JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE PROJECT FOR COMPREHENSIVE TRAFFIC MANAGEMENT PLAN FOR METRO MANILA

TECHNICAL REPORT NO. 6

ROAD INVENTORY SURVEY MANUAL

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

CTMP	Comprehensive Traffic Management Plan
JICA	Japan International Cooperation Agency
JPT	JICA Project Team
LGU	local government unit
MMDA	Metropolitan Manila Development Authority
TBN	traffic bottleneck

1 INTRODUCTION

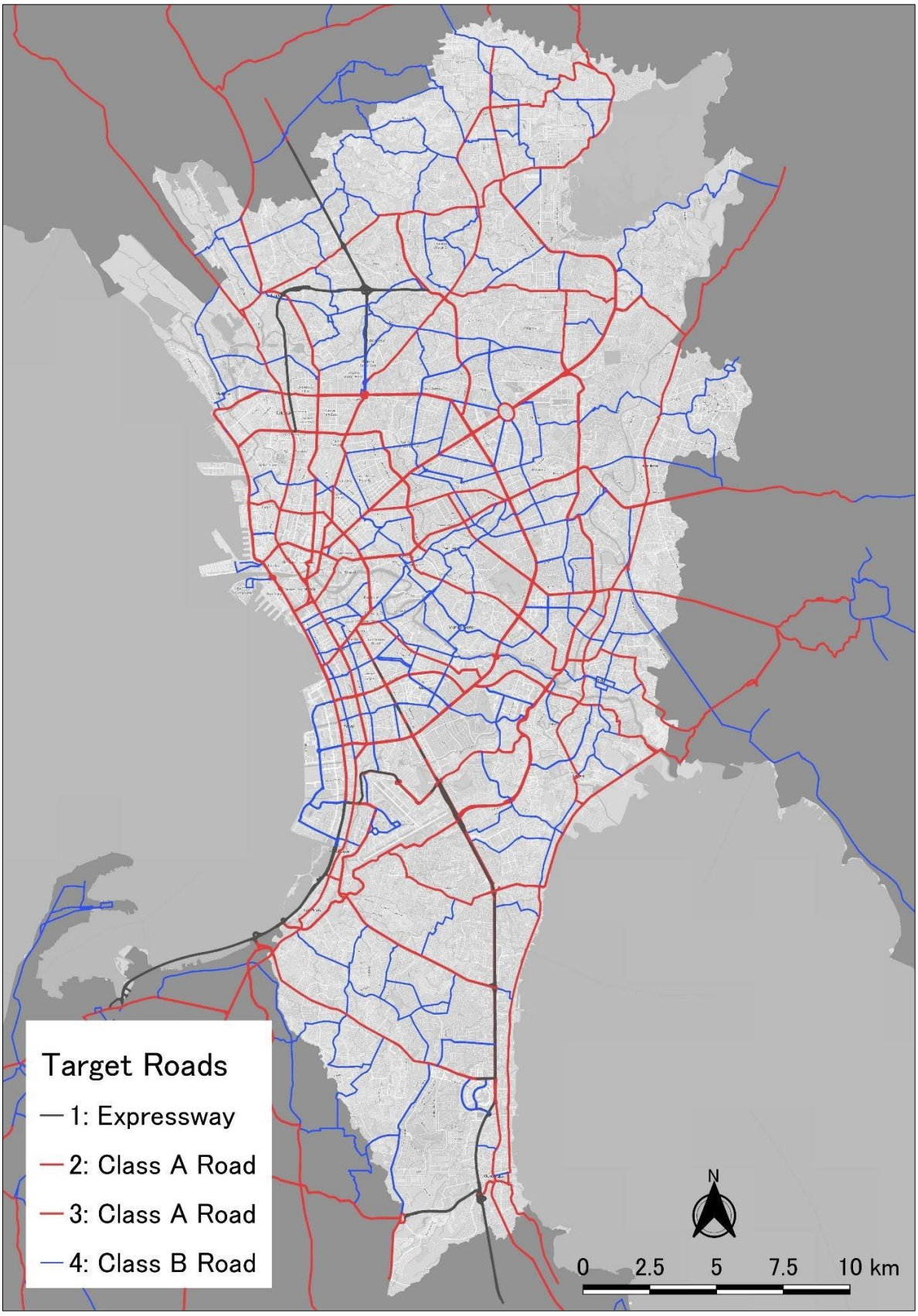
A road's physical characteristics determine its level of service and overall performance. Certain conclusions can be made about the causes of traffic congestion based on lane information, public transport stop locations, road conditions, and land use, among others. Thus, collecting such data is necessary to address traffic problems.

1.1 Objectives

In the CTMP project, the JPT performed a road inventory survey in the 17 LGUs in Metro Manila to collect information on road infrastructure, conditions, and corresponding facilities. In addition, satellite images were taken throughout the survey to capture street level information. This technical report describes the result of inventory survey and how to conduct the survey for development and updating by MMDA and LGUs after the projct.

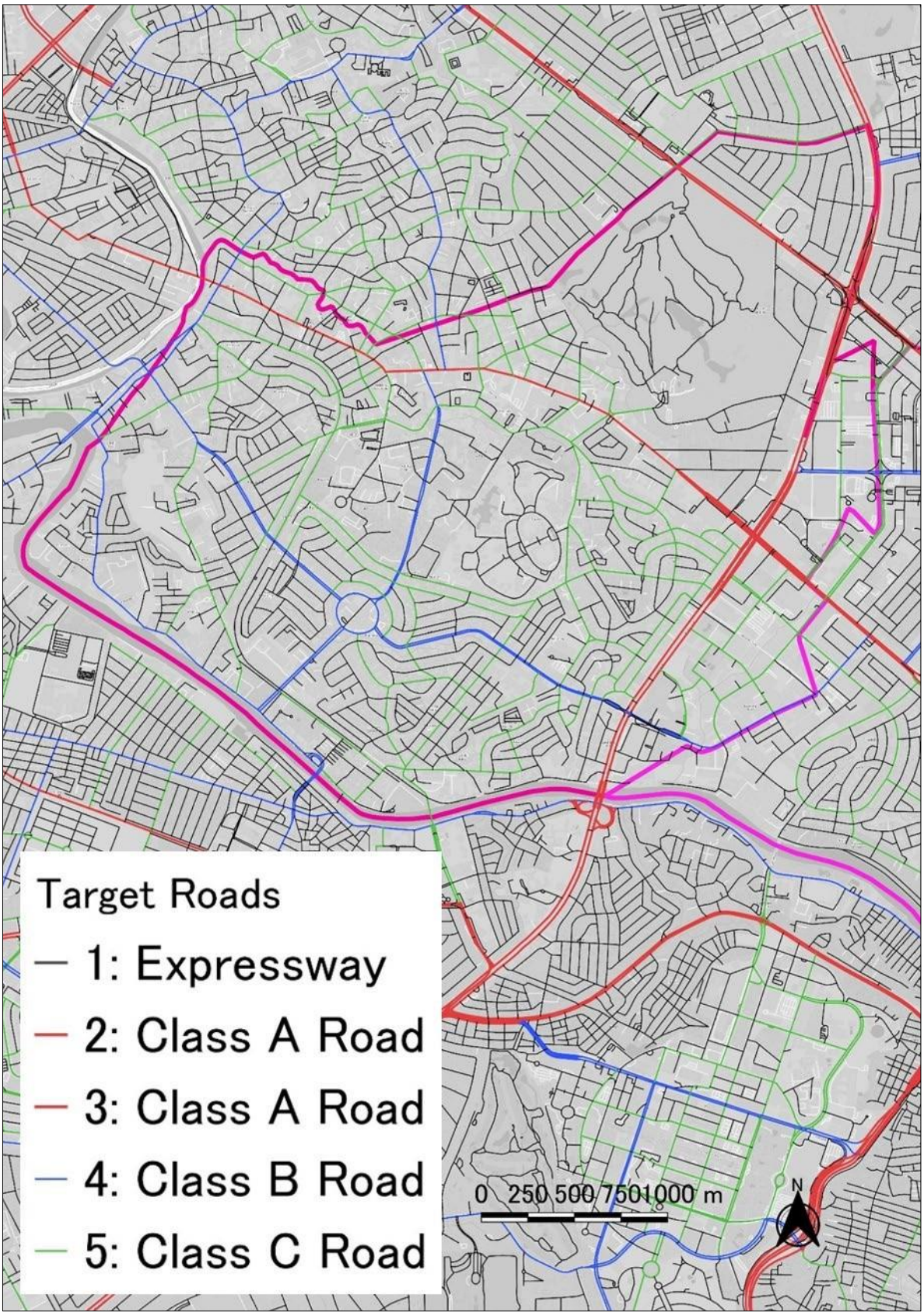
1.2 Scope of Work

The scope of the survey is divided into two scales wherein the first covers class A and B roads throughout the entire Metro Manila, which can be seen in Figure 1. Also, as trial for minor road, the second scale covers class C roads in Mandaluyong and Pasig City, as seen in Figure 2 and Figure 3, respectively.



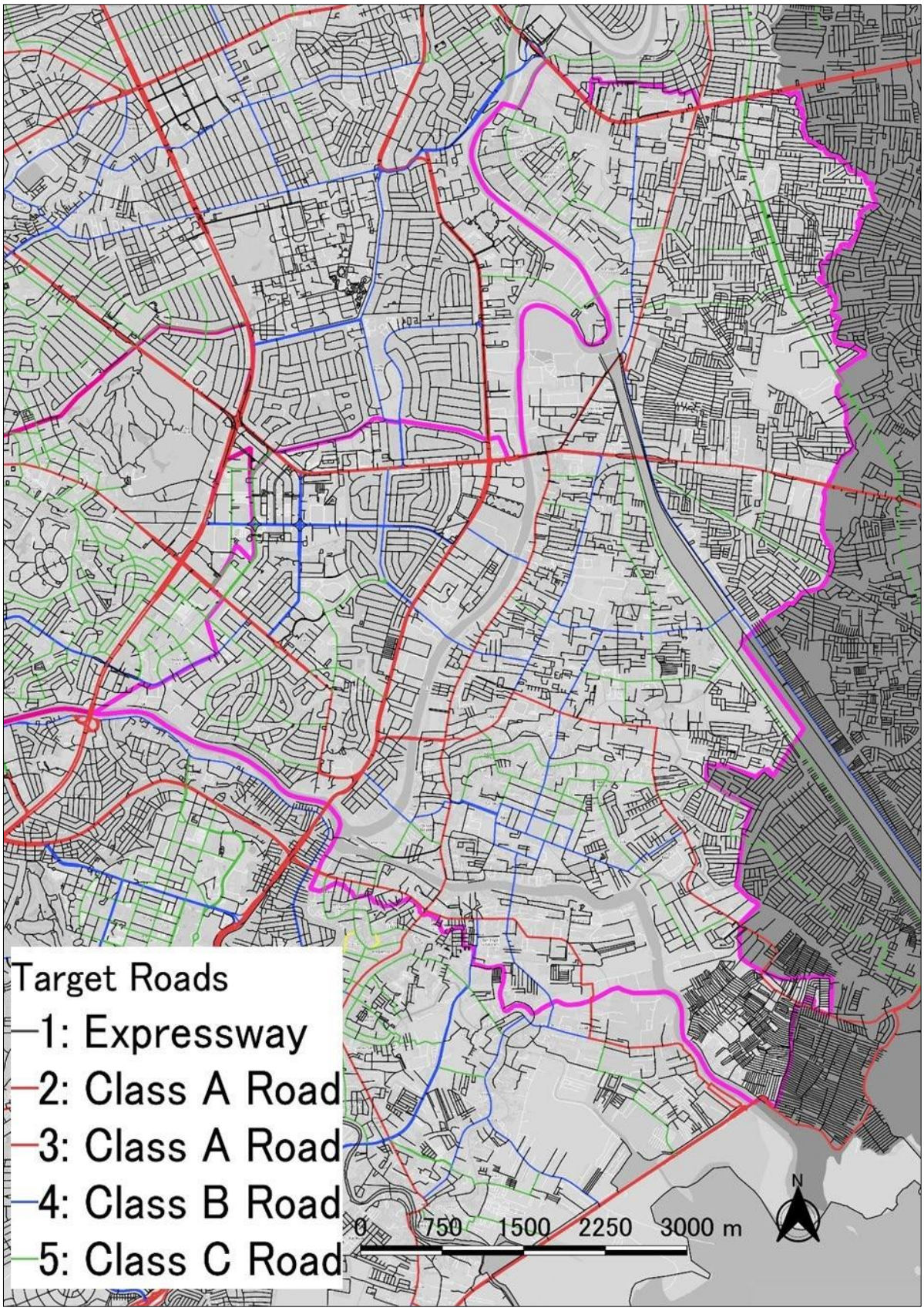
Source: JPT

Figure 1.1: Class A and Class B Roads in the whole Metro Manila



Source: JPT

Figure 1.2: Class A, Class B and Class C Roads of Mandaluyong City



Source: JPT

Figure 1.3: Class A, Class B and Class C Roads of Pasig City

1.3 SOFTWARE REQUIREMENTS

The following software were used throughout the project:

