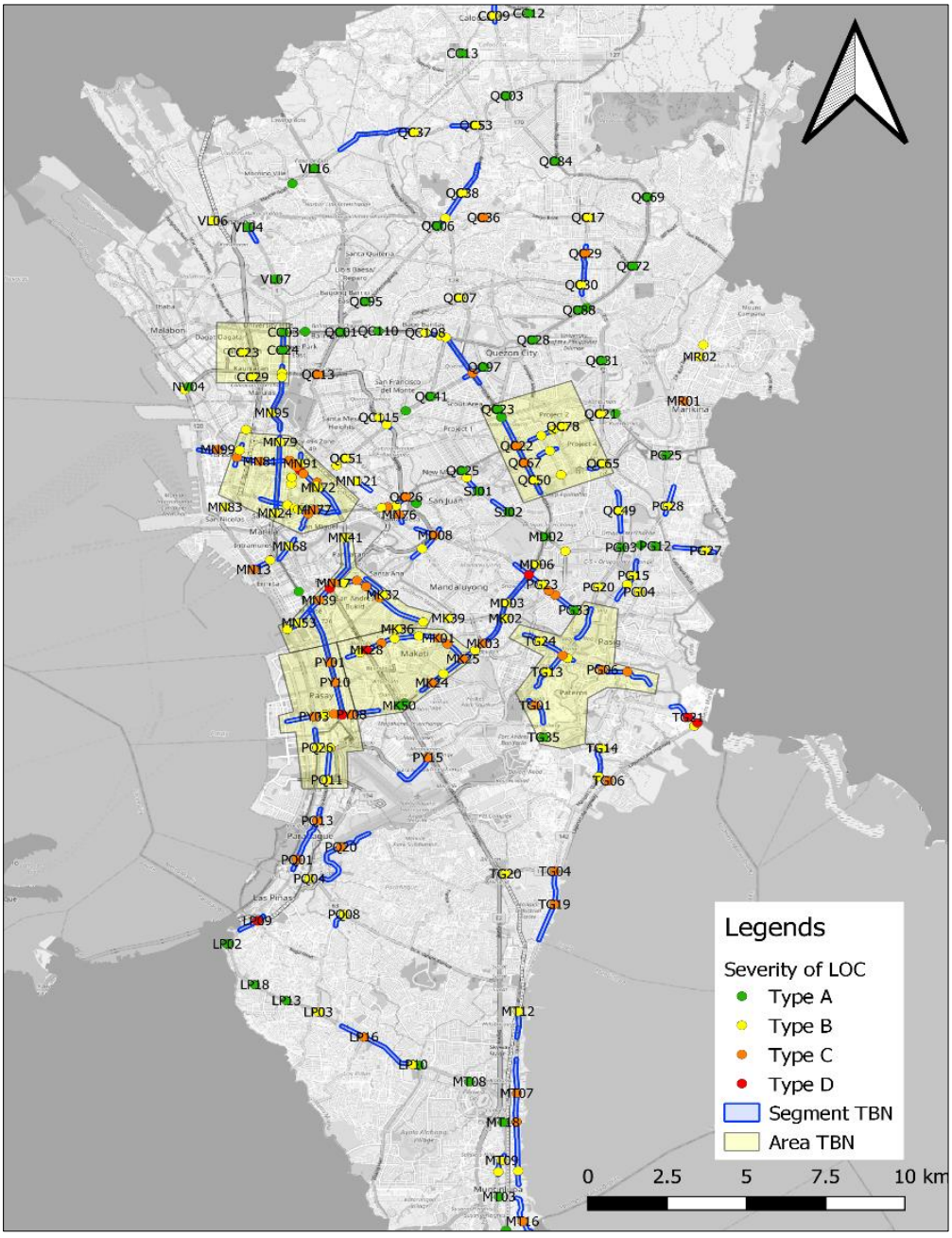
Table 6.2: Menu of Initial Countermeasures for Major Intersection Bottlenecks

Code	Intersection Name	Signal ID	Intersection	New Signal	Signal retiming	Geometric Imp.	Pavement Marking	Traffic Sign
1. CC05	5th Avenue–Rizal Avenue Extension	363	Yes		O		O	O
2. CC23	A. Mabini–P. Burgos	XXX	Yes		O		O	O
3. CC28	Rizal Avenue Extension–4th Avenue	578	Closed		O		O	O
4. LP10	Alabang–Zapote Road-Concha Cruz Drive	XXX	Yes		O		O	O
5. LP16	Alabang–Zapote Road–Marcos Alvarez Avenue	---	Yes	O			O	O
6. MD06	EDSA–Doña Julia Vargas Avenue	---	No				O	O
7. MK01	Buendia Avenue–Makati Ave	488	Yes		O		O	O
8. MK24	EDSA–Antonio S. Arnaiz Avenue	477	Yes		O		O	O
9. MK35	Buendia Avenue–Chino Roces Avenue	471	Yes		O		O	O
10. MK40	Buendia Avenue–Paseo de Roxas	481	Yes		O		O	O
11. MN04	Juan Luna Street–Tayuman St./ Capulong St.	610	Yes		O		O	O
12. MN11	Roxas Blvd.–President Quirino Ave	403	Yes		O		O	O
13. MN13	Roxas Blvd –Padre Burgos Ave.	263	Yes		O		O	O
14. MN39	President Quirino Ave–Singalong St.	172	Yes		O		O	O
15. MN42	Espana Blvd.–Blumentritt Extension	104	Yes		O		O	O
16. MN83	C.M. Recto Ave.–Asuncion St.	---	Yes				O	O
17. MN85	Lacson Ave–Tayuman St./Consuelo St	360	Closed				O	O
18. MT09	Manila South Road–Soldier Hills Village Main Road	---	Yes				O	O
19. MT21	Manila South Road–Bruger	---	Yes				O	O
20. PG09	Shaw Blvd–Pioneer St	XXX	Yes		O		O	O
21. PG20	E. Rodriguez Jr. Ave–R. Lanuza Ave	XXX	Yes		O		O	O
22. PG28	Tramo–Magsaysay	----	Yes				O	O
23. PQ01	Quirino Avenue–Kabihasnan	XXX	Yes		O		O	O
24. PQ08	Dr. Arcadio Santos Avenue–Angelina Canaynay Ave.	901	Yes		O		O	O
25. PQ20	C-5 Extension Road/Kaingin Road–Multinational Ave	XXX	Yes		O	O	O	O
26. PQ26	Roxas Blvd.–Airport Road	636	Yes		O		O	O
27. PY04	EDSA–Taft Avenue	182	Yes		O	O	O	O
28. QC05	Quirino Highway–Don Julio Gregorio	---	Closed				O	O
29. QC108	EDSA (NB)–Corregidor	---	No				O	O
30. QC109	EDSA (NB)–Misamis (SM North EDSA)	---	No				O	O
31. QC115	G. Araneta Avenue–Maria Clara St.	---	Yes				O	O
32. QC13	A. Bonifacio Avenue–5th Avenue/Sgt. Rivera Ave	581	Yes		O		O	O
33. QC29	Luzon Avenue–Diego Silang/Airforce	---	Yes				O	O
34. QC30	Congressional Avenue Extension–Luzon Avenue	---	Closed				O	O
35. QC36	Don Julio Gregorio–F. delos Santos/Gulod Road	---	Yes				O	O
36. QC38	Quirino Highway–Pablo dela Cruz	XXX	Yes		O		O	O
37. QC46	EDSA–North Avenue	---	Closed				O	O
38. QC53	Gen. Luis–Buenamar Drive	---	Yes	O			O	O
39. TG20	Gen. Paulino Santos Ave–East Service Road	---	Yes				O	O
40. VL06	Gov. Ignacio Santiago Road–Rincon Road	---	Yes				O	O
41. LP03	Alabang-Zapote Road–BF Resort Drive/CAA Avenue	982	Yes		O	O	O	O
42. QC07	Mindanao Avenue–Congressional Avenue	45	Yes		O		O	O

Note: XXX in signal ID column indicates signal is installed but no code is assigned.
Source: JPT

(2) Component 1-2 Continued Identification of New TBNs for Further Improvement Based on the CTMP Manuals

Improvement of Major Segment Bottlenecks: Traffic bottleneck locations in Metro Manila expand from points to road segments along the corridors. In this component, each segment bottleneck comprises one or more intersection bottlenecks and segments with LOCs of 3 or 4. These segment bottlenecks show congestion spillover. At these locations, if improvements are implemented at one bottleneck intersection, congestion will shift to the adjacent intersections downstream, creating new bottleneck. Therefore, integrated improvement measures need to be considered for segment bottlenecks. This component aims to mitigate the congestion on major segment bottlenecks. The locations of 64 segment bottlenecks are shown in Figure 6.7.



Source: JPT

Figure 6.7: Location of Major Segment Bottlenecks in Metro Manila

Given the urgency of the situation, Project 1 mainly comprises countermeasures that can be implemented as soon as possible within the existing ROW, such as the use of pavement markings. However, since some locations might need intersection geometric improvement, this should be considered in the detailed design stage in collaboration with potential stakeholders. Meanwhile, more complex improvement measures should be made in the medium and long term, and this lies within the scope of Project 2 and Project 3.

Table 6.3: Menu of Proposed Countermeasures for Major Segment Bottlenecks

Countermeasure	Quantity	Detailed Countermeasure
1. Intersection Geometric Improvement within ROW	40	• Left-turn provision/extension. • Patching potholes. • Improved channelization (pavement markings). • Replacement of pavement.
2. Proper Signage and Marking	93	• Improvement of intersection layout (Intersection box, stop line, pedestrian zebra crossing, broken, double yellow line, and solid lines). • Dedicated right or left turn lane markings. • Installation of traffic signs.
3. Improvement of Safety Facilities	45	• Provision of sidewalks. • Improved streetlighting. • Pedestrian crossing. • Pedestrian barriers/railings. • No-jaywalking sign.
4. Installation of New Traffic Signals	28	• Installation of new traffic signals.
5. Appropriate Signal Operation and Maintenance	87	• Traffic count survey. • Signal re-phasing/retiming. • Repair of detectors, traffic-responsive control.
6. Introduction of Signal Coordination for Corridors	22	• Signal coordination along the segment.
7. Improvement/Installation of Traffic Information Facilities	95	• Installation of directional arrow signs/destination guide signs (gantry).
8. Review of Traffic Regulations for Vehicular Traffic	70	• Traffic signs (one-way, no entry, turn right allowed on red, No right or left turn, change of direction prohibited). • Reversible lanes, U-turn slots.
9. Parking Management (Enhance enforcement, Guidance system, Secure parking space)	47	• Set up and monitor strict traffic enforcement areas (cleaning operation). • Prohibit parking and stopping (traffic signs and curb painting).
10. Review/Replacement of PUB Stops/Routes	83	• Install bus and jeepney stop zones (on-street, lay-bys) (traffic signage and pavement marking). • No contact apprehension (CCTV camera).
11. Improvement of construction management (Enhance coordination on road diggings)	17	• Roadworks safety devices/signage. • Appropriate time and coordination of road construction (The cost should be borne by the contractor).
12. Intersection geometric improvement with conner cut (There may be cases where site acquisition is required)	59	• Corner island construction. • Corner island removal.