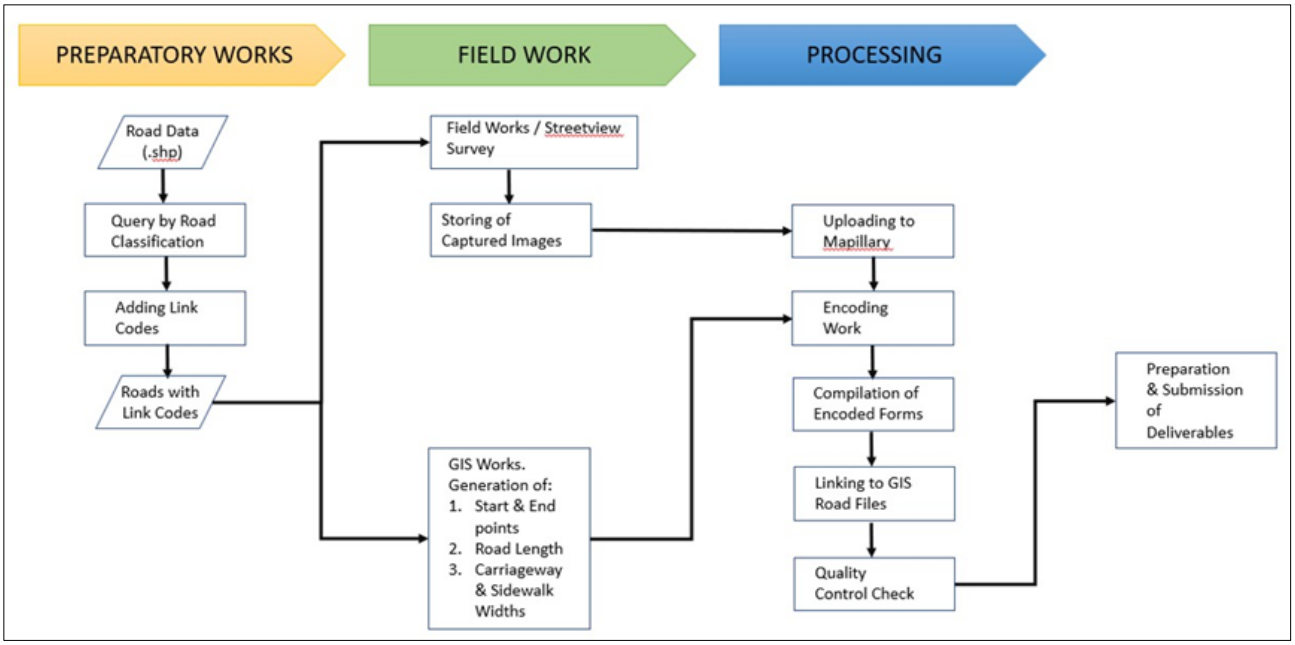
(i) Microsoft Access: for encoding of information

(ii) QGIS: for the spatial visualization of GIS data

(iii) Mapillary: for viewing of street view imagery

1.4 METHODOLOGY

The methodology is divided in to three parts: preparatory works, field work, and processing as seen in Figure 1.4.



Source: JPT

Figure 1.4: Project Workflow

First, preparatory works were done to have a basis for encoding data. Then, the actual field work was performed. Lastly, the collected data were encoded and processed for submission.

2 PREPARATORY WORKS

2.1 Preparatory Works

Prior to the road inventory survey, the following preparatory works need to be performed:

(i) Visit of the target roads to validate the survey form.

(ii) Getting the approval of concerned authorities to conduct the survey.

(iii) Hiring of survey staff and preparation of survey kits.

(iv) Training of survey staff as necessary.

(v) Conducting dry runs to review and finalize the content of the survey forms and to ensure that the survey staff understood the task.

(vi) Creating of the road network shape file.

2.2 Data Format

Data coding is done by assigning unique identifiers, called link codes, for each road link. This will allow the data to be analyzed using MS Excel, GIS, and other software.

Table 2.1: Example of Link Coding

Targeted Corridor Name	Link Code
(example) Corridor A (A)	LA001-LAXXX
EDSA (ED)	LED001- LEDXXX
C5 (C5)	LC5001- LC5XXX
Ortigas Avenue (OA)	LOA001- LOAXXX
Alabang-Zapote Road (AZ)	LAZ001- LAZXXX
Shaw Boulevard (SB)	LSB001- LSBXXX

Source: JPT

The complete and accurate information for analysis can be obtained only if survey forms are filled in correctly and the filled information are encoded carefully. Therefore, collected data should be thoroughly checked and filed by supervisors and the survey chief by survey types and survey sections. Proper number codes for each item should also be carefully chosen and handwritten codes should be legible. Poor or indistinct handwriting can be misinterpreted easily by encoders, resulting in errors and inefficient work.

Firstly, the base map shape file should be formulated, which contains the road network classified as Expressway, Class A Roads, Class B Roads, Class C Roads. The files can be accessed via the following link:

https://www.dropbox.com/sh/h0ugvlwwggxbmla/AADAOKwl5eMRCt5KC65ONZnBa?dl=0

3 FIELD WORK

3.1 Organizational Setup

The survey team should be formed to ensure quality output and should consist of the following staffs:

(a) **Survey chief:** S/He must have adequate experience with similar surveys and should coordinate the entire survey team under the supervision of the JPT.

(b) **Supervisors:** They must prepare survey plans and work assignment schedules for survey staffs and give appropriate instructions.

(c) **Surveyors:** They will conduct the field surveys at each link and node and reflect the information on the survey forms.

(d) **Encoders:** They will encode the collected data to the data entry software.

In addition, the supervisor should implement a system for survey management to cover the following issues:

(i) Operators/surveyors assignment.

(ii) Schedule management; and,

(iii) Quality control.

3.2 Survey Timeline

The timeline in Table 3.1 was implemented beginning with the preparatory works. Dates highlighted in green refer to the collection and processing of data while those in red correspond to the submittals. The activities began in the middle of August 2021 and finished by late October of the same year.

Table 3.1: Sample of Work Schedule

Activities		August				September				October			
		10-13	16-20	23-27	30-3	6-10	13-17	20-24	27-1	4-8	11-15	18-22	25-29
I. Preparatory Works													
1	Coordination Meeting with JICA Project Team (JPT) & MMDA												
2	Inspection and Preparation of Raw Road Data from JPT												
3	Coordination with Concerned Govt. Agencies and Local Government Units (LGUs)												
4	Orientation Meeting of the Project Team												
5	Dry Run of Field Survey												
6	Research Work												
II. Field Works													
7	Ocular visit of the target roads												
8	Street-view Survey												
III. Processing, Encoding and Preparation of Outputs													
9	Processing of field work data												
10	Encoding of Survey Forms												
11	GIS Conversion and Analysis Works												
12	Quality Assurance Check												
13	Preparation of Outputs and Submittals												
IV. Submisssion of Reports and Outputs													
14	Submission of Draft Database												
15	Submission of Final Database												
16	Submission of Accoplished Survey Forms												
17	Submission of GIS datasets and Maps												
18	Submission of Progress Reports												

Source: JPT

3.3 Responsibilities

The supervisor should be responsible for the following:

(i) Preparation of a detailed survey methodology and schedule in English, which should be approved prior to the commencement of the surveys;

(ii) Establishment of office(s) as the headquarters for survey activities;

(iii) Consideration of an appropriate survey organization for efficient operation;

(iv) Training of the survey staff to ensure their full understanding of the survey objectives, contents, and methodologies;

(v) Securing of insurance for the safety of surveyors;

(vi) Obtaining of official permits from concerned authorities to conduct the surveys and;

(vii) Conduction of regular onsite checks to monitor/control the surveys

3.4 Field Survey

In the field, the surveyors should install high resolution 360 camera on the vehicle to expedite the capture and utilize street-view technology (Mapillary[1]) to collect imageries of the target. Also for survey items that require measurement, such as the width of bicycle lanes, the surveyors will manually observe and record the data.

Source: JPT

Figure 3.1: Installation of 360 Camera and Camera View

Upon return to office, the survey team shall organize, transmit and back up all road information data they have collected from the field. Street view imageries will also be uploaded for processing. Before and parallel to the field works, road information such as road width, road length, sidewalk width, no. of lanes, start and end point coordinates of each road segment shall be generated using GIS techniques. In turn, this information shall be validated in the field works and street-view imageries.

[1] Mapillary is the platform that makes street-level images and map data available to scale and automate mapping. They use technology designed to blur any faces and license plates our algorithms detect within the imagery to help reduce privacy impact.

Source: JPT

Figure 3.2: Sample Image in the Mapillary

4 PROCESSING

4.1 Image Data Uploading into Mapillary

All data collected from the field will be stored in a database organized primarily by road class and then by road names. The geotag imageries, front and back photos, were stitched together to create a 360 image. PhotoKMLs were produced and plot out on the map to check the location of the images. Street-view imageries were processed using GoPro Fusion, GeoSetter and QGIS software and uploaded into Mapillary, a free web site where users can view their captured street-view imageries. In this site, encoders can rotate the imageries in 360 and will be able to zoom in and out. The encoders can also view the next road segment or go back to the previous section. The virtual drive-thru of the captured imageries will be guided by a parallel interactive map.

4.2 GIS Works (QGIS)

Parallel to the field works being conducted, GIS works has also commenced and involves generating measurements of the road data based on Google Earth imageries. Information generated from this activity are the total width, carriageway and sidewalk widths, length and median width of each road segments.

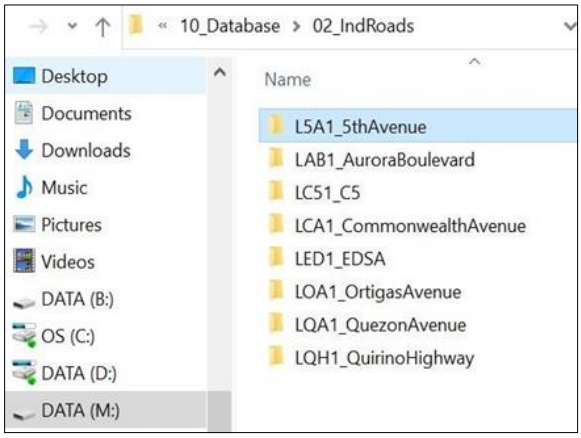
Location of road bridges were also researched and mapped in GIS based on existing bridge inventory from the Department of Public Works and Highways (DPWH).

4.3 Encoding Works (MS ACCESS)

Based on the survey data, encoding to input the collected data into electronic files using MS Access, wherein the outputs will be in forms, CSV and shape file formats. The encoding of data should be done accurately and in a timely manner and regular checks should be performed.

The survey covers information about the lanes, public transportation, road conditions, etc. that describe the overall physical characteristics of each road. The complete list of data items can be found in Annex A. The following steps describe how to fill out the data for each field, beginning with MS Access.

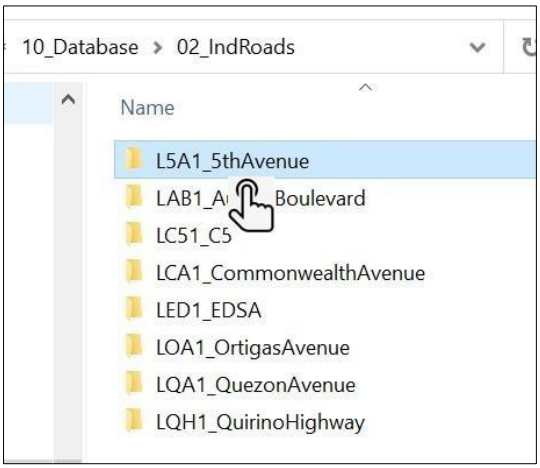
(a) Open windows explorer and go to 2022_MMRoadDB > 10_Database > 02_IndRoads and double-click on a particular road such as L5A1_5thAvenue.



Source: JPT

Figure 4.1: Folders per Road

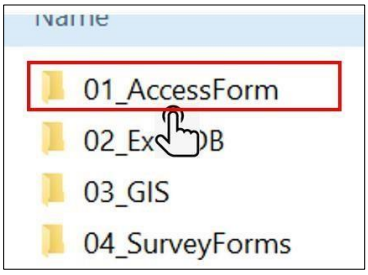
(b) Open windows explorer and go to 2022_MMRoadDB > 10_Database > 02_IndRoads and select a particular road such as L5A1_5thAvenue by double-clicking on the folder.



Source: JPT

Figure 4.2: Selecting the folder for a specific road (5th Avenue)

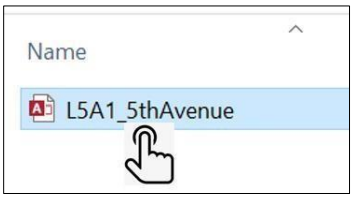
(c) Double-click on 01_AccessForms.



Source: JPT

Figure 4.3: Selecting the Folder Containing the MS Access files

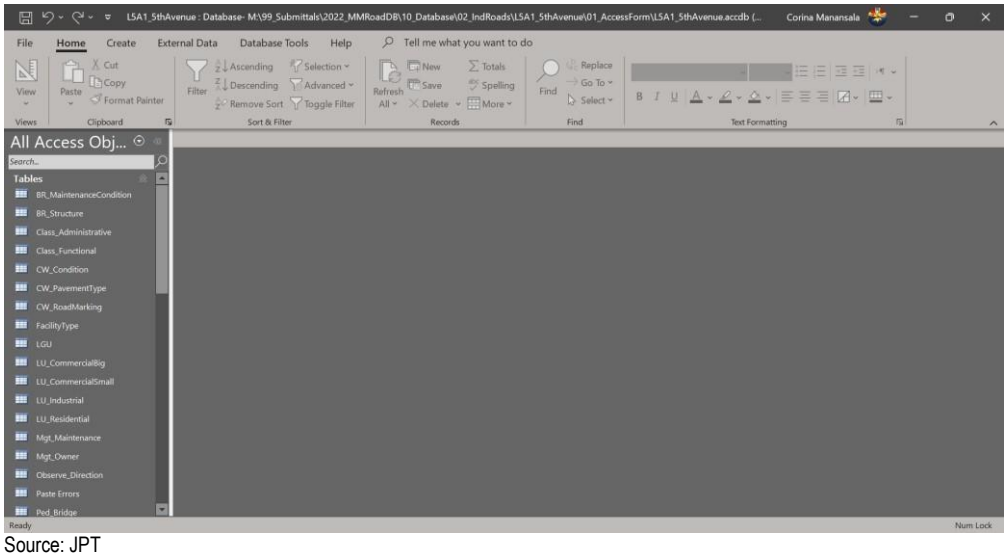
(d) Double-click on the Access file.



Source: JPT

Figure 4.4: Selecting the MS Access file for 5th Avenue

(e) The access file will open as shown below.



Source: JPT

Figure 4.5: MS Access Interface

(1) Understanding the Access Form

The Access Form got its design from the survey form and includes all the road and facilities attributes required for collection and inclusion in the inventory database. The form has several main sections starting with the Link Code and Road Name.

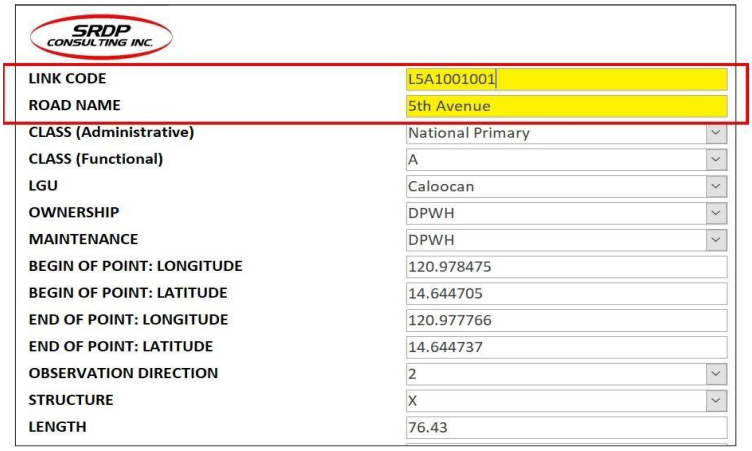
(2) Link Codes and Road Names

Unique link codes were assigned for each road sections (see Figure 4.1). Road names were also encoded in advance.

Table 4.1: Link Code Format

L	ED	1	001	001
Defined as **"Link"**	**Abbreviation of road name**, e.g. ËDSA became ED	**Road Class** 1=Class A 2=Class B 3=Class C 4=Class D	**Road Direction** 001 for Northbound ** this will apply for two-lane roads,* 002 for Southbound	**Unique segment number**

Source: JPT

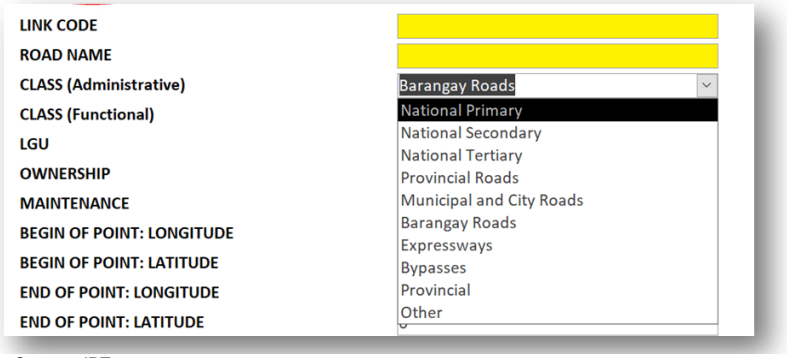


Source: JPT

Figure 4.6: Link Code and Road Name Fields

(3) Class Administrative and Class Functional

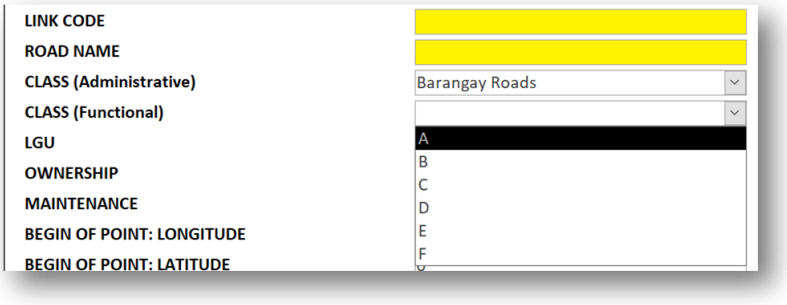
The Class Administrative field classify roads as either national primary, national secondary or national tertiary. This field was designed as a drop-down so that encoders can simply select the appropriate road classification.



Source: JPT

Figure 4.7: Class Administrative Field

The Class Functional field classify roads as either class A, B or C and corresponds to the Class Administrative field.



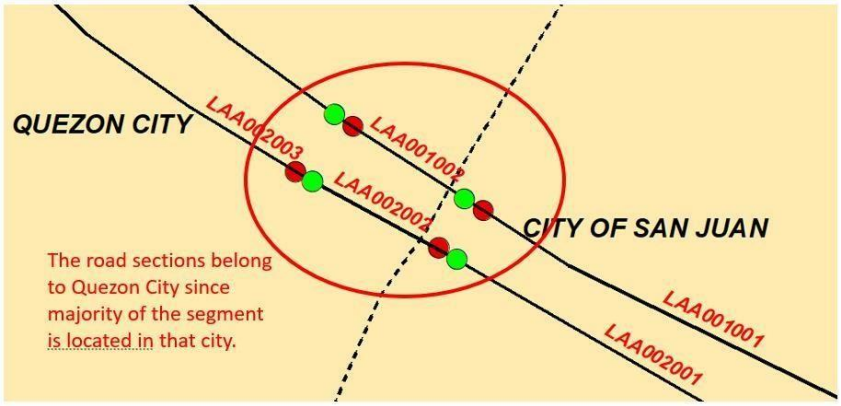
Source: JPT

Figure 4.8: Class Functional Field

(4) Location

The Location field shows to what city or municipality or province the road section is located. However, some road segments cross between locations or LGUs. To address this, a

condition was set such that, wherever the majority of the road segment is located, that is the LGU it corresponds to. Additional research regarding LGU borders may be necessary.



Source: JPT

Figure 4.9: Road Segments Crossing over Two LGUs

(5) Road Management Ownership and Maintenance

The Ownership and Maintenance field pertains to the government body responsible for a specific road.

Figure 4.10: Ownership and Maintenance Field

(6) Coordinates of beginning and end of a road segment

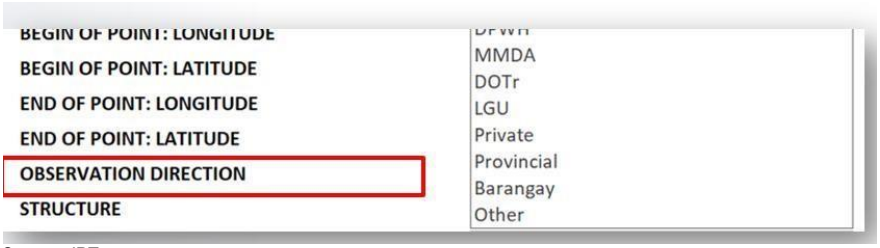
The access form also records the x,y coordinates of the beginning and end point of each road segment or in this case the longitude and latitude position. These values are generated using GIS and are already incorporated in the access form.

BEGIN OF POINT: LONGITUDE	120.978475
BEGIN OF POINT: LATITUDE	14.644705
END OF POINT: LONGITUDE	120.977766
END OF POINT: LATITUDE	14.644737

Figure 4.11: Coordinates Fields

(7) Observation Direction

The observation direction records how the validation team observed the road during field work. The options are either “1” in which observation was conducted from beginning to end of the road or “2” in which observation was conducted from end to beginning of the road segment.

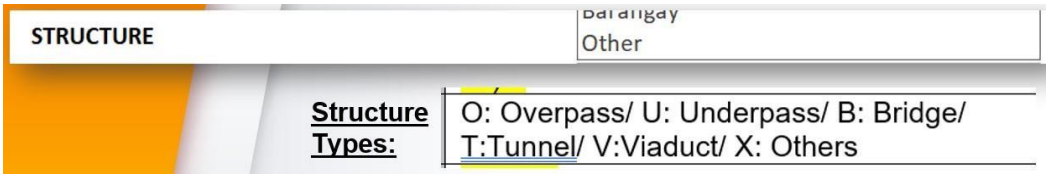


Source: JPT

Figure 4.12: Observation Direction Field

(8) Structure

Structure describes the road foundation. The field is a drop-down list and has six (6) options to choose from.



Source: JPT

Figure 4.13: Structure Field

Table 4.2: Structure Types and its Description

O : Overpass 	B : Bridge 
U : Underpass 	T : Tunnel 
V : Viaduct 	X : Others (leveled roads) 

Source: JPT

(9) Road Measurements

The road measurements section of the form has nine (9) fields. These values are generated using GIS and were already incorporated in the forms except for the number of lanes that needs verification using the streetview imageries.

Source: JPT

Figure 4.14: Road Measurement Fields

Source: JPT

Figure 4.15: Representation of each Road Parts

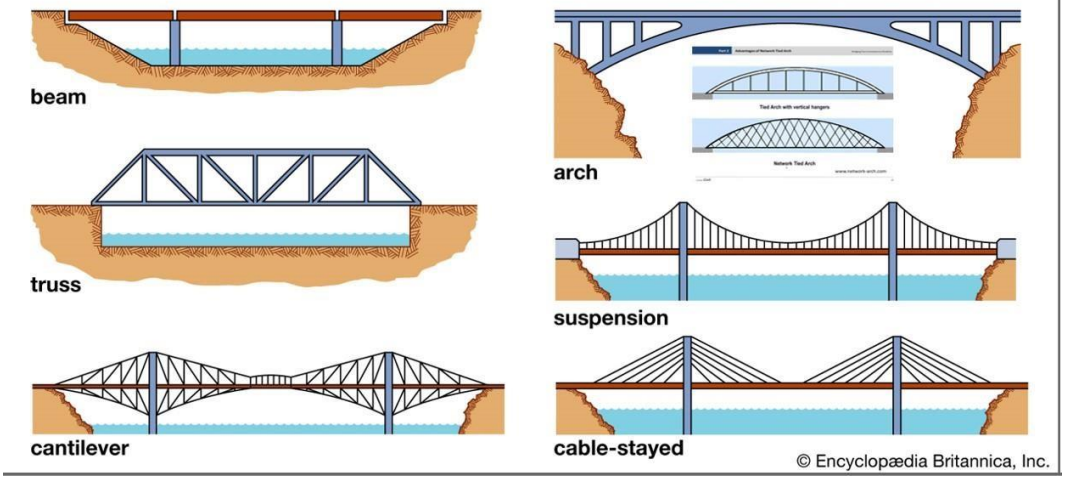
Another method is by complying with the standard DPWH lane widths on national roads that states one lane has a width of 3 meters. By multiplying this standard with the number of lanes observed will give you the carriageway width. However, this does not apply to certain junctions where road widths change due to variations in the number of lanes, starting point of overpasses or underpasses or where the road branches out to several segments.