Source: JPT

Periodic Identification of Emerging TBNs based on the Outputs of CTMP: The CTMP Project identified 42 major intersections and 64 segment bottlenecks that urgently need improvement and proposed the respective countermeasures. However, traffic conditions are constantly changing, and it is difficult to address existing bottlenecks with a long-term perspective in mind. Therefore, it is important to continuously identify TBNs, then plan and implement countermeasures to improve traffic conditions in the entire Metro Manila. For this purpose, the following actions are proposed:

(i) Adopt the PDCA cycle by preparing manuals which describe procedures such as identifying traffic bottlenecks, planning countermeasures, and monitoring actions;

(ii) Verify the bottlenecks identified in the previous year;

(iii) Review major TBNs annually by using travel speed data from Waze and other databases;

(iv) Plan and implement countermeasures periodically; and

(v) Coordinate and collaborate with related organizations.

To assist the MMDA in the above actions, the JPT also produced a guidebook on identifying and monitoring traffic bottlenecks.

Establishment of a Unit in MMDA to Undertake the above Activities Regularly: As the cycle of identifying emerging TBNs is critical to improving the day-to-day traffic situation in the metropolis, the JPT recommends that a unit be established in MMDA in the immediate term. If this will not be possible, the JPT recommends a task force be established first. Table 6.4 shows the recommended MMDA offices that will comprise the task force.

Table 6.4: Responsibilities of the Task Force on Bottleneck Improvement

Responsibility	Recommended Lead Office
1. Data Collection and Analysis, Identification of Emerging TBNs	MMDA (Planning and Design Division of TEC)
2. Site Observation to Determine Traffic Conditions	MMDA (TDO and TEC)
3. Preparation of Detailed Designs and Cost Estimation	MMDA (PDD, TSOMD)
4. Allocation of Budget	MMDA (Budget Division)
5. Implementation of Countermeasures	MMDA (PDD, TSOMD)
6. Coordination among the Stakeholders	MMDA (Physical Planning & Spatial Development Service), LGUs, DPWH

Source: JPT

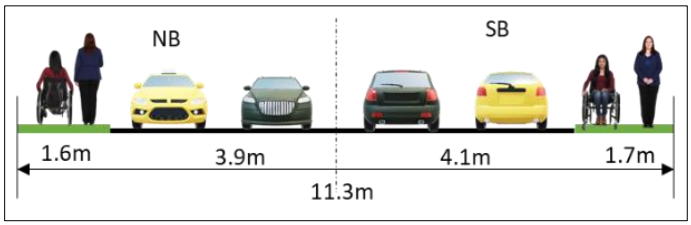
2) Project 2: Further Improvement of Traffic Corridors

While attending to current traffic congestion and existing bottlenecks are serious concerns for Metro Manila, and while low-cost countermeasures are required immediately, it is also important to improve the overall mobility of vehicles and people, that is, while road users may be inconvenienced by a number of bottlenecks, in the end, their concern is the overall travel time between their origin and destination.

With the above in mind, the JPT formulated long-term projects and actions to comply with the 12 strategies described in the preceding pages. To promote fundamental improvement, the Team took the following elements of a traffic corridor into consideration: carriageway, sidewalks, bike lanes, PUV stops, roadside parking, streetlights, traffic signs, central medians, railings, bollards, utilities, and other facilities.

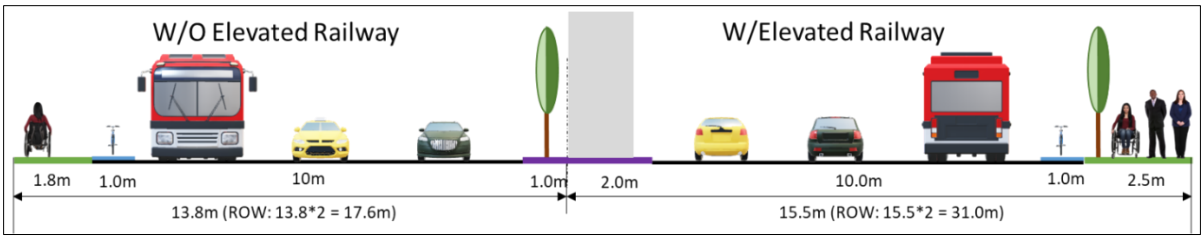
(1) Component 2-1 Further Upgrading of Traffic Corridors

Objective: As discussed in Chapter 3, the current issues of traffic corridors that have issues such as narrow ROW widths, not enough sidewalk width, insufficient bike lane width (Figure 6.8). Therefore, the ideal cross-section showing 2 cases without elevated railway (left image in the figure) and with elevated railway (Figure 6.9) is considered. The widening of ROW will need land acquisition, which takes long time and large cost. However, the government should not give up efforts to facilitate necessary negotiations.



Source: JPT.

Figure 6.8: Existing Cross-section of a Narrow Section of R-2



Source: JPT

Figure 6.9: Proposed Cross-section for R-2

Improvement Scenarios: Based on the issues stated above, the general characteristics of corridors, along with several scenarios, are shown in Table 6.5. The table is based on the corridor database, which the JPT recommends that MMDA maintain and update. Class D and E roads were not included because of various urban problems.

Table 6.5: Current and Assumed Characteristics of Corridors

Item		Current Condition			Scenario					
					Long Term (W/o Railway Pillar)			Long Term (With Railway Pillar)		
		Class A C&R	Other A	B	Class A C&R	Other A	B	Class A C&R	Other A	B
Length (km)		273	189	412	273	189	412	273	189	412
Area (km^2)		6.4	3.4	6.1	7.7	4.4	8.8	8.5	5.0	10.2
ROW Width Ave (m)		23.5	17.7	14.7	28.3	23.4	21.3	31.1	26.4	24.8
Composition	Carriageway width (m)	18.2	12.6	10.3	19.0	14.0	13.4	19.0	14.0	13.4
	No. of Lanes	6.2	2.1	1.7	5.7	4.2	4.0	5.7	4.2	4.0
	Bike lane width(m)	1.8	0.7	0.5	2.4	2.4	2.4	2.4	2.4	2.4
	Sidewalk Width (m)	2.3	2.7	3.1	4.8	5.0	4.0	5.7	6.0	5.0
	Streetlight (No./km)	32.5	5.4	4.2	36.0	40.0	30.0	35.3	20.0	15.0
Median	Median width(m)	2.9	1.8	0.9	1.0	2.0	1.5	2.0	1.0	0.8

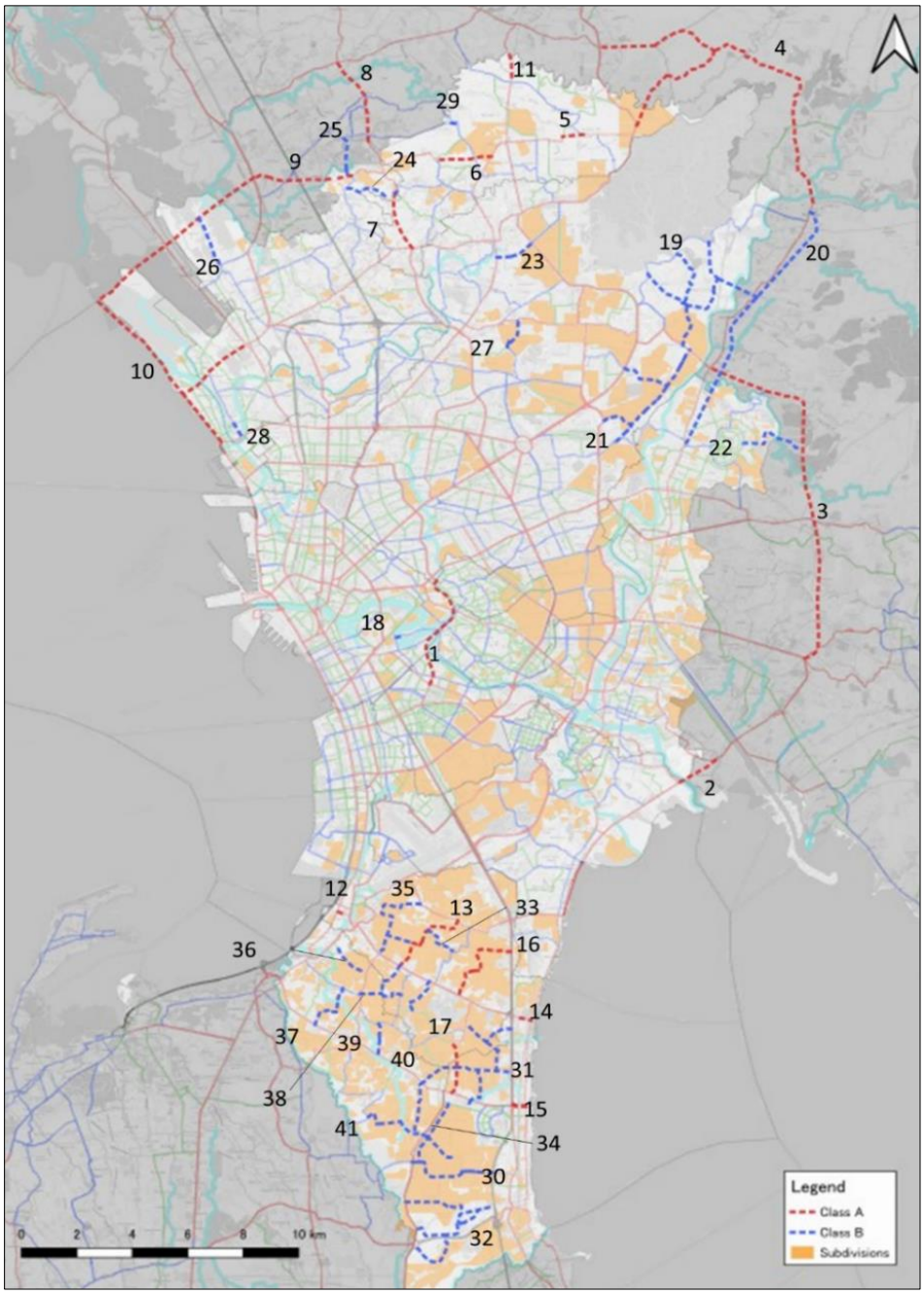
Source: JPT

(2) Component 2-2 Removal of Missing Links[12]

In Metro Manila, there are many missing links on roads where critical urban facilities are located. Because traffic is impeded, managing traffic flow has been difficult. In the future, traffic congestion is expected to escalate, and constructing roads alone may not be enough. The JPT thus recommends the immediate construction especially of BBB projects.

In addition and based on the issues mentioned above, the JPT suggests removing the missing road links (Figure 6.10), i.e., building connectors or new roads and widening Class A and B roads. The links should follow the network hierarchy so that traffic will be distributed to the corresponding road classes. Missing links in class A and B roads and in narrow roads are targeted, particularly the segments where large-scale transportation projects are planned.

[12] Refers to non-existent roads and Class A and B roads with insufficient number of lanes.



Source: JPT

Figure 6.10: Location of Missing Links in Metro Manila

Role Sharing: The roles of various MMDA offices in Project 2 are shown in Table 6.6. MMDA should suggest the issues for corridor updating and missing links based on the database, and contribute to ease new traffic congestion by the regulation and signal timing in accordance with the changes in traffic after the construction.

Table 6.6: Roles of MMDA Offices in Project 2

Component	Recommended Lead Organization
1. Further Corridor Upgrading Component	DPWH, LGU, MMDA (TEC, OAGMP, TSOMD) ,DOTr
2. Construction of Missing Links Component	DPWH, LGU, MMDA (TEC, OAGMP, TSOMD) ,DOTr

Source: JPT

3) Project 3: Further Improvement of Intersections

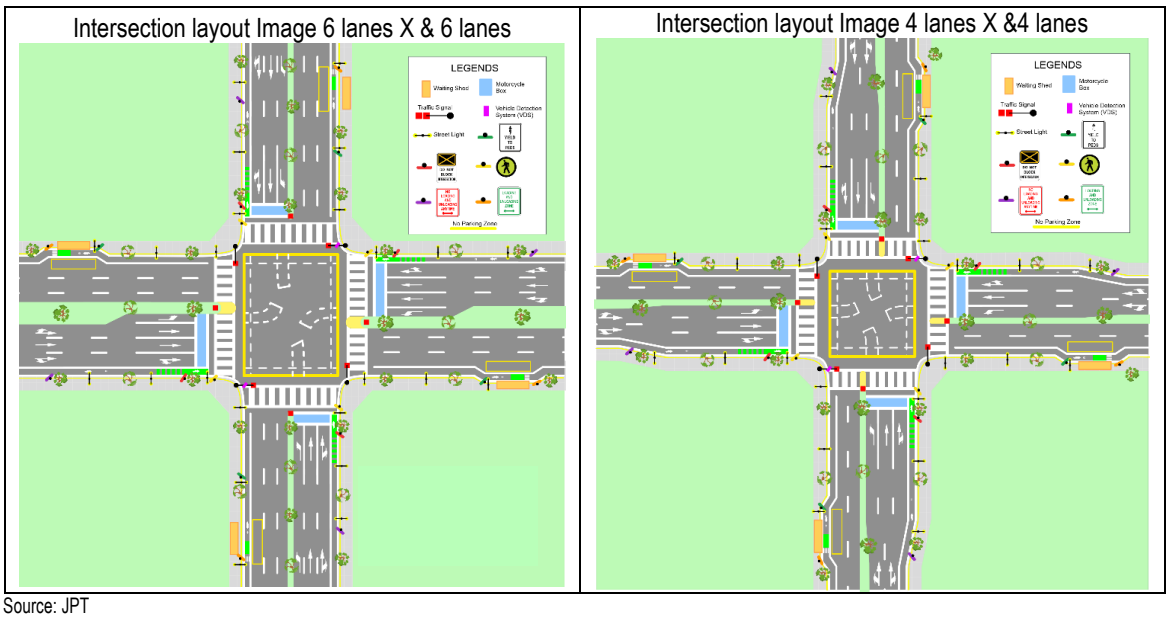
Given the urgency of the situation, Project 1 is important as a short-term and routine measure. However, without geometric improvement that includes land acquisition along the intersections, there will be no significant improvement in the traffic environment. In addition, improving road and public transportation facilities may be needed if it is difficult to alleviate traffic congestion through traffic management measures alone. For this, several subprojects are proposed below.

(1) Component 3-1: Planning for Further Intersection Improvement / Upgrading

It is very important to design intersections for safety of and accessibility by all types of road users. Intersections in urban areas should be compactly designed, and speeds should be controlled. In Metro Manila, where streets have evolved over the years and have posed unique challenges regarding land use and density, the performance of a corridor depends largely upon the design and efficiency of its intersections. To prepare the design guidance for intersections, the following should be considered: (i) geometric alignment, (ii) right of way (ROW), (iii) land use, (iv) traffic count, (v) intersection design for vehicles and pedestrians, and (vi) traffic signal installation for the long term.

(2) Component 3-2 Implementation of Further Improvement

Based on the above design guidance, intersection improvements are recommended, as shown in Figure 6.11. The improvement menu consists of geometric improvement (such as a dedicated left-turn lane), proper signage and pavement marking (such as guide lines within the intersection), improvement of safety facilities (such as pedestrian space, zebra crossings), installation of signals for pedestrians, no-parking signage, relocation of bus stops, proper bike lane, motorcycle box, and vehicle detection system, as shown in Table 6.7.



Source: JPT

Figure 6.11: Proposed Intersection Layouts

Table 6.7: Improvement Menu and Components

Improvement Menu	Component for Cost Estimation
1. Intersection Geometric Improvement	Dedicated left turn lanes (remove median)
	Dedicated left turn lanes (construct right turn lanes pavement)
	Dedicated left turn lanes (solid line)
	Dedicated left turn lanes (arrow marking)
	Replacement of pavement within intersection
	Land acquisition
2. Proper Signage and Marking	Pavement marking with guideline within intersection
	Yellow box
	Signage for Do Not block intersection
	Signage for Pedestrians crossing
	Clear lane marking
3. Improvement of Safety Facilities	Zebra crossing
	Sidewalks pavement
	Tree
	Light pole
	Pedestrian barriers/railings
4. Installation of New Traffic Signals	Installation of signals
	Installation of pedestrian signals
5. Parking Management	No parking signage
6. Review/Replacement of PUVs Stops/Routes	New bus stop
	Signage for Loading and Unloading Zone
	Signage for No Loading and Unloading Anytime
	Pavement for PUV stop
7. Improvement of Bike Lanes	Pavement marking
	Colored pavement (for bike lane)
	Bollard
8. Installation of Motorcycle Boxes	Pavement marking
	Colored pavement (for motorcycle box)
9. ITS	Vehicle Detection System

Source: JPT

Role Sharing: The roles of various MMDA offices in Project 3 are shown in Table 6.8.

Table 6.8: Roles of MMDA Offices in Project 3

Component	Recommended Lead Office
1. Planning for further intersection improvement/upgrading	MMDA (TEC, OAGMP, TSOMD), DPWH,DOTr
2. Implementation of the further improvement	MMDA (TEC, OAGMP, TSOMD), DPWH,DOTr

Source: JPT

4) Project 4: Improvement of the Traffic Signal System

Project Objectives: MMDA operates two (2) area traffic control (ATC) systems, Hermes system and Cosmos system, covering more than 400 intersections. But the system is not performing to its maximum potential. The signals operate with time-of-day (TOD) mode only, and the signal timing is not updated properly, with some exceptions. Enhancing the MMDA's technical capacity in the fields of signal design, procurement, implementation, operation, and maintenance is also required to undertake the proposed improvement works.

Project Components: Improving the traffic signal system involves upgrading the existing ATC system and has the following components: upgrading of signal control algorithm, signal retiming, and enhancement of project management capability. These components are described below.

(1) Component 4-1 Upgrading of Signal Control Algorithm and Retiming

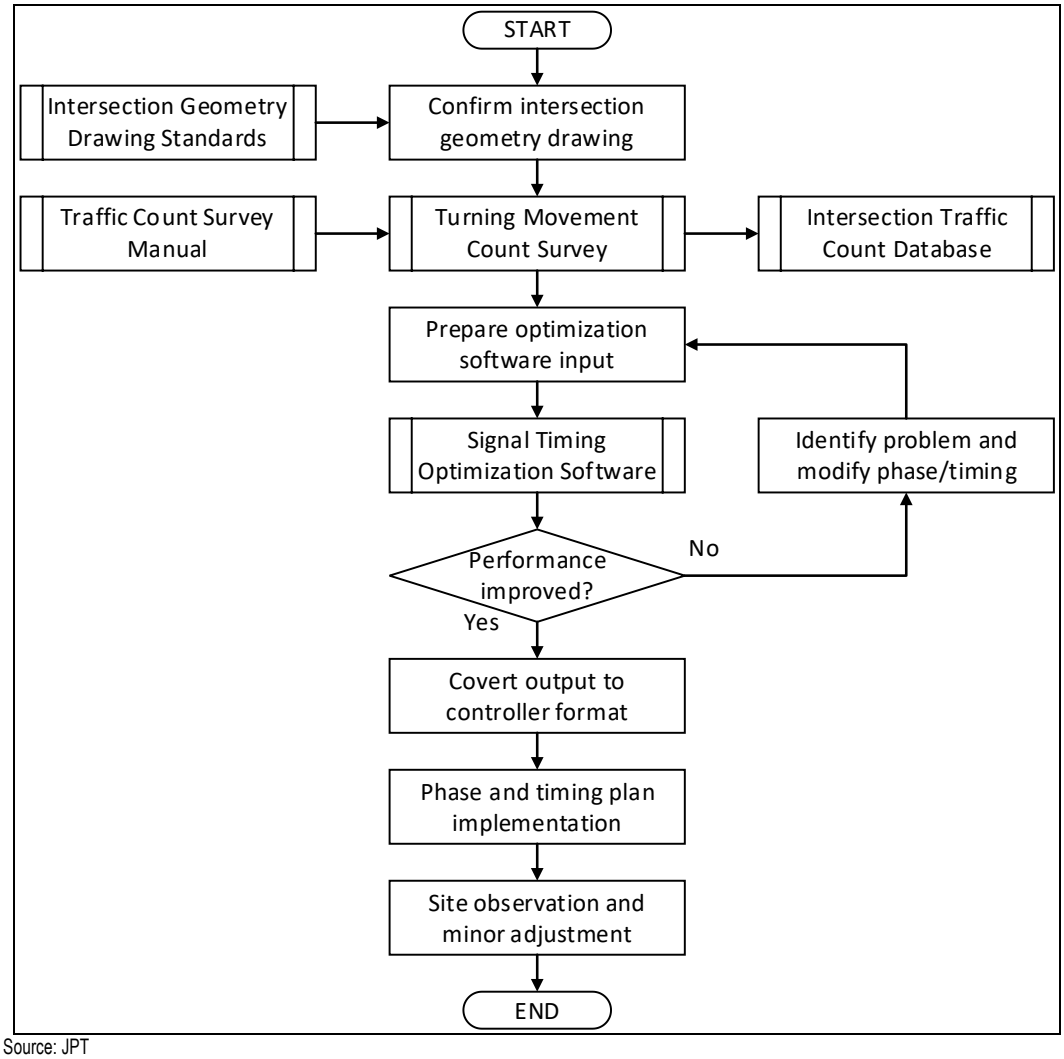
Upgrading of Signal Control Algorithm: MMDA's existing ATC system, i.e., COSMOS, is currently operating in a time-of-day (TOD) control algorithm. Under TOD control, the day is divided into several time zones based on the traffic condition, and timing parameters preset through the offline procedure are applied for each time zone. Thus, signal timing does not consider the prevailing traffic condition which changes day by day. The Cosmos system uses loop detectors installed at the approach of signalized intersections to count the number of vehicles and the time during which the vehicles are above the loop. These data are sent to the ATC center to calculate the traffic volume, average speed, and occupancy rate[13]. Traffic volume and occupancy are recorded as historical data, but they are not used for signal control. MMDA has a plan to upgrade the signal control mechanism of the existing ATC system into a traffic-responsive control (TRC) by setting up the required database. The composition of signal groups will also be reviewed and modified, if necessary. Additional vehicle detectors will also be installed.