Medians refer to the center islands and they require measuring based on available satellite imagery of the road, in addition verification in the field. This also applies to measuring sidewalks.

(10) Bridge Information

The bridge information section has six (6) fields starting with the Bridge Structure which is a drop-down with the following options.

Bridge	Structure	01 Beam, 02 Truss, 03 Cantilever, 04 Arch, 05 Tied Arch, 06 Suspension, 07 Cable-stayed, 99 Other.



Source: JPT

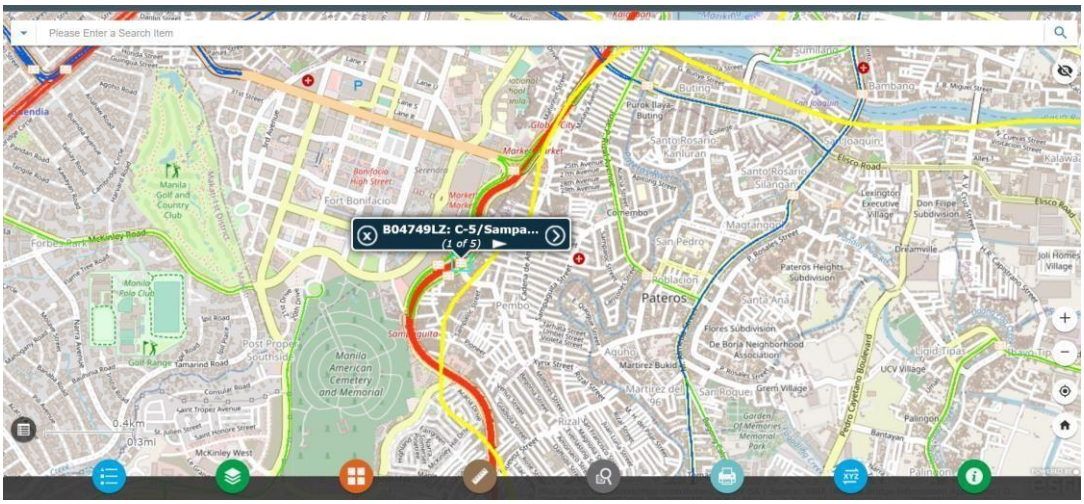
Figure 4.16: Bridge Structure Types

The year the bridge was constructed would require research if no information was found during field work. SRDP referred to the DPWH Roads and Bridges Information portal to find out the details on these fields.

BRIDGE YEAR CONSTRUCTED	0
BRIDGE LENGTH (m)	0
BRIDGE WIDTH (m)	0
BRIDGE WEIGHT LIMIT (Ton)	0

Source: JPT

Figure 4.17: Bridge Information



Source: JPT

Figure 4.18: DPWH Roads and Bridges Inventory Portal

The bridge weight limit is sometimes observe in the fieldwork and can be seen clearly on the streetview imageries.

Source: JPT

Figure 4.19: Bridge Weight Limit Signage

The same goes with the determination of the bridge maintenance condition which has three options: 1 for poor condition, 2 for acceptable and 3 for good condition. This field is a dropdown box and encoders only need to select the appropriate answer.

Factors were defined to determine the bridge maintenance condition.

Table 4.3: Bridge Maintenance Condition Factors

Bridge Maintenance Condition	Factor/s
1 for poor condition	Bridge is unpaved or under construction
	No road markings or signages No bridge railings Appearance seems dilapidated.
2 for acceptable condition	Bridge is paved but without road markings Signages are faded out or old Bridge railings are unpainted or seems old.
3 for good condition	Bridge is paved, well-constructed Have clear road markings and new signages Railings are painted and made of stronger material

Source: JPT

Source: JPT

Figure 4.20: Example of a Bridge in Good Condition

Source: JPT

Figure 4.21: Bridge with Acceptable Condition

(11) Railway Information

The railway information section has three (3) fields: Line, Structure and Station Name. All of the fields are in drop-down format in the access form.

Table 4.4: Railway Information Fields

Railway	Line	"LRT 1", "LRT 2", "MRT 3", "PNR"
	Structure	"Elevated", "At-grade", "Underground", "Other"
	Station Name	ex) Buendia

Source: JPT

The Railway Line field was observed during fieldwork. Another reference used was by looking at online maps such as OpenStreetMap or thru local knowledge of the encoders.

Source: JPT

Figure 4.22: OpenStreetMap Reference

The Railway Structure field has four options (elevated, at-grade, underground and other). This information were observed during field work and recorded on the street view imageries.

Source: JPT

Figure 4.23: Example of an At-grade Railway Structure

Source: JPT

Figure 4.24: Example of an Elevated Railway Structure

The Railway Station field were observed during field work and referenced with OpenStreetMap or other online maps.

Source: JPT

Figure 4.25: Ayala MRT Station

(12) Safety Facilities

The Safety Facilities section has six (6) fields: Pedestrian Crossing, Pedestrian Bridge, Underground Passage, Traffic Sign, Street Light and Street Tree.

Table 4.5: Safety Facilities fields

Safety Facilities	Pedestrian Crossing (Y: Yes/ N: No)	ex) Y
	Pedestrian Bridge (Y: Yes/ N: No)	ex) N
	Underground Passage (Y: Yes/ N: No)	ex) N
	Traffic Sign (Number)	ex) 2
	Street Light (Number)	ex) 3
	Street Tree (Y: Yes/ N: No)	ex) N

Source: JPT

Pedestrian Crossing pertains to road crossings marked on the roads. In the form, the field is a drop-down with only two options: Y for Yes and N for No.

Source: JPT

Figure 4.26: Example of a Pedestrian Crossing

Pedestrian Bridge are overpasses crossing the roads. In the form, the field is a drop-down with only two options: Y for Yes and N for No.

Source: JPT

Figure 4.27: Example of a Pedestrian Bridge

Underground passages are much harder to determine and may require local knowledge and field verification.

Source: JPT

Figure 4.28: Entry point of an Underground Passage

Traffic Sign pertains to the different signages found along the road. These signages have to be counted along a particular road segment.

Source: JPT

Figure 4.29: Example of Traffic Signages

Street Light are counted based on what was observed during fieldwork and reflected on the streetview imagery.

Source: JPT

Figure 4.30: Street Lights

The field Street Trees determined if there are trees along a particular road segment and is in Yes or No format.

Source: JPT

Figure 4.31: Street Trees along the Sidewalks

(13) Dedicated Traffic Lane

The Dedicated Traffic Lane section focuses on only three types of transport: bus, motorcycle and bicycle and requires the assigned number of lanes and lane width.

Table 4.6: Dedicated Traffic Lane Fields

Dedicated Traffic Lane	Bus Lane (Number)	ex) 1
	Bus Lane Width (m)	ex) 5.00
	Motorcycle Lane (Number)	ex) 1
	Motorcycle Lane Width (m)	ex) 2.00
	Bicycle Lane (Number)	ex) 1
	Bicycle Lane Width (m)	ex) 2.00

Source: JPT

Source: JPT

Figure 4.32: Example of Bus Lane

Source: JPT

Figure 4.33: Example of Motorcycle Lane

As before, the standard DPWH road widths are apply in measuring the road width of the assigned lane for buses and motorcycles. For bicycle lanes, these have to be measured physically in the field.

Source: JPT

Figure 4.34: Measuring the Bicycle Lane

U-turn slots are also included in the inventory. The numbe of lanes it covers and road widths are determined based on captured streetview imagery and physical measurements during field work.

Source: JPT

Figure 4.35: U-turn Slot

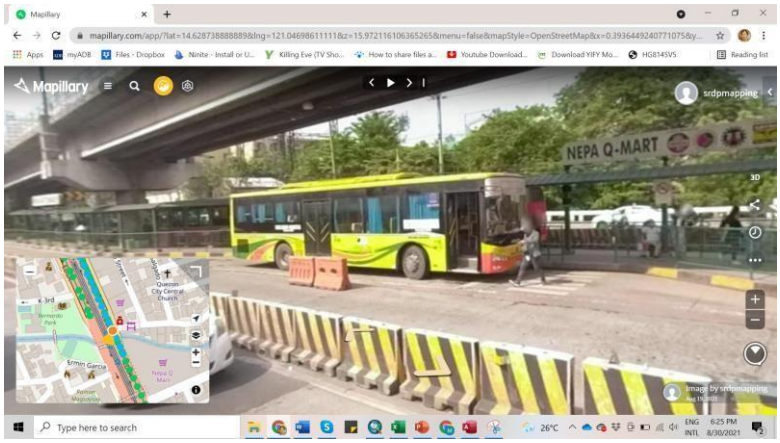
(14) Public Transport

The Public Transport section determines PUJ and PUB stops along a particular road segment. These were observed during field work and records both on-street and off-street stops. The team has to count the number of stops made by each transport type.

Table 4.7: Public Transport Fields

Public Transport	PUJ Stop (Number)	On-street	ex) 1
		Off-street	ex) 1
	PUB Stop (Number)	On-street	ex) 1
		Off-street	ex) 1

Source: JPT



Source: JPT

Figure 4.36: Screenshot of a PUB off-street stop

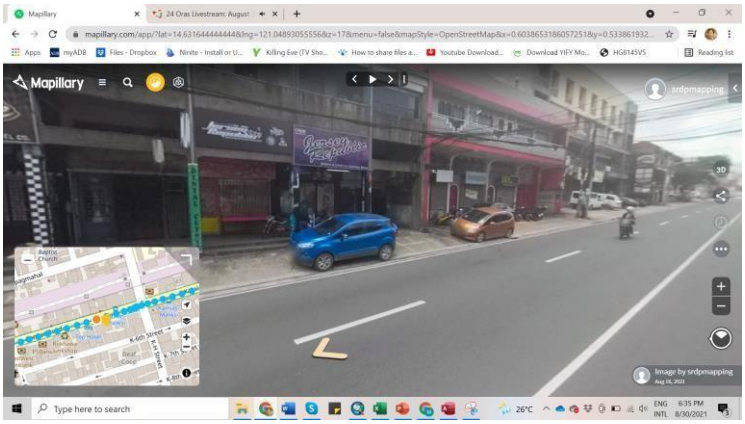
(15) Parking Facilities

In this section, there are two (2) fields: On-Street Parking Slot and Off-Street Parking Slot. Encoders have to record the number of parking spaces based on the streetview imagery. For Off-Street Parking Slot, aside from entering the number of parking spaces, the encoder has to enter that facility type that provides that parking.

Table 4.8: Parking Facilities Fields

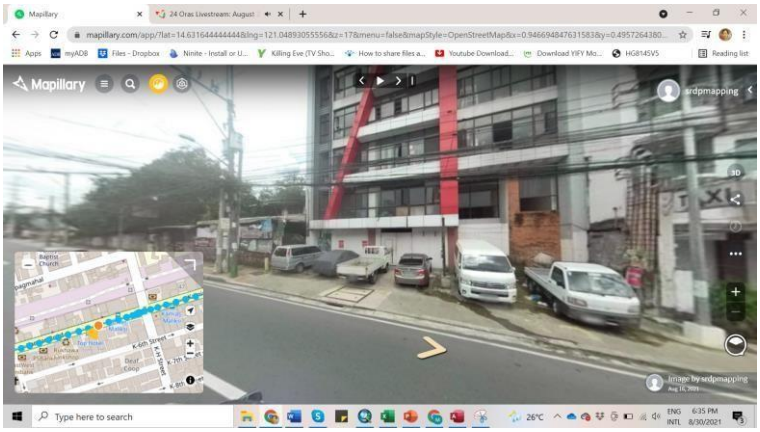
Parking Facilities	On-Street Parking Slot (Number)	Number of parking	ex) 1
	Off-Street Parking Slot provided by Bldg.	Number of parking	ex) 30
		Facility Type	"Residence", "Commercial Institution", "Office/Bank", "Factory/Warehouse", "School/University", "Park/Recreational", "Medical/Welfare", "Religious/Social", "Wholesale/Retail shop", "Restaurant/Entertainment", "Other"

Source: JPT



Source: JPT

Figure 4.37: On-Street Parking (Cars parked by the Sidewalk)



Source: JPT

Figure 4.38: Example of Off-Street Parking

For basement and building parking, the team had to conduct research and interview on-site to collect the number of parking slots.