Signal Retiming: Signal timing has a large impact on the efficiency of traffic flow at the intersection and along corridors. As traffic demand and pattern change over time, signal timing must be reviewed and updated periodically to adjust to such changes. Currently, however, the signal timing is reviewed only when inefficiency or inadequacy of the signal operation is noticed. Systematic review and updating of the signal timing should be carried out to enhance the efficiency of the existing signals. Signal retiming should be carried out as shown in Figure 6.12. As a prerequisite, intersection drawings must be updated to reflect the existing conditions, and intersection directional traffic count must be available. The target signals for retiming falls under two groups, i.e., signals at serious bottlenecks and signals at key intersections of signal groups. The first group comprises 24 signals at 42 major bottlenecks, while the second group comprises 132 signal groups defined in the Cosmos system for signal control. As there are six (6) signals common to both groups, the number of signals for retiming in the second group is 126 signals. And the existing signals will be divided into three (3) batches for signal retiming. The first batch will cover 24 signals which are located in the major intersection TBNs. The second and third batches will cover 63 signals each. The second batch will cover the Group#02 through Group#107[14] as defined in the Cosmos system while the third batch will be the remaining groups.

(2) Component 4-2 Enhancement of Project Management Capacity

Rationale: Although MMDA has designed many signals in the past, there is no established procedure for signal design. Thus, this component aims to establish the design procedure to make signal design more efficient and consistent. To procure a good system and avoid any dispute, knowledge on project management and the preparation of proper tender documents are essential. Proper maintenance is indispensable for an ATC system and its associated equipment to perform their functions in the most efficient manner throughout their design life. The size of the ATC system in Metro Manila requires outsourcing the maintenance work to experienced and qualified maintenance contractors based on adequately prepared specifications, reporting forms, and drawing for maintenance work. This component focuses on the items described above and will be carried out mainly through on-the-job training. The MMDA staff and maintenance staff will carry out the work, while the technical advisor will provide advice and suggestions.

[13] Occupancy is the proportion of time during which vehicle is above the loop coil of vehicle detector.
[14] The Cosmos system groups signals for signal control. There are 132 groups in the existing Phases II and IV systems. Group IDs are not sequential.



Source: JPT

Figure 6.12: Signal Retiming Procedure

Scope of Work: The project component consists of three (3) actions, namely, signal design, project management, and system maintenance (Table 6.9).

5) Project 5: Enhancement of Traffic Control and Enforcement

Project Objectives: Enhancing traffic control and enforcement aims at the following: (i) to reduce the burden of traffic enforcers and enhance prioritized traffic enforcement, application of information and communication technologies (ICT) and involvement of the private sector is vital; (ii) to harmonize traffic regulations and ordinances issued by stakeholders to change road user behavior (mindset) by providing the same message tor road users; and, (iii) to evaluate the effectiveness of the measures/policies introduced.

(1) Component 5-1 Upgrading of Enforcement Devices and Facilities

MMDA should discuss with the LTO and LGUs the introduction of mobile e-ticketing devices with RFID/QR code license plate reader that issue citation ticket easily and identify multiple traffic violations automatically. MMDA's traffic enforcement and apprehension systems can be more efficient with real-time access to pertinent LTO records within the Land Transport Management System (LTMS). Using an e-ticketing device that can access these data, MMDA can quickly identify drivers who have committed multiple traffic violations, suspend their licenses, and require them to undergo mandatory training in road safety and traffic

rules. Also, the LTO has issued QR codes and RFID stickers which store several vehicle information, such as owner data and plate numbers in consideration of the data privacy act.

Table 6.9: Scope of Work of Component 4-2

Action	Detailed Work
1. Signal Design	• Acquisition of basic knowledge on traffic engineering and signal design • Standardization of turning movement count at intersections and establishment of a traffic volume count database • Establishment of a signal warrant, signal design procedure, and drawing standards • Establishment of guidelines for intersection geometric design and improvement • Preparation of traffic sign and pavement markings application guidelines • Review and preparation of standard specifications for signal system equipment (control center hardware, software, database, local controller, signal lanterns, vehicle detector, etc.
2. Project Management	• Understanding of project management components • Understanding and preparation of standard tender documents and drawings: Invitation to bid, Instructions to bidders, General conditions of contract (standard document issued by FIDIC may be referred), Form of bid, Employer's requirements, Drawings.
3. System Maintenance	• Review of current maintenance work (organization, staffing, tools and equipment, reporting system, forms, spare parts inventory, procurement, etc.) • Review of malfunction records, and identification and analysis of malfunctions • Preparation of maintenance plan, maintenance manual, maintenance contract, maintenance specifications, and checklists and forms • Development of maintenance database (malfunction record, spare part inventory, checklist, maintenance logbook, etc.) • Establishment of spare parts inventory and procurement procedure • Securing of maintenance budget

Source: JPT

(2) Component 5-2 Improvement of Traffic Control/Management Measures

Adoption of a Demerit Point System[15] for Drivers: MMDA should discuss with LTO about its adoption of a demerit system for driver licenses as soon as possible. LTO has already applied the demerit point system to those who commit driving or traffic violations. This system is more effective than fines, as repeated violations and point deductions can lead to license suspension. MMDA should adopt the system as soon as possible.

Outsourcing of Parking Enforcement: MMDA should discuss internally the outsourcing of parking enforcement to the private sector to reduce the burden of traffic enforcers and allow them to focus on traffic regulation enforcement. In Japan, parking enforcement has been outsourced to the private sector through an amendment of the traffic code in 2006. According to Tokyo's Metropolitan Police Department, enforcement by the private sector in the areas where this was introduced the earliest increased more than five times in two years. The number of on-street parking (excluding for motorcycles), including legal parking on major routes, decreased by 58.9%.

新たな駐車違反ステッカー

Source: https://e-asima.com/defense/parking/

Figure 6.13: Outsourced Parking Enforcement in Japan

15 https://filipiknow.net/lto-demerit-points-meaning/

Harmonization of Traffic Regulations and Ordinances Issued by Stakeholders: MMDA should discuss with the Metro Manila Council, the LTO, and other NGAs about the need to unify traffic regulations. While traffic conditions vary by LGU, major traffic measures should be unified to maintain traffic order. MMDA Resolution No. 08-07 Series of 2008 states that the Uniform Traffic Management Code of the LGUs in Metro Manila enacted as local ordinances by the LGUs should be implemented uniformly in Metro Manila. Furthermore, it mentions the need to establish interconnection among government agencies involved in traffic and transportation management in Metro Manila.

Role Sharing: The roles of various MMDA offices in Project 5 are shown below.

Table 6.10: Roles of MMDA Offices and Related Organizations in Project 5

Component	Recommended Lead Office
1. Upgrading of Enforcement Devices and Facilities	MMDA TDO (TEG), TED, and TEC,LTO,LTFRB
2. Strengthening of Existing Enforcement Organizations through Improved Training and Deployment	MMDA TDO (TEG) and TEC,LTO
3. Adoption by MMDA of the Demerit System for Drivers Licenses	MMDA TDO,LTO
4. Illegal Parking Enforcement Outsourced to Private Sector	MMDA TDO,LTO
5. Harmonization of Traffic Regulations and Ordinances Issued by Stakeholders	MMDA planning, TEC,LGUs, LTO, LTFRB

Source: JPT

6) Project 6: Enhancement of Traffic Safety and Education

Project Objectives: This project aims to improve traffic accident data collection in Metro Manila to aid in reducing traffic accidents through 3Es (engineering, enforcement, and education) based on appropriate accident analysis.

(1) Component 6-1 Identification of Black Spots and Enhancement of Accident Data Analysis

MMDA should take the following actions with the support of NCTS: (i) to establish criteria for identifying black spots; (ii) to refer to DPWH's accident black spot investigation handbook (2004) and UP NCTS's studies such as accident rate with corresponding AADT, rate quality control method, etc.; (iii) to analyze accident data by identifying accident causes for each black spot with MMDA's CCTV camera; (iv) to consider the solutions that MMDA should implement in terms of 3Es; and (v) to share the results of accident analysis with related agencies and academia.

(2) Component 6-2 Strengthening of Traffic Safety Capacity (Education, Enforcement, Engineering)

Promote Better Traffic Engineering to Improve Road Environment: Based on the accident analysis, MMDA should collaborate with the DPWH and LGUs in correcting black spots through traffic engineering measures.

Reduce Road Accidents: For MMDA: (i) To consider/implement traffic engineering measures in reducing road accidents in each black spot in coordination with the DPWH and LGUs; (ii) if black spots are TBNs as well, consolidate countermeasures such as physical improvement, provision of sidewalks and pedestrian crossings, retiming of signal and signalization; and (iii) to monitor/evaluate effectiveness/impact after the implementation.

Conduct Road Safety Audits: For MMDA: (i) To train its civil engineers in conducting road safety audits in collaboration with NCTS; (ii) to conduct road safety audit for existing intersections; (iii) to recommend solutions to the DPWH to help improve traffic

management; (iv) to enhance traffic enforcement to prevent road accidents; (v) to deploy more traffic enforcers and CCTV cameras in black spots where accidents due to traffic violations, such as speeding and driving under the influence, have been identified and where pedestrian protection is needed; and (vi) to introduce a demerit point system to MMDA's enforcement.

Enhance Traffic Education: For MMDA in collaboration with LGUs: (i) to formulate traffic education guidelines and refer these to LGUs; (ii) to disclose information on black spots to the public and promote road safety awareness; (iii) to include traffic education in textbooks and websites; (iv) to hold lectures in schools and commercial vehicles in coordination with LGUs; (v) to introduce driving simulators for new drivers and habitual offenders; (vi) to promote a safety campaign in coordination with i-ACT, LGUs, private companies, NGOs, and academia (e.g., Presidential Proclamation No. 115-A declares May as Road Safety Month, national coalition for child road traffic injury prevention); and (vii) to increase the number of road safety parks to disseminate road safety awareness and education.

Formulate a Road Safety Action Plan: MMDA should formulate a road safety action plan based on the Philippine Road Safety Action Plan. For the agency: (i) to be actively involved in the development of the new PRSAP in cooperation with the DOTr; (ii) to formulate its own road safety action plan based on the PRSAP; and (iii) to enhance the capacity of its Road Safety Unit to take the lead.

Role Sharing: The roles of various MMDA offices in Project 6 are shown in Table 6.11.

Table 6.11: Roles of MMDA Offices in Project 6

Component	Recommended Lead Office
1. Improvement of Traffic Accident Data Collection and Database	MMDA (Road Safety Unit), PNP, DOTr, DPWH, LGUs
2. Identification of Black Spots and Enhancement of Accident Data Analysis	MMDA (TEC, Road Safety Unit), PNP, DPWH, DOTr, LGUs
3. Promotion of Road Safety Engineering to Improve the Road Environment	MMDA (TEC), DPWH
4. Enhancement of Traffic Enforcement to Prevent Road Accidents	MMDA (Traffic Discipline Office)
5. Enhancement of Traffic Education	MMDA (Traffic Education Division), LGUs, Department of Education, LTO, LTFRB, Technical Education and Skills Development Authority
6. Formulate Road Safety Action Plan in MMDA	MMDA (Metropolitan Dev't Planning Service, MMDA Road Safety Unit), DOTr

Source: JPT

7) Project 7: ITS Development for Traffic Management

Project Objectives: This project aims to work out an ITS roadmap to enhance the related functions of other strategies and to identify the areas of intervention for the stepwise introduction of ITS.

(1) Component 7-1 Asset Management of Existing ICT Facilities

The tasks in the component are shown as follows: (i) To establish an ICT inventory database of ICT; (ii) to assess existing ICT facilities and operation of the systems; (iii) to rehabilitate/Improve ICT facilities if necessary; and (iv) to develop an online monitoring system for ICT facilities

(2) Component 7-2 Review and Revision of ITS Plans, Assessment of the Smart Center Platform, and Conduct of Pre-F/S of ITS Technologies

Review of ITS Master Plan: The tasks in the component are shown as follows: (i) to review the existing MMDA ITS Plan and the planned Smart Center Platform; (ii) to study ITS-related projects by NGAs and LGUs; and (iii) to study world trends in transportation policies and new ITS technologies.

Source: JPT

Figure 6.14: Sample of New ITS Technologies

Formulation of an ITS Master Plan for Traffic Management: The tasks in the component are as follows: (i) to identify ITS needs for traffic management (planning, operation, maintenance); (ii) to study/formulate the basic policy; (iii) to concretize ITS development and deployment; (iv) to prepare an implementation plan including specifications for each facility and equipment; (v) to select useful technologies and conduct proof of concept[16]; (vi) to assess the feasibility of introducing ITS technologies in Metro Manila; and (vii) to prepare a procurement plan for implementation.

Role Sharing: The roles of various MMDA offices in Project 7 are shown in Table 6.12.

Table 6.12: Roles of MMDA Offices in Project 7

Component	Recommended Lead Office
1. Rehabilitation/Improvement of Existing ICT Facilities	MMDA (Metrobase, TSOMD)
2. Review of ITS Plans, Smart center platform, and Pre F/S of ITS technologies	MMDA (TEC, Metrobase, TSOMD), DOTr, DPWH, DICT, DOST

Source: JPT

8) Project 8: Development of a Database System

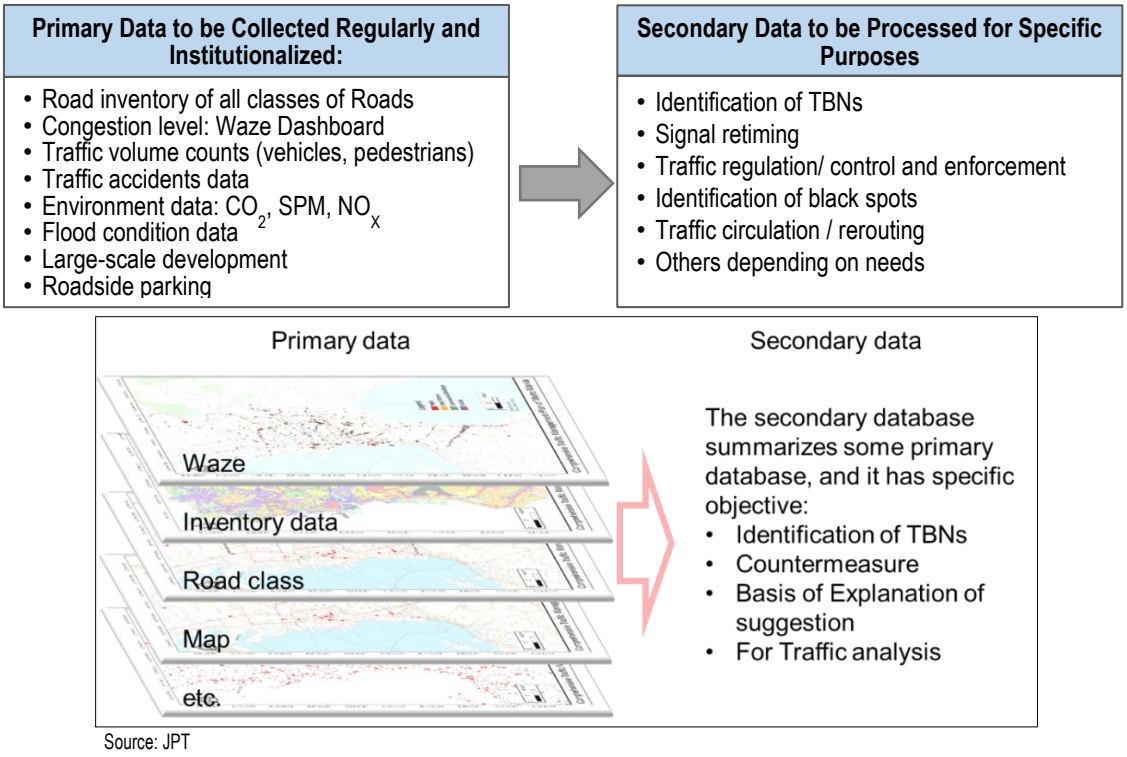
(1) Component 8-1 Development of Planning Databases and Enhancement of Coordination

The concept of databases on bottlenecks, corridors, and other elements needed for planning is shown below. In the CTMP Project, the primary data and secondary data indicated in the figure were collected. These data are very effective in determining traffic management issues and developing countermeasures. The database will be shared with other related agencies as well as within MMDA.

MMDA must discuss the following matters internally and with related agencies: (i) when a database task force is established in MMDA, the task force will take the lead to develop, operate, and manage the comprehensive traffic management database for Metro Manila;

[16] A proof of concept (POC) is an exercise in which work is focused on determining whether an idea can be turned into a reality. A proof of concept is meant to determine the feasibility of the idea or to verify that the idea will function as envisioned.

(ii) based on the prototype database developed by the JPT, update the bottleneck and corridor databases to aid in the identification of new bottlenecks and in traffic management planning. These database updates also include the road inventory, Waze data, and other necessary surveys. In the future, (iii) the database will be developed as shown in the table below; (iv) the database development and utilization possibilities indicated in Table 6.13 should be considered for traffic management planning. Transportation information (e.g., public transportation) from other agencies will also be utilized. (v) Consensus must be reached to formulate a comprehensive traffic management database within and among MMDA and other related organizations.



Source: JPT

Figure 6.15: Concept of a Database for Planning

Table 6.13: List of Possible Development and Utilization of the Databases

Category	Database Name	Frequency of Update	Main Responsibility (tentative)
Primary Data (Regular Data Collection)	Road inventory of all classes of Roads	Annual, Every time there is a new/ upgraded road	TEC
	Congestion level: Waze Dashboard	Annual	TEC
	Traffic volume counts (vehicles, pedestrians)	Annual	TEC
	Traffic accident data	Annual	PNP, Road Safety Unit, Waze
	Environment data: CO_2, SPM, NO_X	Annual	DENR etc.
	Flood condition data	Annual	Waze, Mines and Geosciences Bureau (DENR)
	Large-scale development	Annual	Planning Office
	Roadside parking	Annual	LGU, etc.
	Enforcers' opinion	Annual	TEC
	Public transport information LPTRP	Regularly	DOTr/ LTFRB
Secondary Database (for specific objectives)	Bottleneck DB	Annual	Task Force
	Corridor DB	Annual	Task Force
	Accident DB	Annual	Task Force
	Environment DB	Annual	Task Force
	Flood management DB	Annual	Task Force

Source: JPT

(2) Component 8-2 Establishment of a Common Accident Database and Enhancement of Coordination

MMDA must discuss the following matters with the PNP and related agencies: (i) to determine the accident reporting form and minimum items which should be collected for traffic accident analysis; (ii) to collect accident location (coordinates) to identify the black spots in Metro Manila; (iii) to agree on the procedure/protocol of collecting and sharing accident data among related agencies; and (iv) to authorize the DRIVER system which was already launched in the Philippines as a common accident database in the Metro Manila.

Role Sharing: The roles of various MMDA offices in Project 8 are shown in Table 6.14.

Table 6.14: Roles of MMDA Offices in Project 8

Component	Recommended Lead Office
1. Development of planning databases and enhancement of coordination	Database Task Force (TEC, TSOMD, and OAGMP), DPWH, DOTr, LGUs
2. Establishment of a common accident database and enhancement of coordination	Database Task Force (TEC, TSOMD, and OAGMP), DPWH, PNP, DOTr, LGUs

Source: JPT

9) Project 9: Strengthening of Traffic Management Planning and Implementation Capacities of MMDA

(1) Component 9-1 Enhancement of Planning Capacity

Strengthening capacity in traffic management is an urgent issue for MMDA as explained in Strategy 9. The areas are diverse, from planning, engineering, procurement, and project implementation to maintenance. Monitoring is also a critical area. Moreover, there are many cross-sectoral issues in traffic management that MMDA should address in coordination with other departments internally and with related organizations externally.

As general organizational reforms are beyond the scope of the project, improvements and practical recommendations are made regarding the implementation of proposed priority projects and actions. Key to this is to review the current organizational structure and staffing, as explained in Strategy 9 by making maximizing available resources and capacities. Action should start by establishing a task force within MMDA.

(2) Component 9-2 Enhancement of Enforcement Capacity

To conduct a laddered training program to match the various levels of enforcers' skills: MMDA's Traffic Education Division (TED) and the Traffic Enforcement Group have a plan to conduct a ladderized program that is tailored to the traffic enforcers' level to avoid duplication of efforts and to enhance their capacity continuously. Currently, TED categorizes their trainees into three levels and provides training to match these levels.

To review the enforcers' deployment plan based on data-driven analysis and to exchange data/information between TEC and TED: Based on a data-driven analysis, MMDA should focus on enforcers' deployment at identified traffic bottlenecks, accident black spots, and locations where there are many traffic violations. The MMDA Planning and Design Division under the TEC should analyze traffic data, such as Waze and traffic accident data, and provide the Traffic Enforcement Group with information on TBNs and black spots. Meanwhile, the latter and the Traffic Ticketing Management Division should provide the locations and data where most traffic violations occur.

Role Sharing: The roles of various MMDA offices in Project 9 are shown in Table 6.15.

Table 6.15: Roles of MMDA Offices in Project 9

Component	Recommended Lead Office
1. Capacity enhancement of planning sector	MMDA related divisions for planning, engineering, procurement, project implementation, maintenance, Monitoring
2. Capacity enhancement of Enforcement	MMDA (TDO, TED, OAGMP), LGUs ,LTO

Source: JPT

10) Project 10: Strengthening of External Coordination of MMDA

(1) Component 10-1 Establishment of an Interagency Task Force at Central Government Level for an Integrated Traffic Management in Metro Manila

The formulation of a traffic management plan in an integrated and coordinated manner is a critical matter for Metro Manila not only in the short term but also from the medium to long term. Road traffic congestion is a complex issue for which many interacting factors related to infrastructure, road users' attitude, and traffic management have to be considered. They often extend beyond MMDA's mandate and involve other agencies such as DPWH for road infrastructure, DOTr for public transportation, etc. Improving roads directly affects traffic capacities, and public transportation affects the modal choices of road users along major traffic corridors. On the other hand, traffic management by MMDA requires the associated actions of these agencies.