(16) Traffic Regulation

The Traffic Regulations section has six (6) fields pertaining to enforcement of traffic rules in each road.

Table 4.9: Traffic Regulations Fields

Traffic Regulation (if yes, please indicate time)	Speed Limit (km/ h)	ex) 40
	One-Way (N: No, if Yes, AM/PM Hour should be described)	ex) 6AM–9PM
	Prohibition (N: No, if Yes, AM/PM Hour should be described)	ex) N
	Truck Ban (N: No, if Yes, AM/PM Hour should be described)	ex) 6AM–9PM
	Parking Prohibition (N: No, if Yes, AM/PM Hour should be described)	ex) N
	Load/ Unload Prohibition (N: No, if Yes, AM/PM Hour should be describe)	ex) 6AM–9PM

Source: JPT

Except for the Speed Limit, all the fields are answerable by either Yes or No with the time of enforcement included.

(17) Road Maintenance

The Road Maintenance section deals with the pavement type and condition of the carriageway and sidewalk with all the fields in drop-down format. Some factors were put into place to determine if the sidewalk and pavement condition are poor, acceptable or good.

Table 4.10: Road Maintenance Fields

Road Maintenance	Sidewalk	Pavement Type	A: Asphalt, C: Cement/Concrete, G: Ground
		Condition	ex) 1: poor 2: acceptable 3: good
	Carriageway	Pavement Type	A: Asphalt, C: Cement/Concrete, G: Ground
		Condition	ex) 1: poor 2: acceptable 3: good
		Road Marking	ex) 1: poor 2: acceptable 3: good

Source: JPT

Table 4.11: Sidewalk Condition

Sidewalk Condition	Criteria
Good	1. The sidewalk is leveled and concrete 2. No obstructions. 3. No potholes 4. Clearly marked or painted 5. Width is 2meters or wider
Acceptable	1. Sidewalk slope slightly changes and is made of concrete. 2. Minimal obstructions 3. Some potholes 4. Faded markings 5. Width is 1.5 to 2 meters
Poor	1. Sidewalk slope changes drastically 2. Not made of concrete 3. Lots of potholes 4. No markings or paint 5. Width is smaller than 1.5 meters

Source: JPT

Table 4.12: Pavement Condition

Pavement Condition	Criteria
Good	1. Pavement is made of asphalt or concrete 2. Clearly marked 3. No potholes
Acceptable	1. Pavement is made of asphalt or concrete 2. Faded road markings 3. Some potholes
Poor	1. Pavement is bare ground or soil 2. No road markings 3. Lots of potholes 4. Under construction

Source: JPT

Source: JPT

Figure 4.39: Example of a Good Pavement Condition

(18) Roadside Land Use

This section pertains to the land or building use surrounding a particular road segment and is answerable by yes or no.

Table 4.13: Roadside Land Use Fields

	Road Marking	ex) Y: poor
Roadside Land Use	Commercial (roadside shop or small) (Y: Yes/ N: No)	ex) Y
	Commercial (medium or shopping mall) (Y: Yes/ N: No)	ex) N
	Industrial (Y: Yes/ N: No)	ex) Y
	Residential (Y: Yes/ N: No)	ex) Y

Source: JPT

Table 4.14: Criteria of Commercial

Commercial Size	Criteria
Small	1. Roadside shop 2. Local commercial establishments such as eatery, laundry, small convenient store, car wash, etc. 3. Typically, the commercial shop is situated at the ground level of a residential building.
Medium	1. Shopping malls 2. Commercial establishment is situated at the ground level of a condominium or corporate building. 3. Gasoline stations 4. Popular fastfood or fine dining restaurants

Source: JPT

4.4 Accessing the Mapillary Website

The satellite images collected throughout the survey were stored in the Mapillary website, which can be accessed via www.mapillary.com. Click “explore map data”, zoom in to Metro Manila, and navigate to the desired area. Since it is an open-source website, inputs that are not from SRDP, under the username srdpmapping, should be filtered out.

Source: JPT

Figure 4.1: Sample Street View Imagery from Mapillary

ANNEX A: Data Items

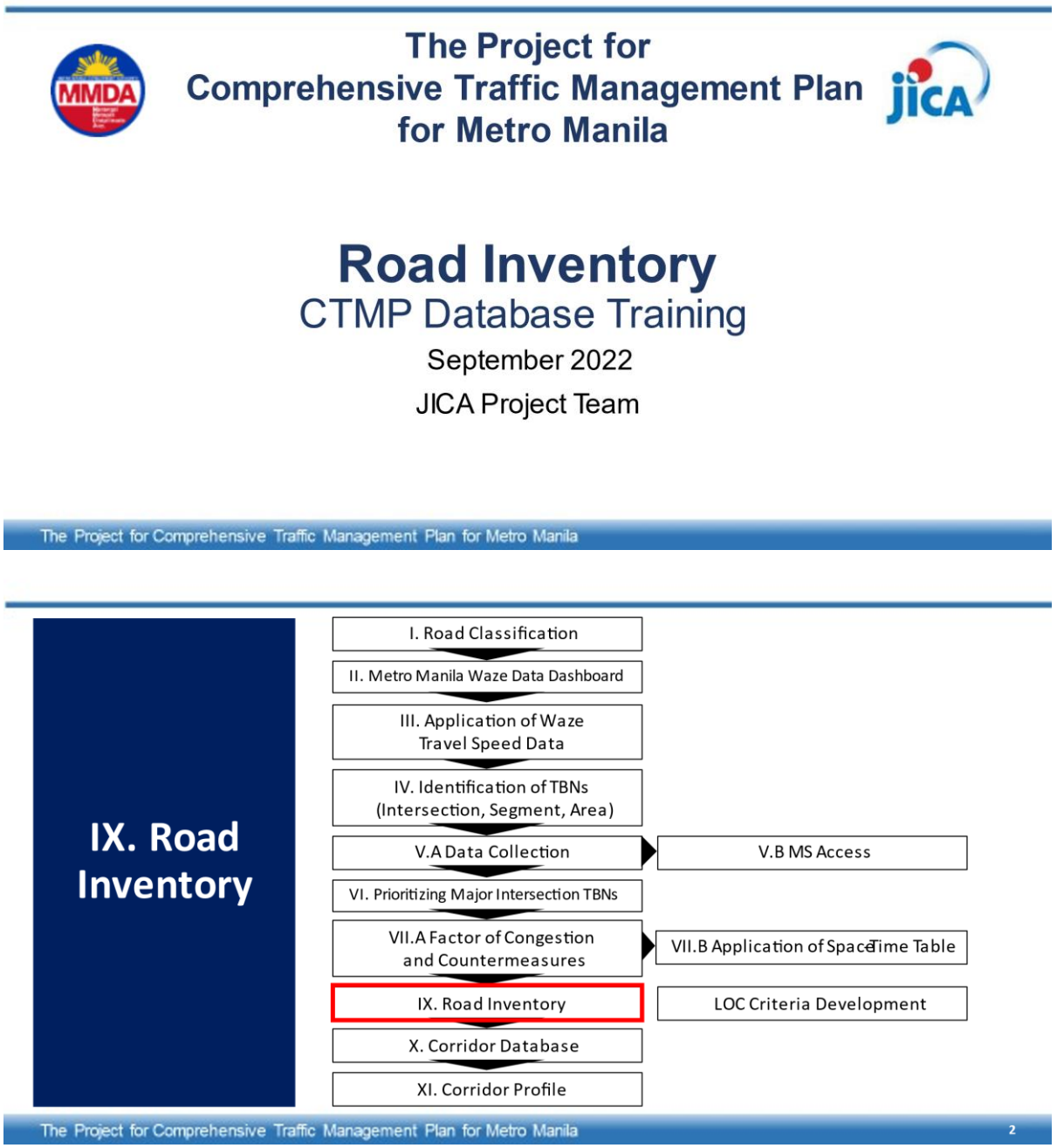
Data items				Data input	Data format
Link Code				ex) LA001	String (10 digits)
Class (Administrative)				"National Primary", "National Secondary", "National Tertiary", "Provincial Roads", "Municipal and City Roads", "Barangay Roads", "Expressways", "Bypasses", "Provincial", "Other"	String (30 digits)
Class (Functional)				ex) A: Class A, B: Class B, C: Class C. D: Class D, E: Class E, F: Other	String (1 digits)
Location	LGU (Metro Manila)/ Province Name			"Manila", "Pasay", "Makati", "Taguig", "Mandaluyong", "San Juan", "Quezon", "Caloocan", "Valenzuela", "Malabon", "Navotas", "Marikina", "Pasig", "Pateros", "Paranaque", "Muntinlupa", "Las Pinas", "Bulacan", "Cavite", "Laguna", "Rizal", "Other",	String (15 digits)
Road management	Ownership			"MMDA", "DPWH", "LGU","DOTr", "Private", "Provincial", "Barangay", "Other"	String (10 digits)
	Maintenance			"MMDA", "DPWH", "LGU","DOTr", "Private", "Provincial", "Barangay", "Other"	String (10 digits)
Coordinates		Beginning	Longitude	ex) 14.562519	
			Latitude	ex) 121.043057	
		End	Longitude	ex) 14.563837	
			Latitude	ex) 121.044271	
Observation Direction (1: Begin->End, 2: End->Begin)				ex) 1	Integer (1 digits)
Structure				O: Overpass/ U: Underpass/ B: Bridge/ T:Tunnel/ V:Viaduct/ X: Others	String (1 digits)
Length (m)				ex) 500	Integer (10 digits)
Carriageway	Total Width (m)			ex) 30.00	Real (6 digits and the 2nd decimal places)
	Sidewalk Width (1st direction) (m)			ex) 2.50	Real (6 digits and the 2nd decimal places)
	Carriageway Width (1st direction) (m)			ex) 10.00	Real (6 digits and the 2nd decimal places)
	Number of lane (1st direction)			ex) 2	Integer (2 digits)

Data items		Data input	Data format
Carriageway	Median (m)	ex) 5.00	Real (6 digits and the 2nd decimal places)
	Carriageway Width (2nd opposite direction) (m)	ex) 10	Real (the 2nd decimal places)
	Number of lane (2nd opposite direction)	ex) 2	Integer (2 digits)
	Sidewalk Width (2nd opposite direction) (m)	ex) 2.50	Real (6 digits and the 2nd decimal places)
Bridge	Structure	01 Beam, 02 Truss, 03 Cantilever, 04 Arch, 05 Tied Arch, 06 Suspension, 07 Cable-stayed, 99 Other.	String (2 digits)
	Year constructed	ex) 2000	Integer (4 digits)
	Length (m)	ex) 100	Integer (5 digits)
	Width (m)	ex) 3.50	Real (6 digits and the 2nd decimal places)
	Weight Limit (ton)	ex) 20.5	Real (6 digits and the 1nd decimal places)
	Maintenance Condition	ex) 1: poor 2: acceptable 3: good	Integer (1 digits)
Railway	Line	“LRT 1”, “LRT 2”, “MRT 3”, “PNR”	String (15 digits)
	Structure	“Elevated”, “At-grade”, “Underground”, “Other”	String (15 digits)
	Station Name	ex) Buendia	String (15 digits)
Safety facilities	Pedestrian Crossing (Y: Yes/ N: No)	ex) Y	String (1 digits)
	Pedestrian Bridge (Y: Yes/ N: No)	ex) N	String (1 digits)
	Underground Passage (Y: Yes/ N: No)	ex) N	String (1 digits)
	Traffic Sign (Number)	ex) 2	Integer (3 digits)
	Street Light (Number)	ex) 3	Integer (3 digits)
	Street Tree (Y: Yes/ N: No)	ex) N	String (1 digits)