MMDA should also take the initiative when it comes to transportation plans and policies because many transportation issues are closely related to land use and hazard risk prevention, which are also included in their mandate and which eventually affect the local activities of LGUs. There is a need for a more harmonized and synchronized approach toward transportation policies, as explained in Strategy 10 in detail. For this, it is necessary to establish an inter-agency task force on integrated traffic management with MMDA's initiative. The approximate budget for an interagency task force is PHP0.5 million/year.

(2) Component 10-2 Strengthening of Coordination Capacities of MMDA with Metro Manila LGUs

While it is becoming more and more apparent that many transportation/traffic issues in Metro Manila are interrelated at the local level, the LGUs' mandate should harmonize with traffic management plans/projects metrowide as explained in Strategy 11.

The proposed project is to enhance planning and implementation capabilities of LGUs by providing them with training courses/lectures/workshops, formulating coordinated LGU transportation/traffic management plans together with MMDA with possible assistance of external resources such as UP-NCTS. Initially for this project, approximately PHP0.5 million/year is estimated.

Role Sharing: The roles of various MMDA offices in Project 10 are shown in Table 6.16.

Table 6.16: Roles of MMDA Offices in Project 10

Component	Recommended Lead Office
1. Establishment of Interagency Task Force at central government level for integrated Traffic management in Metro Manila	MMDA Interagency Task Force NEDA, DOTr,DPWH, DILG, DHSUD, LGUs
2. Strengthening of Coordination capacities of MMDA with LGUs of Metro Manila	MMDA Interagency Task Force NEDA, DOTr,DPWH, DILG, DHSUD, LGUs

Source: JPT

6.5 Implementation Plan

1) Considerations

Traffic management is handled across different levels of public governance. The urgency of the suggested projects can be categorized according to the following:

(a) **Implement as Soon as Possible:** Projects, such as Project 1 (traffic bottleneck improvement), should/can be conducted immediately. The budget can be secured, and the demarcation and identification of proposed works can be done readily.

(b) **Implement Regularly:** The projects should be continued yearly to improve traffic management in Metro Manila. Once the CTMP Project is completed, the MMDA should be able to implement the tasks of identifying new bottlenecks and countermeasures.

(c) **Implement for the Long Term:** Some projects, such as major construction, should be implemented not only for five (5) years but for the long term to continually improve the traffic situation in Metro Manila. Implementing organizations should maintain coordination with related agencies.

(d) **Develop Capacity and Conduct Studies:** Capacity development and the conduct of studies are necessary in advancing the projects. For example, “Project 9: Strengthening of Traffic Management Planning and Implementation Capacities of MMDA” covers planning matters and the utilization of databases and varied study approaches is critical here. If necessary, a technical assistance project or a technical committee with researchers may be established.

2) Roadmap

The proposed projects/actions should be implemented as shown in Table 6.15.

3) Funding Opportunities

The required budget to accomplish the five-year action plan exceeds MMDA’s budget. Therefore, it is essential to secure funding from various sources.

(a) **Traffic Management and Infrastructure Development:** When large-scale infrastructures are developed, the traffic situation may drastically change, and new congestion points may emerge. With this, traffic management measures should be implemented in a wider area. When BBB projects are constructed, missing links are removed, intersections and corridors are improved, traffic management becomes even more necessary, as large-scale development projects affect traffic flow in areas wider than their construction sites. This entails a large budget. However, budget releases may not be enough for the scale of TM measures needed by the affected areas. Thus, the implementation of appropriate traffic management solutions should be included when planning infrastructure projects.

(b) **Development of Traffic Management Systems:** The use of ICT/ITS and databases in further improving traffic of corridors and intersections can significantly ease congestion, but this requires a large budget. When tapping the national budget for this, MMDA can utilize some schemes such as the Three-year Rolling Infrastructure Program (TRIP), Public Investment Program (PIP), Core Investment Program (CIP), RDIP, Infrastructure Flagship project, ICT program and COVID-19/New Normal intervention, etc. However, the submission of budget requests is required and should include the cost estimates, project necessity, effect, and exact location. If the project is

large in scale, such as when developing corridors and intersections as described in the five-year action plan, MMDA should identify the agencies that should address specific traffic management issues and should coordinate with DOTr and DPWH.

(c) Support from Donors: Support from donors, such as technical cooperation projects, technical assistance, and ODA loan projects might be opportunities to support the implementation. The urgency, effectiveness, impact, and sustainability of projects will be reviewed to receive support from donors.

(d) **Public-Private Partnership Schemes:** Public-private partnerships (PPPs) can also be considered for some countermeasures. Traffic enforcement, such as collecting proofs of traffic violations, providing support to enforcers, and reporting violations to enforcers, could be outsourced without any need for special laws/authorization. This way, human resources can be allocated to more important tasks. On other hand, in other countries, the operations and management of toll bridges and roads, the management of streetlights, and the management of public transportation terminals/ stations/stops, among others, are carried out under PPP schemes. Such schemes should be given enough consideration so that projects can be implemented.

Table 6.17: Roadmap for the Five-year Action Plan on Traffic Management 2023–2027

No	Proposed Project	Component	Estimated Cost (PHP mil)		Implementation Schedule (Year)					Responsible Agency	
			Capital	Annual O&M	Five-year Action Plan					Lead	Support
					1	2	3	4	5		
1	Traffic Bottleneck Improvement	1-1 Urgent Improvement of Major Intersection Bottlenecks	358.4	5.7	▬	▬				MMDA	DPWH LGUs
		1-2 Continued Identification of New TBNs for Further Improvement based on the CTMP Manuals	1,074	62.2	▪▪	▪▪▬	▪▪▬	▪▪▬	▪▪▬		
2	Further Improvement of Traffic Corridors	2-1 Further Upgrading of Traffic Corridors	263,199 -346,099	2,864 -3,693	▪▪▪	▬	▬	▬	▬	MMDA DPWH	DOTr LGUs
		2-2 Removal of Missing Links	151,206	1,512	▪▪▪	▬	▬	▬	▬	DPWH	MMDA LGUs
3	Further Improvement of Intersections	3-1 Planning for Further Intersection Improvement/Upgrading	1,079	0	▪▪▪▪▪	▪▪▪▪▪				MMDA	DPWH
		3-2 Implementation of Further Improvement	10,791	108			▬	▬	▬	DPWH	MMDA
4	Improvement of the Traffic Signal System	4-1 Upgrading of Signal Control Algorithm and Retiming	21	0	▪▪▪	▪▪▬	▪▪▬	▪▪▬	▪▪▬	MMDA	LGUs
		4-2 Enhancement of Project Management Capacity	53	0	▪▪▪	▬	▬	▬	▬	MMDA	
5	Enhancement of Traffic Control and Enforcement	5-1 Upgrading of Enforcement Devices and Facilities	250	0	▪▪▪	▬	▬	▬	▬	MMDA	LTO
		5-2 Improvement of Traffic Control/Management Measures			▪▪▪	▪▪▬	▬	▬	▬	MMDA LTO	LGUs LTFRB
6	Enhancement of Traffic Safety and Education	6-1 Identification of Black Spots and Enhancement of Accident Data Analysis	155	0	▪▪▪	▬	▬	▬	▬	MMDA	PNP DPWH
		6-2 Strengthening of Traffic Safety Capacity (Education, Enforcement, Engineering)	150	0	▪▪▪	▪▪▬	▬	▬	▬	MMDA	DOTr DPWH LGUs
7	ITS Development for Traffic Management	7-1 Asset Management of Existing ICT Facilities	150	0	▪▪▪	▬	▬	▬	▬	MMDA	
		7-2 Review and Revision of ITS Plans, Assessment of Smart Center Platform, and Conduct of Pre-F/S of ITS Technologies			▪▪▪	▬	▬	▬	▬	MMDA	DOTr DOST DICT
8	Development of a Database System	8-1 Development of Planning Databases and Enhancement of Coordination	150	0	▪▪▪	▬	▬	▬	▬	MMDA	DOTr DPWH
		8-2 Establishment of a Common Accident Database and Enhancement of Coordination	150	0	▪▪▪	▬	▬	▬	▬	MMDA	PNP DOTr DPWH
9	Strengthening of Traffic Management Planning and Implementation Capacities of MMDA	9-1 Enhancement of Planning Capacity	150	0	▪▪	▬	▬	▬		MMDA	
		9-2 Enhancement of Enforcement Capacity	150	0	▪▪	▬	▬	▬		MMDA	LTO
10	Strengthening of External Coordination of MMDA	10-1 Establishment of an Interagency Task Force at Central Government Level for an Integrated Traffic Management in Metro Manila	0.5 (MMDA)	-	▪▪	▬	▬	▬	▬	MMDA	NEDA DOTr DPWH DHSUD LGUs
		10-2 Strengthening of Coordination Capacities of MMDA with Metro Manila LGUs	0.5 (MMDA)	-	▪▪▪	▬	▬	▬	▬	MMDA	DILG LGUs

Source: JPT ▬ : Implementation ▪▪ : Preparatory work

6.6 Plan Evaluation

1) Methodology

To estimate the impact of the five-year action plan, a macroscopic evaluation using JICA STRADA was used. This software is appropriate for evaluating wider areas or the overall transportation network. While some of the suggested projects, such as the improvement of traffic bottlenecks, need to be analyze through traffic simulation (Vissim, LocalSim, etc.) and other software, JICA STRADA is useful in comparing scenarios more comprehensively (see ***Appendix I*** on Pilot Project 1 regarding traffic simulation).

Macroscopic-level evaluation indicators can estimate network performance, while economic, social, and environmental indicators can show the impact of the proposed traffic management measures if they are implemented or not.

The microsimulation results of Case Study 2 showed the travel time to decrease by 23%. This figure was used as an assumption of the road traffic capacity and maximum allowed speeds to evaluate Projects 1, 2-1, 3, and 4, which showed an increase of 5% (project on improving bottlenecks) and 15% (corridor improvement project). In the long term, the assumption on travel time decrease is 20%.

2) Scenarios and Forecasts

Based on the assumed transportation network and five-year action plan, several scenarios were developed to forecast the latter's impact in Metro Manila's traffic situation, as shown below. The impact of the projects on removing traffic bottlenecks and improving corridors were evaluated separately; in addition, the base scenario and target year used for both projects was 2020 for easy comparison. Scenarios (e) and (f) are future cases to compare the indicators with the baseline.

(a) **Baseline 2020:** Assumed as the present/baseline case (2020); COVID-19 impact on traffic was not included in the evaluation.

(b) **TBN Improvement in 2020:** Improving traffic bottlenecks as proposed in Project 1.

(c) **Corridor Improvement in 2020:** Improving corridors as proposed in Project 2.

(d) **Do-nothing Scenario by 2027:** Situation in 2027 if projects were not implemented.

(e) **Implementation of BBB and Other Measures by 2027:** Situation in 2027 if all projects, including the abovementioned (b), (c), removal of missing links, and BBB projects, were implemented by 2027.

(f) I**mplementation of BBB and Other Measures by 2030:** Situation in 2030 if all projects, including the abovementioned (b), (c), removal of missing links, and BBB projects, were implemented by 2030.

3) Evaluation Results

The results of forecasting the scenarios are shown below.

(a) **Impact of Improved TBNs:** The estimated economic impact is shown in Table 6.16 and Figure 6.16. The removal of traffic bottlenecks reduces the transportation cost (comprising vehicle operating cost and travel time cost) by PHP0.4 billion/day (PHP4.9–4.5 billion/day). On the other hand, completing large-scale transportation projects in 2020 (Figure 6.5 in Chapter 6.3) reduces the transportation cost by PHP1.6 billion/day (PHP4.9–3.3 billion/day). Therefore, the impact of improving the TBNs is much smaller than that of completing large-scale infrastructures. But the cost of the former is also

much smaller (PHP1.4 billion for Project 1 and PHP11.8 billion for Project 3 compared to PHP2,385 billion for BBB projects, as shown in Chapter 5). Therefore, removing TBNs is more cost-efficient.

(b) **Impact of Corridor Improvement:** Corridor improvement will reduce the transportation cost by PHP0.8 (PHP4.9-4.1) billion/day. The effect of improving TBNs is limited; however, corridor improvement includes land acquisition, which will require more resources.

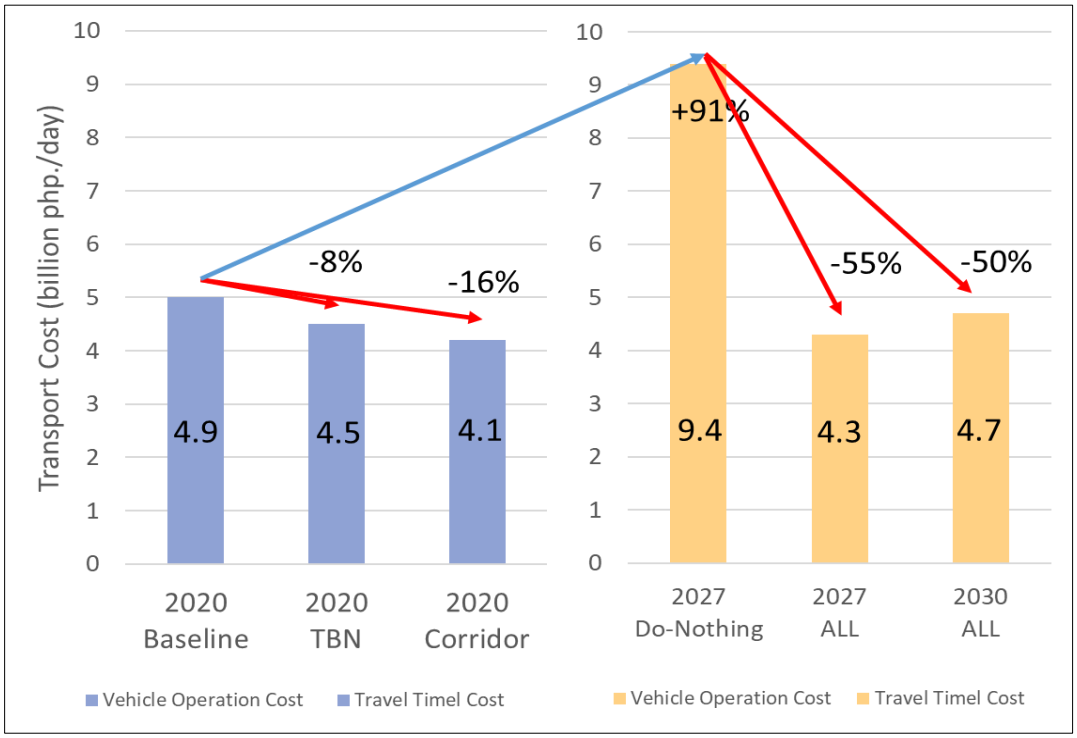
(c) **Do-nothing Scenario in 2027:** For the future, the do-nothing situation in 2027 indicates a transportation cost of PHP9.4 billion/day (1.91 times compared with the 2020 baseline). Traffic problems will be more serious than now, and traffic management should be coordinated even more with transportation infrastructure.

(d) **Impact of Implementing BBB and Other Projects in 2027 and 2030:** BBB and other projects include the removal of TBNs, corridor improvement, BBB projects, and removal of missing links. By implementing all these projects, the transportation cost in the Do-all Scenario will decrease by PHP5.1 billion/day in 2027 and by PHP4.7 billion/day in 2030, which are both significantly lower than that in 2027 if BBB and other projects are not implemented.

Table 6.18: Transportation Costs and Environment Indices by Scenario

Impact		2020 Baseline	2020 TBN	2020 Corridor	2027 DN	2027 ALL	2030 ALL
Transportation Cost	VOC(billion PHP/day)	1.2	1.1	1.1	1.6	1.2	1.2
	TTC (billion PHP/day)	3.8	3.4	3.1	7.8	3.1	3.5
	Total (billion PHP/day)	4.9	4.5	4.1	9.4	4.3	4.7
Environment	CO2 (ton/day)	19,238	18,763	18,281	26,033	19,897	20,758
	NOx (ton/day)	86.0	83.9	81.7	119.2	96.1	100.0
	PM (ton/day)	4.6	4.5	4.4	6.7	4.8	5.0

Source: JPT



Source: JPT

Figure 6.16: Transportation Costs and Environment Indices by Scenario

6.7 Monitoring

1) Importance of Monitoring

In Metro Manila, plans, projects, and traffic congestion levels have not been properly monitored, resulting in an inadequate understanding of the situation and ineffective policy/project implementation. Therefore, the JPT proposes that the following be given importance:

(i) Understanding the traffic situation objectively to identify the locations of traffic bottlenecks;

(ii) Proper and annual monitoring by the MMDA of the five-year action plan and rollover of unfinished/unimplemented projects to the following years; and

(iii) Monitoring of the effects of the action plan on road users based on such parameters as average travel time on the corridors they use.

2) Monitoring Indicators

The JPT proposes key performance indicators (KPIs) both for the TBNs and the five-year action plan, as follows:

(a) **Monitoring of TBNs:** Traffic bottleneck information can be obtained according to the methods done in this Project, in particular, using data from Waze. The data will not only be used by the MMDA-TEC in preparing plans but also by related organizations and for public dissemination.

(b) **Monitoring the Progress of the Five-year Action Plan:** The implementation of some of the proposed traffic improvement projects are difficult to measure quantitatively. Nonetheless, the progress of each KPI by year can indicate achievement (Table 6.17).

(c) **Monitoring the Impact of the Five-year Action Plan:** Monitoring the impact of the five-year plan is of primary importance. Since many aspects are involved, monitoring parameters (Table 6.18) must be quantitative to adequately analyze the situation. The JPT estimated the target values based on the demand forecast; however, some indicators should be recalculated based on the future survey data.

Table 6.19: Proposed KPIs to Monitor the Implementation of the Five-year Action Plan

No.	Proposed Project	Component	Indicator	Unit	Base -line	Target Value (2027)
1	Traffic Bottleneck Improvement	1-1 Urgent Improvement of Major Intersection Bottlenecks	Number of improved TBNs	Location	0	42
			Number of improved segment bottlenecks	Location	0	64
			Progress of establishing a unit in MMDA to identify, plan, and improve TBNs	Progress rate	0	100
		1-2 Continued Identification of New TBNs for Further Improvement based on the CTMP Manuals	Progress of preparing the improvement manual	Progress rate	0	100
2	Further Improvement of Traffic Corridors	2-1 Further Upgrading of Traffic Corridors	Progress of planning the further upgrading of traffic corridors	Progress rate	0	100
			Number of widened ROWs	l.m.	0	664,100*
			Number of sidewalks	m^2	0	254,700*
			Number of bike lanes	l.m.	0	94,000*
			Number of installed streetlights	pc.	0	2,700*
		2-2 Removal of Missing Links	Progress of planning the removal of missing links	Progress rate	0	100
			Removed missing links/ Constructed connectors	l.m.	0	97,300*
3	Further Improvement of Intersections	3-1 Planning for Further Intersection Improvement/Upgrading	Progress of preparing the implementation plan	Progress rate	0	100
		3-2 Implementation of Further Improvement	Number of improved intersections	Location	0	125*
4	Improvement of the Traffic Signal System	4-1 Upgrading of Signal Control Algorithm and Retiming	Number of upgraded signal control algorithm and retimed signals	Location	0	500
		4-2 Enhancement of Project Management Capacity	Number of signal designs	Location	0	
			Progress of preparing standard tender documents and drawings	Progress rate	0	100
			Progress of developing a maintenance database	Progress rate	0	100
5	Enhancement of Traffic Control and Enforcement	5-1 Upgrading of Enforcement Devices and Facilities	Progress of introducing mobile e-ticketing devices with RFID/QR code license plate readers	Progress rate	0	100
		5-2 Improvement of Traffic Control/ Management Measures	Progress of adopting a demerit system in the MMDA	Progress rate	0	100
			Progress of privatizing parking enforcement	Progress rate	0	100
6	Enhancement of Traffic Safety and Education	6-1 Identification of Black Spots and Enhancement of Accident Data Analysis	Number of identified black spots and causes of accidents	Location	0	TBC
		6-2 Strengthening of Traffic Safety Capacity (Education, Enforcement, Engineering)	Number of removed black spots thru safety engineering	Location	0	TBC
			Number of actions to enhance traffic enforcement and education	Actions	0	TBC
			Progress of formulating a road safety action plan	Progress rate	0	100
7	ITS Development for Traffic Management	7-1 Asset Management of Existing ICT Facilities	Progress of establishing an ICT inventory database	Progress rate	0	100
			Progress of developing an online monitoring system for ICT facilities	Progress rate	0	100
		7-2 Review and Revise of ITS Plans, Assessment of Smart Center Platform ,and Conduct of	Progress of reviewing the ITS plan and related information	Progress rate	0	100
			Progress of formulating a new ITS master plan for traffic management	Progress rate	0	100

No.	Proposed Project	Component	Indicator	Unit	Base -line	Target Value (2027)
		Pre-F/S of ITS Technologies	Progress of introducing new technologies for traffic management	Progress rate	0	100
8	Development of a Database System	8-1 Development of a Planning Database and Enhancement of Coordination	Progress of establishing a database task force in MMDA	Progress rate	0	100
			Progress of updating the bottleneck database, corridor database	Progress rate	0	100
			Progress of developing a comprehensive traffic management database	Progress rate	0	100
		8-2 Development of an Accident Database and Enhancement of Coordination	Progress of developing accident reporting forms and minimum items	Progress rate	0	100
			Progress of accident data collection with coordinates to help identify black spots	Progress rate	0	100
			Progress of establishing a common accident database in Metro Manila	Progress rate	0	100
9	Strengthening of Traffic Management Planning and Implementation Capacities of MMDA	9-1 Enhancement of Planning Capacity	Progress of enhancing the capacity of planners	Progress rate	0	100
		9-2 Enhancement of Enforcement Capacity	Progress of implementing a ladderized training program for enforcers	Progress rate	0	100
			Progress of reviewing the enforcers' deployment plan based on data-driven analysis and exchanging data/information between TEC and TED:	Progress rate	0	100
10	Strengthening of External Coordination of MMDA	10-1 Establishment of an Interagency Task Force at Central Government Level for an Integrated Traffic Management in Metro Manila	Progress of establishing an inter-agency task force by MMDA	Progress rate	0	100
		10-2 Strengthening of Coordination Capacities of MMDA with Metro Manila LGUs	Progress of enhancing planning and implementation capabilities of LGUs	Progress rate	0	100