Data items			Data input	Data format
Dedicated traffic lane	Bus Lane (Number)		ex) 1	Integer (2 digits)
	Bus Lane Width (m)		ex) 5.00	Real (6 digits and the 2nd decimal places)
	Motorcycle Lane (Number)		ex) 1	Integer (2 digits)
	Motorcycle Lane Width (m)		ex) 2.00	Real (6 digits and the 2nd decimal places)
	Bicycle Lane (Number)		ex) 1	Integer (2 digits)
	Bicycle Lane Width (m)		ex) 2.00	Real (6 digits and the 2nd decimal places)
	Number of Lane of U-turn Slot (Number)		ex) 1	Integer (2 digits)
	Length of U-turn Slot (m)		ex) 25.00	Real (6 digits and the 2nd decimal places)
Public transport	PUJ Stop (Number)	On-street	ex) 1	Integer (2 digits)
		Off-street	ex) 1	Integer (2 digits)
	PUB Stop (Number)	On-street	ex) 1	Integer (2 digits)
		Off-street	ex) 1	Integer (2 digits)
Parking facilites	On-Street Parking Slot (Number)	Number of parking	ex) 1	Integer (4 digits)
		Number of parking	ex) 30	Integer (4 digits)
		Facility Type	"Residence", "Commercial Institution", "Office/Bank", "Factory/Warehouse", "School/University", "Park/Recreational", "Medical/Welfare", "Religious/Social", "Wholesale/Retail shop", "Restaurant/Entertainment", “Other”	String (25 digits)

Data items			Data input	Data format
Traffic regulation (if yes, indicate the time)	Speed Limit (km/ h)		ex) 40	Integer (3 digits)
	One-Way (N: No, if Yes, AM/PM Hour should be described)		ex) 6AM–9PM	String (9 digits)
	Prohibition (N: No, if Yes, AM/PM Hour should be described)		ex) N	String (9 digits)
	Truck Ban (N: No, if Yes, AM/PM Hour should be described)		ex) 6AM–9PM	String (9 digits)
	Parking Prohibition (N: No, if Yes, AM/PM Hour should be described)		ex) N	String (9 digits)
	Load/ Unload Prohibition (N: No, if Yes, AM/PM Hour should be described)		ex) 6AM–9PM	String (9 digits)
Road maintenance	Sidewalk	Pavement Type	A: Asphalt, C: Cement/Concrete, G: Ground	String (1 digits)
		Condition	ex) 1: poor 2: acceptable 3: good	Integer (1 digits)
	Carriageway	Pavement Type	A: Asphalt, C: Cement/Concrete, G: Ground	String (10 digits)
		Condition	ex) 1: poor 2: acceptable 3: good	Integer (1 digits)
		Road Marking	ex) 1: poor 2: acceptable 3: good	Integer (1 digits)
Roadside land use	Commercial (roadside shop or small) (Y: Yes/ N: No)		ex) Y	String (1 digits)
	Commercial (medium or shopping mall) (Y: Yes/ N: No)		ex) N	String (1 digits)
	Industrial (Y: Yes/ N: No)		ex) Y	String (1 digits)
	Residential (Y: Yes/ N: No)		ex) Y	String (1 digits)

APPENDIX B: Training Presentation Slides



IX. ROAD INVENTORY

OUTLINE

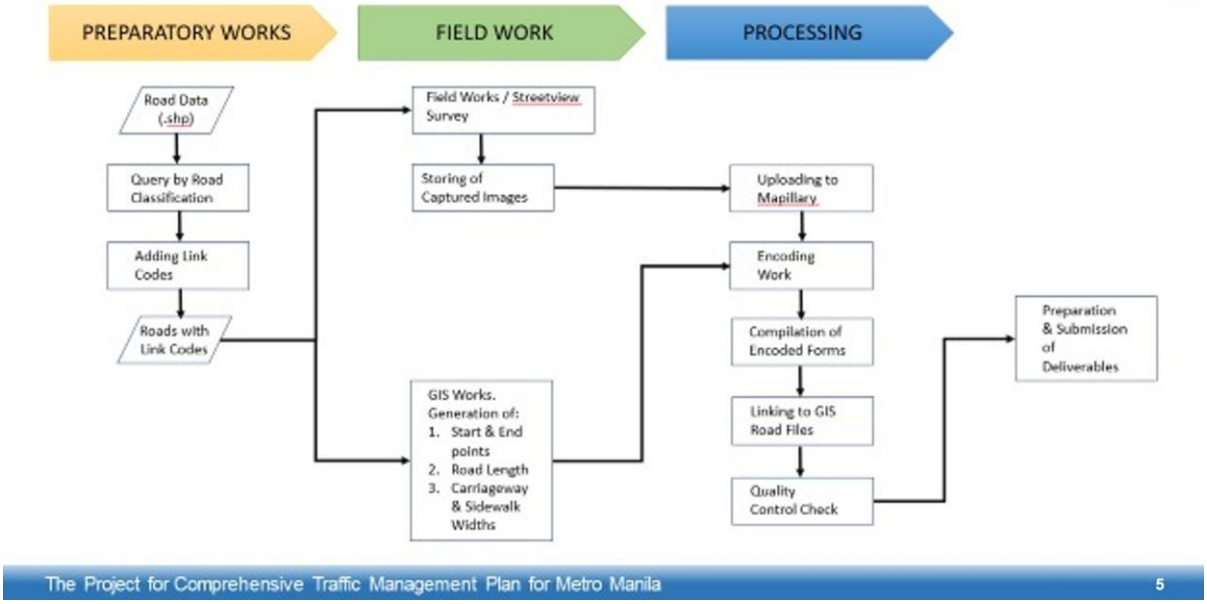
1. Project Objective
2. Workflow
3. Methodology
4. Visualizing Road Inventory Data using GIS
5. Visualizing Road Inventory Data using Google Street View/ Mapillary

1. PROJECT OBJECTIVES

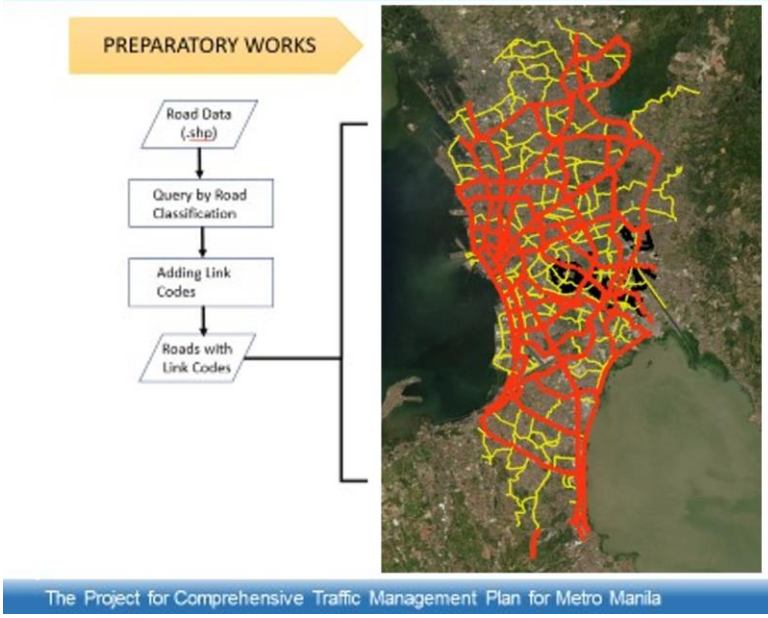
Project Objective

Collect the information on th e current conditions of road infrastructure and facilities on the roads.

2. WORK FLOW



PREPARATORY WORKS



Filtering / Selecting Road Class A& B for the whole Metro Manila.

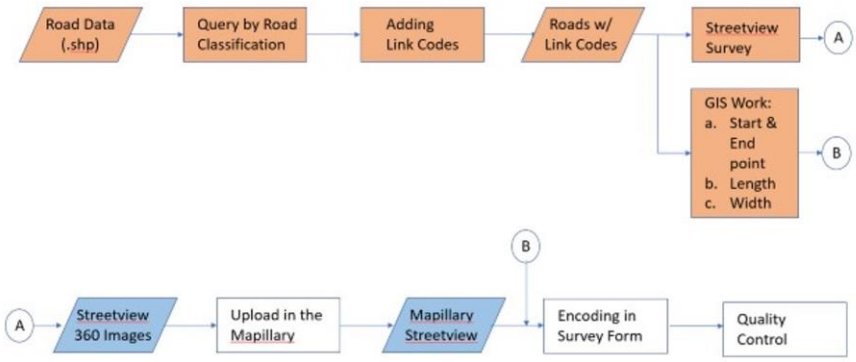
Filtering / Selecting Road Class C in Pasig City and Mandaluyong City

PREPARATORY WORKS

Assigning LINKCODES for each Road Segments

L	ED	1	001	001
Defined as **"Link"**	**Abbreviation of road name**, e.g. ËDSA became ED	**Road Class** 1=Class A 2=Class B 3=Class C	**Road Direction** 001 for Northbound **for two-lane roads, this will apply* 002 for Southbound	**Unique segment number**

PREPARATORY WORKS



3. LIST OF DATAITEMS

Basic Information:
- Link ID
- Administrative road class
- Functional road class
- LGU location
- Ownership
- Maintenance

Coordinates of the start and end point of each link

Width and lane information (d1)

Data items				Data input	Data format
Link Code				ex) LA001	String (10 digits)
Class (Administrative)				"National Primary", "National Secondary", "National Tertiary", "Provincial Roads", "Municipal and City Roads", "Barangay Roads", "Expressways", "Bypasses", "Provincial", "Other"	String (30 digits)
Class (Functional)				ex) A: Class A, B: Class B, C: Class C, D: Class D, E: Class E, F: Other	String (1 digits)
Location	LGU (Metro Manila)/ Province Name			"Manila", "Pasay", "Makati", "Taguig", "Mandaluyong", "San Juan", "Quezon", "Caloocan", "Valenzuela", "Malabon", "Navotas", "Marikina", "Pasig", "Pateros", "Paranaque", "Muntinlupa", "Las Pinas", "Bulacan", "Cavite", "Laguna", "Rizal", "Other",	String (15 digits)
	Ownership			"MMDA", "DPWH", "LGU","DOTr", "Private", "Provincial", "Barangay", "Other"	String (10 digits)
	Maintenance			"MMDA", "DPWH", "LGU","DOTr", "Private", "Provincial", "Barangay", "Other"	String (10 digits)
		Start point	Longitude	ex) 14.562519	
			Latitude	ex) 121.043057	
		End point	Longitude	ex) 14.563837	
			Latitude	ex) 121.044271	
Observation Direction (1: Begin->End, 2: End->Begin)				ex) 1	Integer (1 digits)
Structure				O: Overpass/ U: Underpass/ B: Bridge/ T:Tunnel/ V:Viaduct/ X: Others	String (1 digits)
Length (m)				ex) 500	Integer (10 digits)
	Total Width (m)			ex) 30.00	Real (6 digits and the 2nd decimal places)
	Sidewalk Width (1st direction) (m)			ex) 2.50	Real (6 digits and the 2nd decimal places)
	Carriageway Width (1st direction) (m)			ex) 10.00	Real (6 digits and the 2nd decimal places)
	Number of lane (1st direction)			ex) 2	Integer (2 digits)

3. LIST OF DATAITEMS

Width and lane information (d2)

Bridge information

Railway information

Pedestrian facilities

Dedicated lanes

Data items		Data input	Data format
	Median (m)	ex) 5.00	Real (6 digits and the 2nd decimal places)
	Carriageway Width (2nd opposite direction) (m)	ex) 10	Real (the 2nd decimal places)
	Number of lane (2nd opposite direction)	ex) 2	Integer (2 digits)
	Sidewalk Width (2nd opposite direction) (m)	ex) 2.50	Real (6 digits and the 2nd decimal places)
	Structure	01 Beam, 02 Truss, 03 Cantilever, 04 Arch, 05 Tied Arch, 06 Suspension, 07 Cable-stayed, 99 Other.	String (2 digits)
	Year constructed	ex) 2000	Integer (4 digits)
	Length (m)	ex) 100	Integer (5 digits)
	Width (m)	ex) 3.50	Real (6 digits and the 2nd decimal places)
	Weight Limit (ton)	ex) 20.5	Real (6 digits and the 1nd decimal places)
	Maintenance Condition	ex) 1: poor 2: acceptable 3: good	Integer (1 digits)
	Line	"LRT 1", "LRT 2", "MRT 3", "PNR"	String (15 digits)
	Structure	"Elevated", "At-grade", "Underground", "Other"	String (15 digits)
	Station Name	ex) Buendia	String (15 digits)
	Pedestrian Crossing (Y: Yes/ N: No)	ex) Y	String (1 digits)
	Pedestrian Bridge (Y: Yes/ N: No)	ex) N	String (1 digits)
	Underground Passage (Y: Yes/ N: No)	ex) N	String (1 digits)
	Traffic Sign (Number)	ex) 2	Integer (3 digits)
	Street Light (Number)	ex) 3	Integer (3 digits)
	Street Tree (Y: Yes/ N: No)	ex) N	String (1 digits)
	Bus Lane (Number)	ex) 1	Integer (2 digits)
	Bus Lane Width (m)	ex) 5.00	Real (6 digits and the 2nd decimal places)
	Motorcycle Lane (Number)	ex) 1	Integer (2 digits)
	Motorcycle Lane Width (m)	ex) 2.00	Real (6 digits and the 2nd decimal places)
	Bicycle Lane (Number)	ex) 1	Integer (2 digits)
	Bicycle Lane Width (m)	ex) 2.00	Real (6 digits and the 2nd decimal places)
	Number of Lane of U-turn Slot (Number)	ex) 1	Integer (2 digits)

3. LIST OF DATAITEMS

PT stops

Parking

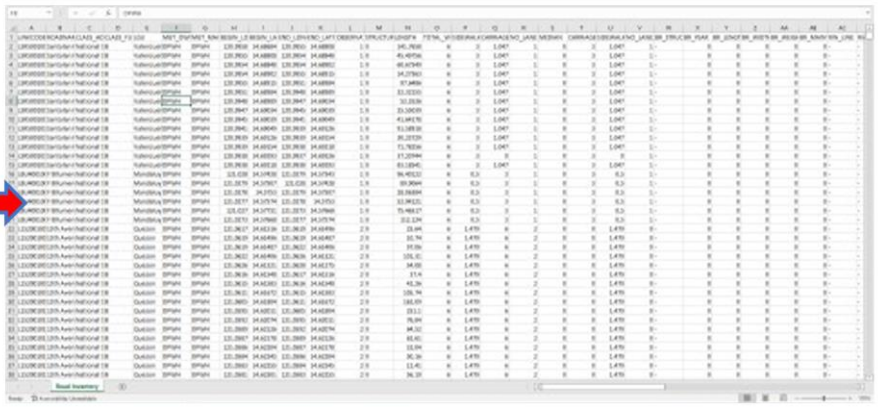
Policies and regulations

Conditions

Data items			Data input	Data format
	Length of U-turn Slot (m)		ex) 25.00	Real (6 digits and the 2nd decimal places)
	PUJ Stop	On-street	ex) 1	Integer (2 digits)
		Off-street	ex) 1	Integer (2 digits)
	PUB Stop	On-street	ex) 1	Integer (2 digits)
		Off-street	ex) 1	Integer (2 digits)
	On-Street Parking Slot (Number)	Number of parking	ex) 1	Integer (4 digits)
		Number of parking	ex) 30	Integer (4 digits)
		Facility Type	"Residence", "Commercial Institution", "Office/Bank", "Factory/Warehouse", "School/University", "Park/Recreational", "Medical/Welfare", "Religious/Social", "Wholesale/Retail shop", "Restaurant/Entertainment", "Other"	String (25 digits)
	Speed Limit (km/ h)		ex) 40	Integer (3 digits)
	One-Way (N: No, if Yes, AM/PM Hour should be described)		ex) 6AM–9PM	String (9 digits)
	Prohibition (N: No, if Yes, AM/PM Hour should be described)		ex) N	String (9 digits)
	Truck Ban (N: No, if Yes, AM/PM Hour should be described)		ex) 6AM–9PM	String (9 digits)
	Parking Prohibition (N: No, if Yes, AM/PM Hour should be described)		ex) N	String (9 digits)
	Load/ Unload Prohibition (N: No, if Yes, AM/PM Hour should be describe)		ex) 6AM–9PM	String (9 digits)
	Sidewalk	Pavement Type	A: Asphalt, C: Cement/Concrete, G: Ground	String (1 digits)
		Condition	ex) 1: poor 2: acceptable 3: good	Integer (1 digits)
	Road	Pavement Type	A: Asphalt, C: Cement/Concrete, G: Ground	String (10 digits)
		Condition	ex) 1: poor 2: acceptable 3: good	Integer (1 digits)
		Road Marking	ex) 1: poor 2: acceptable 3: good	Integer (1 digits)
	Commercial (roadside shop or small) (Y: Yes/ N: No)		ex) Y	String (1 digits)
	Commercial (medium or shopping mall) (Y: Yes/ N: No)		ex) N	String (1 digits)
	Industrial (Y: Yes/ N: No)		ex) Y	String (1 digits)
	Residential (Y: Yes/ N: No)		ex) Y	String (1 digits)

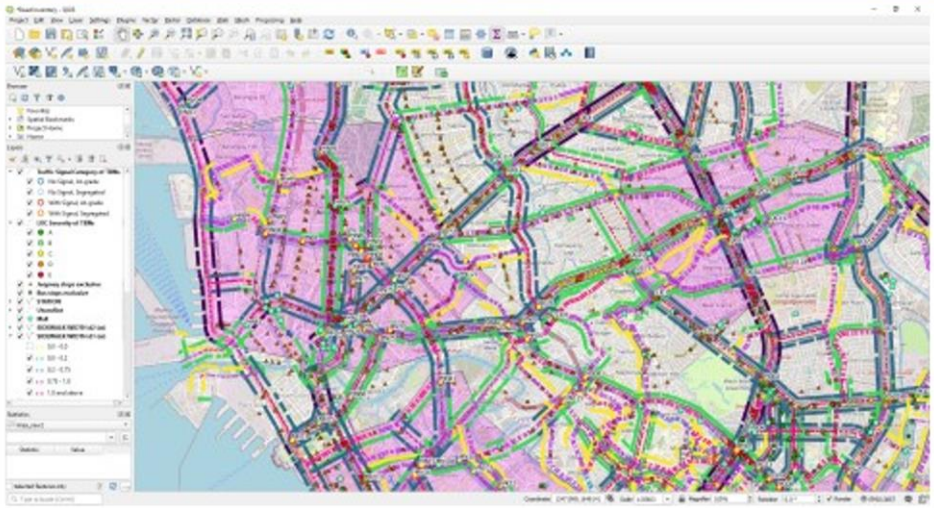
3. LIST OF DATAITEMS

List of Data Items



CSV files can be opened in MS Excel. The spreadsheet contains the road inventory data and corresponds to the list of data items.

4. VISUALIZING ROAD INVENTORY DATA USING GIS



The CSV file can be imported into the GIS software. Styles can be applied to help visualize the situation This will be discussed in detail during the Corridor Database session

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Structure Types:

O – overpass	B – bridge	V – viaduct
U – underpass	T – tunnel	X - others

O: Overpass

B: Bridge

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

U: Underpass

T: Tunnel

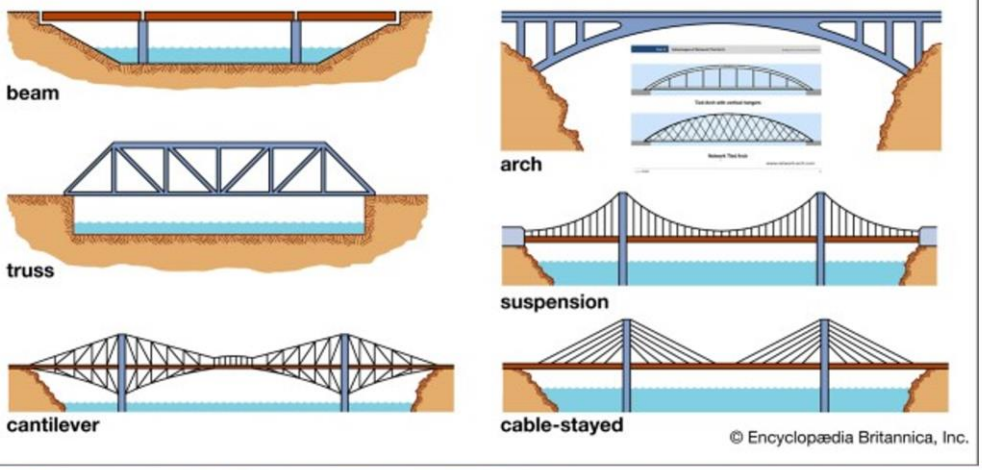
5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

V: Viaduct

X: Others

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Bridge	Structure	01 Beam, 02 Truss, 03 Cantilever, 04 Arch, 05 Tied Arch, 06 Suspension, 07 Cable-stayed, 99 Other.



The Project for Comprehensive Traffic Management Plan for Metro Manila 17

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

The Project for Comprehensive Traffic Management Plan for Metro Manila 18

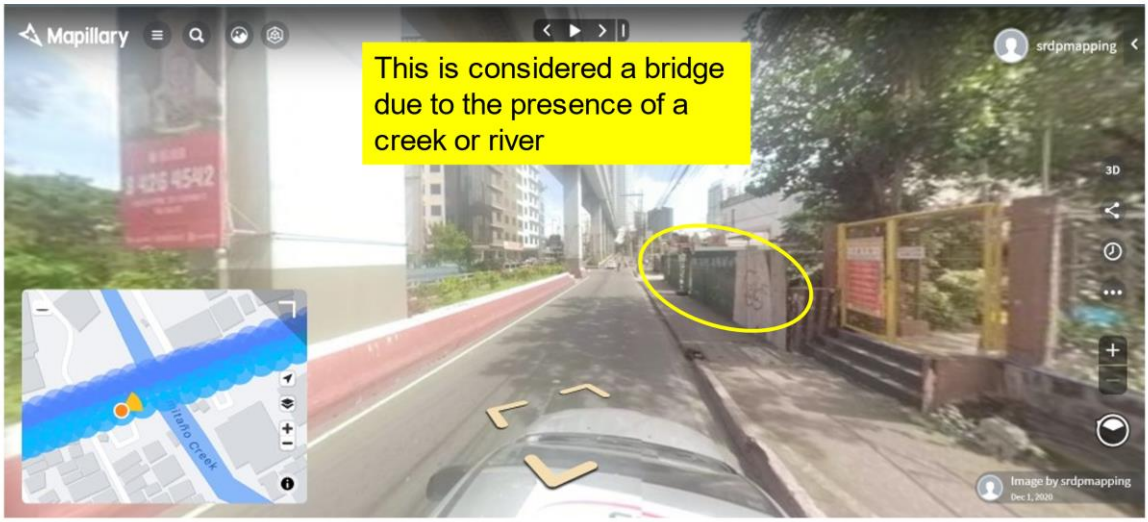
5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Maintenance Condition:

ex) 1 – poor; 2 – acceptable; 3 – good

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY



The Project for Comprehensive Traffic Management Plan for Metro Manila 21

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

The Project for Comprehensive Traffic Management Plan for Metro Manila 22

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Railway	Line	"LRT 1", "LRT 2", "MRT 3", "PNR"
	Structure	"Elevated", "At-grade", "Underground', "Other"
	Station Name	ex) Buendia

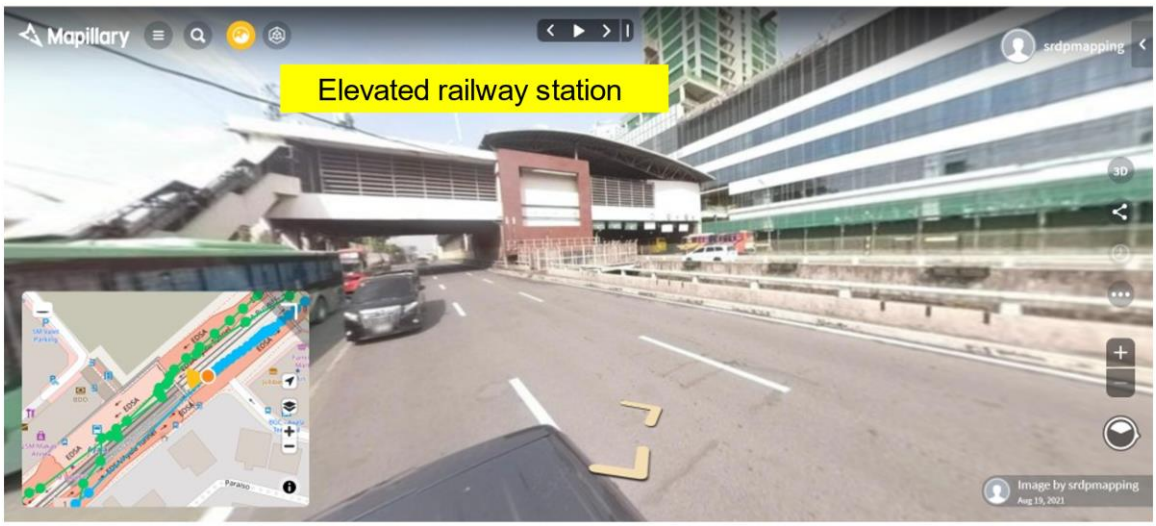
5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Railway	Line	"LRT 1", "LRT 2", "MRT 3", "PNR"
	Structure	"Elevated", "At-grade", "Underground', "Other"
	Station Name	ex) Buendia