*Note: Progress 16.7% of total amount is assumed. The progress is depending on the degree of other related agencies cooperation such as DOTr, DPWH, and LGUs
Source: JPT

Table 6.20: Proposed KPIs to Monitor the Impact of the Five-year Action Plan

Area	Suggested KPI	Description	Baseline Value	Value by Year					Target Value (TBN +Corridor)	Target Value (All Projects)
				1	2	3	4	5		
Metro Manila	1. No. of Improved TBNs	From TBN Database	0							
	2. No. of Identified TBNs	From TBN Database	42							
	3. VOC + TTC (bil. PHP/day)	Forecast result	4.9						5.8	4.3
	4. V/C Ratio	Based on traffic count survey	1.00						1.0	0.8
	5. CO_2 Emission (000 tons/day)	Forecast result	19.2						22.9	19.9
	6. No. of Accidents	No. of accidents	121,771						97,000	97,000
Corridor specific (C-4) 28.3km	1. No. of Intersection TBNs	From TBN Database	29							
	2. No. of Segment TBNs	From TBN Database	10							
	3. V/C Ratio	Based on traffic count survey	1.72						1.61	1.35
	4. Accident Rate (no./ 000km)	No. of accidents								
	5. Ave. Travel Time (min)	Based on Waze data	78.2						66.8	60.6
Corridor specific (R-1) 10.2 km	1. No. of Intersection TBNs	From TBN Database	4							
	2. No. of Segment TBNs	From TBN Database	4							
	3. V/C Ratio	Based on traffic count survey	0.5						0.45	0.41
	4. Accident Rate (no./ 000km)	No. of accidents								
	5. Ave. Travel Time (min)	Based on Waze data	23.4						18.5	16.5
Corridor specific (R-3) 24.4 km	1. No. of Intersection TBNs	From TBN Database	11							
	2. No. of Segment TBNs	From TBN Database	4							
	3. V/C Ratio	Based on traffic count survey	0.76						0.81	0.73
	4. Accident Rate (no./ 000km)	No. of accidents								
	5. Ave. Travel Time (min)	Based on Waze data	84.3						80.9	73.9
Corridor specific (R-5) 8.6 km	1. No. of Intersection TBNs	From TBN Database	12							
	2. No. of Segment TBNs	From TBN Database	6							
	3. V/C Ratio	Based on traffic count survey	0.67						0.73	0.64
	4. Accident Rate (no./ 000km)	Based on Waze data								
	5. Ave. Travel Time (min)	Based on Waze in 2019	29.4						29.2	26.0
Corridor specific (R-7) 28.0 km	1. No. of Intersection TBNs	From TBN Database	16							
	2. No. of Segment TBNs	From TBN Database	5							
	3. V/C Ratio	Based on traffic count survey	0.7						0.71	0.60
	4. Accident Rate (no./ 000km)	No. of accidents								
	5. Ave. Travel Time (min)	Based on Waze data	161.8						159.1	120.2
Corridor specific (R-10) 6.2 km	1. No. of Intersection TBNs	From TBN Database	1							
	2. No. of Segment TBNs	From TBN Database	0							
	3. V/C Ratio	Based on traffic count survey	1.35						1.39	1.25
	4. Accident Rate (no./ 000km)	No. of accidents								
	5. Ave. Travel Time (min)	Based on Waze in 2019	46.0						40.0	40.1

Note: Target value of VCR is estimated using demand forecast and survey result. Length of corridor is based on the map coordination.
Source: JPT

7 CONCLUSION AND RECOMMENDATIONS

1) Conclusion

The CTMP Project has reached the following conclusion:

(a) **Scientific Analysis on TBNs has been Made and Manuals Prepared:** The process of identifying and analyzing traffic bottlenecks was successfully implemented in the Project. Waze's travel speed data was utilized to assess the level of congestion which was then further observed both by MMDA enforcers and the JPT. This was the first time that traffic bottlenecks were identified based on a scientific analysis. Because traffic flow changes, continuous monitoring and updating of TBNs are essential. For this, the Waze travel speed dashboard, which was developed in the Project, will be managed by the MMDA for future use. The entire process of identify TBNs was described in a manual, and a training session was held before the Project ends.

(b) **Participation of Counterparts in the Project was Active and Useful:** The intensive involvement of the counterparts in the Project resulted in enhanced capacities of counterparts especially in planning small-scale but urgently required countermeasures. Regular CPT meetings and the conduct of case studies and pilot projects over three (3) years have generated favorable outcomes. Continuous capacity building should be carried out.

(c) **Understanding of Traffic Congestion among Related Organizations has been Promoted:** As is aforementioned, an approach introduced in the Project, i.e., identifying traffic bottlenecks at intersections, road segments, and congested areas, was very practical in understanding where problems lie. This is expected to facilitate the understanding of traffic management matters by various sectors of society and sharing among traffic management organizations.

(d) **Need for Inter-agency Coordination has been Promoted:** While traffic management is complex and involves many interacting factors, there is a strong need among relevant organizations to coordinate with each other, especially among MMDA, DOTr, and DPWH at the national level and between MMDA and LGUs at the subnational level. More authority should be given to MMDA to facilitate inter-LGU coordination.

(e) **Importance of Database was Recognized:** It is apparent that the database on traffic management in Metro Manila is weak and insufficient. Non-availability of updated databases has affected the quality of planning traffic management measures. A traffic management database is very much needed for the PDCA cycle. Development and continuous updating of the database are required.

(f) **Cost-effectiveness of Traffic Management Investment has been Proven:** More funds for traffic management measures have to be spent yearly to continuously improve traffic or avoid a worsening of the situation. It is roughly estimated that a 20% improvement in vehicle travel speeds on main roads can reduce VOC and time cost by PHP1.2 billion a day (i.e., removal of intersection bottlenecks=PHP 0.4 billion, corridor improvement=PHP 0.8 billion a day), showing high cost effectiveness of traffic management measures.

(g) **Target Roads for MMDA's Traffic Management were Made Clear:** A functional classification of roads indicates that roads should be managed as an integrated network

regardless of administrative responsibility. At least, traffic management for these roads must be done by the MMDA. Traffic management for Class A and B roads, which provides mobility, should be done by the MMDA, while lower-class roads, which provide access, should be managed by each LGU.

(h) **Promotion of Active Transportation is Crucial for a People-oriented Mobility:** A bike lane network should be developed, and the walking environment should be improved to seamlessly connect transportation modes, especially local roads. At the same time, proper traffic management should be carried out under local governments' responsibility.

(i) **Important Role of LGUs in Traffic Management has been Recognized:** There are more local roads than major ones, and these are mostly under the local governments' responsibility. Since they are connected to major roads, local roads affect the performance of major roads directly and indirectly.

2) Recommendations

Based on the foregoing, the JICA Project Team recommends the following:

(a) **Continuously Implement and Monitor the Five-year Action Plan:** The action plan's proposed projects are to be implemented by MMDA in coordination with relevant organizations at the national and local levels. The action plan's progress must be monitored regularly, and its projects/actions modified yearly depending upon the situation. Projects and actions not started nor completed in a given year should be scheduled or continued in succeeding years.

(b) **Institutionalize the Traffic Management Policy Function at the National Government Level:** At present, the function is dispersed through relevant organizations according to subject matter. The conversion of the Joint Coordination Committee, which was formed for this Project, into a task force or a more permanent unit within MMDA may be considered to strengthen inter-agency coordination. A practical institutional mechanism to coordinate among and with LGUs is also needed.

(c) **Strengthen Coordination with LGUs:** As traffic congestion and bottlenecks are interactive on a functionally classified road network, there is an increasing need for planning and plan implementation. Enhanced coordination must include the following points:

(i) Formulation of LGU traffic management plans in coordination with MMDA and adjoining LGUs with focus on Class C, D, and E roads because the function of these roads is different from that of Class A and B roads. Active transportation and accessibility to land uses should be considered as major concerns;

(ii) Capacity building of LGUs must be enhanced further because capabilities vary by LGU. For this, technical guidelines and lectures implemented in this Project's Pilot Project 2 should be used for reference; and

(iii) Inter-LGU coordination at the technical level must be institutionalized to enable sharing of experiences and knowledge. MMDA must take the lead in inter-LGU collaboration.

(d) **Enhance MMDA's and LGUs' Capacity on Traffic Management with NCTS's Support:** Developing the capacities in planning, engineering, and enforcement of planning and engineering personnel not only in MMDA but also in LGUs is critical. A

proper mechanism to institutionalize this CB arrangement is necessary.

(e) **Implement Traffic Management Plans during Construction:** Large-scale transportation infrastructure projects have been implemented actively and more are expected in the coming years. As traffic impacts during construction have been observed to be significant, adequate traffic management plans during construction must be prepared and implemented. Also, MMDA and LGUs should monitor them as to their effectiveness and efficacy.

3) Considerations for the Next Five-year Plan

The five-year action plan for 2023–2027 necessarily focuses on priority issues. However, because traffic management affects and is affected by other urban concerns, issues that may come up in the near future must be considered accordingly. The JPT thus recommends that the following aspects be considered by MMDA and other stakeholders for the next five-year planning period:

(a) **Coordination with Adjacent LGUs about Traffic Management:** The current action plan covers the 17 LGUs in Metro Manila. However, traffic demand from adjacent provinces (e.g., Cavite, Laguna, Rizal, and Bulacan) is expected to increase significantly, as mentioned in Chapter 2. MMDA and the LGUs should coordinate traffic management efforts together with adjacent LGUs.

(b) **Consideration of Electric Vehicles:** Electric vehicles (EVs) are required from the perspective of climate change. The enactment of Republic Act (RA) No.11697 or “An Act Providing for the Development of the Electric Vehicle Industry” or the “EVIDA” prescribes that the Department of Energy is the primary agency responsible for ensuring that the provisions of this R.A. are carried out. Other entities, such as the DPWH, DOTr, DTI, DENR, DILG, and the LGUs, have also been tasked with the responsibility. Particularly relevant to MMDA and other stakeholders is the implementation of “green routes,” which “Section. 4. Definition of Terms” refers to as public transportation routes exclusively for electric PUVs.

In the current situation wherein there is still low demand for EVs, applying green routes will worsen congestion. However, when the market penetration rate of EVs reaches a certain level in the future, MMDA and the LGUs should be prepared to implement these green routes; a positive impact to traffic flow and the commuters should be confirmed early on.

(c) **Management of Maritime Traffic:** MMDA operates the Pasig River ferry service (water buses) to reduce road congestion. Although its role in mitigating congestion may be very limited, utilizing waterways to transport cargo is still one option to lessen road freight traffic. The JPT recommends that MMDA to study the possibility of using river transportation.