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

The Project for Comprehensive Traffic Management Plan for Metro Manila 25

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY



The Project for Comprehensive Traffic Management Plan for Metro Manila 26

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Safety Facilities	Pedestrian Crossing (Y: Yes/N: No)	ex) Y
	Pedestrian Bridge (Y: Yes/N: No)	ex) N
	Underground Passage (Y: Yes/N: No)	ex) N
	Traffic Sign (Number)	ex) 2
	Streetlight (Number)	ex) 3
	Street Tree (Y: Yes/N: No)	ex) N


5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Safety Facilities	Pedestrian Crossing (Y: Yes/N: No)	ex) Y
	Pedestrian Bridge (Y: Yes/N: No)	ex) N
	Underground Passage (Y: Yes/N: No)	ex) N
	Traffic Sign (Number)	ex) 2
	Streetlight (Number)	ex) 3
	Street Tree (Y: Yes/N: No)	ex) N


5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Safety Facilities	Pedestrian Crossing (Y: Yes/N: No)	ex) Y
	Pedestrian Bridge (Y: Yes/N: No)	ex) N
	Underground Passage (Y: Yes/N: No)	ex) N
	Traffic Sign (Number)	ex) 2
	Streetlight (Number)	ex) 3
	Street Tree (Y: Yes/N: No)	ex) N

The Project for Comprehensive Traffic Management Plan for Metro Manila 29

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Safety Facilities	Pedestrian Crossing (Y: Yes/N: No)	ex) Y
	Pedestrian Bridge (Y: Yes/N: No)	ex) N
	Underground Passage (Y: Yes/N: No)	ex) N
	Traffic Sign (Number)	ex) 2
	Streetlight (Number)	ex) 3
	Street Tree (Y: Yes/N: No)	ex) N

The Project for Comprehensive Traffic Management Plan for Metro Manila 30

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Safety Facilities	Pedestrian Crossing (Y: Yes/N: No)	ex) Y
	Pedestrian Bridge (Y: Yes/N: No)	ex) N
	Underground Passage (Y: Yes/N: No)	ex) N
	Traffic Sign (Number)	ex) 2
	Streetlight (Number)	ex) 3
	Street Tree (Y: Yes/N: No)	ex) N

The Project for Comprehensive Traffic Management Plan for Metro Manila 31

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Dedicated Traffic Lane	Bus Lane (Number)	ex) 1
	Bus Lane Width (m)	ex) 5.00
	Motorcycle Lane (Number)	ex) 1
	Motorcycle Lane Width (m)	ex) 2.00
	Bicycle Lane (Number)	ex) 1
	Bicycle Lane Width (m)	ex) 2.00

The Project for Comprehensive Traffic Management Plan for Metro Manila 32

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

The Project for Comprehensive Traffic Management Plan for Metro Manila 33

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Number of Lane of U-turn Slot (Number)	ex) 1
Length of U-turn Slot (m)	ex) 25.00

The Project for Comprehensive Traffic Management Plan for Metro Manila 34

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

PUJ Stop (Number)	On-street	ex) 1
	Off-street	ex) 1
PUB Stop (Number)	On-street	ex) 1
	Off-street	ex) 1

The Project for Comprehensive Traffic Management Plan for Metro Manila 35

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

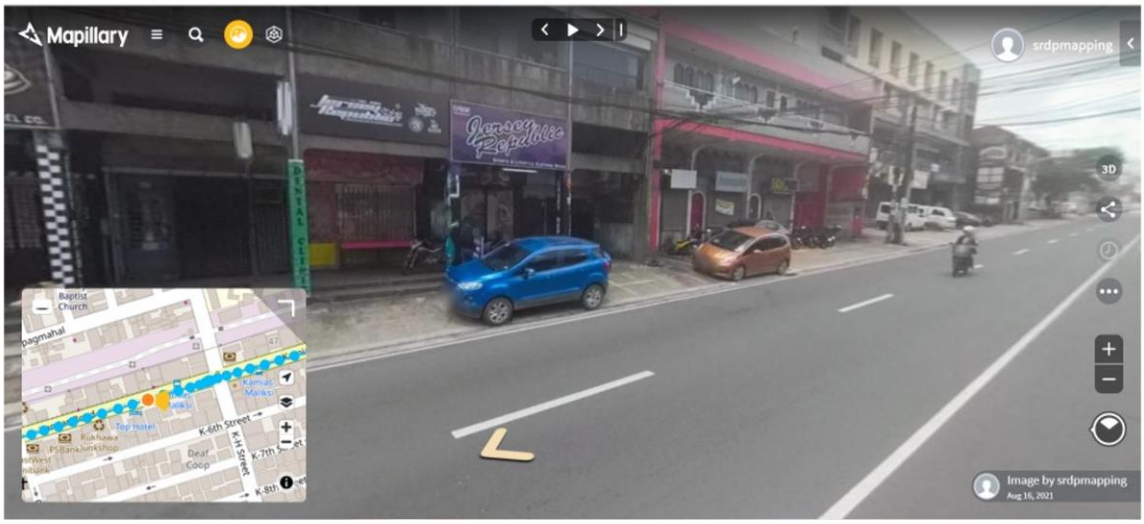
The Project for Comprehensive Traffic Management Plan for Metro Manila 36

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

On-Street Parking Slot (Number)	Number of parking	ex) 1
Off-Street parking Slot provided by Bldg.	Number of parking	ex) 30
	Facility Type	"Residence", "Commercial Institution", "Office/Bank", "Factory/Warehouse", "School/University", "Park/Recreational", "Medical/Welfare", "Religious/Social", "Wholesale/Retail shop" "Restaurant/Entertainment", "Other"

The Project for Comprehensive Traffic Management Plan for Metro Manila 37

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY



The Project for Comprehensive Traffic Management Plan for Metro Manila 38

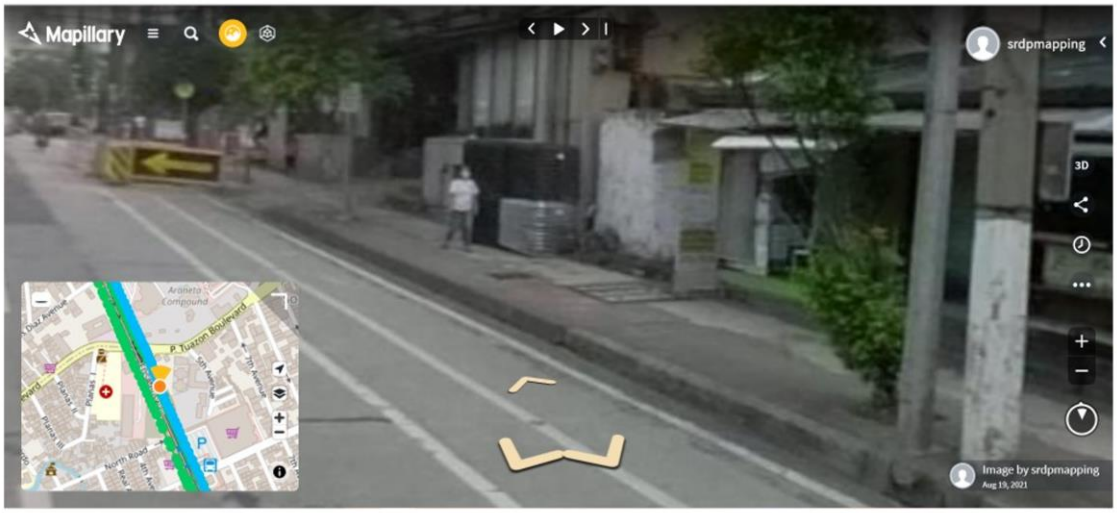
5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Traffic Regulation (if yes, please indicate time)	Speed Limit (km/ h)	ex) 40
	One-Way (N: No, if Yes, AM/PM Hour should be described)	ex) 6AM–9PM
	Prohibition (N: No, if Yes, AM/PM Hour should be described)	ex) N
	Truck Ban (N: No, if Yes, AM/PM Hour should be described)	ex) 6AM–9PM
	Parking Prohibition (N: No, if Yes, AM/PM Hour should be described)	ex) N
	Load/ Unload Prohibition (N: No, if Yes, AM/PM Hour should be describe)	ex) 6AM–9PM

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Road Maintenance	Sidewalk	Pavement Type	A: Asphalt, C: Cement/Concrete, G: Ground
		Condition	ex) 1: poor, 2: acceptable, 3: good
	Carriageway	Pavement Type	A: Asphalt, C: Cement/Concrete, G: Ground
		Condition	ex) 1: poor, 2: acceptable, 3: good
		Road Marking	ex) 1: poor, 2: acceptable, 3: good

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY



5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Road Maintenance	Sidewalk	Pavement Type	A: Asphalt, C: Cement/Concrete, G: Ground
		Condition	ex) 1: poor, 2: acceptable, 3: good
	Carriageway	Pavement Type	A: Asphalt, C: Cement/Concrete, G: Ground
		Condition	ex) 1: poor, 2: acceptable, 3: good
		Road Marking	ex) 1: poor, 2: acceptable, 3: good

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

Roadside Land Use	Commercial (roadside shop or small) (Y: Yes/N: No)	ex) Y
	Commercial (medium or shopping mall) (Y: yes/N: No)	ex) N
	Industrial (Y: Yes/N: No)	ex) Y
	Residential (Y: Yes/N: No)	ex) Y

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

The Project for Comprehensive Traffic Management Plan for Metro Manila 45

5. VISUALIZING ROAD INVENTORY USING GOOGLE STREET VIEW / MAPILLARY

The Project for Comprehensive Traffic Management Plan for Metro Manila 46

NEXT STEPS

- Storing the inventory data
- Visualization and analysis using GIS
- Using the findings in formulating countermeasures

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE PROJECT FOR COMPREHENSIVE TRAFFIC MANAGEMENT PLAN FOR METRO MANILA

TECHNICAL REPORT NO. 7

MANUAL ON TRAFFIC BOTTLENECK DATABASE

November 2022

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

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

CTMP	Comprehensive Traffic Management Plan
JICA	Japan International Cooperation Agency
JPT	JICA Project Team
LGU	local government unit
MMDA	Metropolitan Manila Development Authority
TBN	traffic bottleneck

Factor item	Checkpoint	Factor of Congestion
Road infrastructure	Number of lanes	Lack of lanes
		Insufficient road width
	Intersection layout	Wrong geometric layout
		Inadequate corner cutting
		Improper location of road facilities (road markings)
Traffic regulation	Signal timing	Inadequate traffic signal control (If No Signal)
		Inadequate traffic signal control (If With Signal)
		Bad visibility of traffic signal
	Left-turning or oncoming vehicles	No left-turn lane
		Insufficient left-turn lane length
		Conflict between left-turn and through movements
	Right-turning vehicles	Right-turning vehicles blocking vehicles proceeding straight ahead
		Improper stop line position
		Improper channelization
Traffic situation	Large vehicle	Speed reduction due to large vehicle
		Obstruction by motorcycles
		Obstruction by bicycles
		Obstruction by pedestrians
Environment of Roadside and intersection	Railway Crossing	Stopped traffic at at-grade railway crossings
	Driveway from roadside shop	Traffic flow in/out from intersections and narrow streets
		Traffic flow in/out from ICs at expressways
	PUJ, PUV	Speed reduction due to PUV stops
		Speed reduction due to PUJ stops
		Lane reduction with dedicated bus and priority lanes
	On-street parking	Obstruction of travel by on-street parking
Traffic Demand	Over capacity	Excess traffic capacity at intersections
		Excess traffic capacity at non-intersections
	Concentrated traffic	Concentration of traffic at specific times
		Concentration of traffic on roadside facilities at specific times and periods
		Concentration of traffic at specific periods during events or incidents
Others	Construction	Lane blockage due to construction
	Clogging of downstream	Clogging with congestion downstream
		Pedestian is obstructed
		Bike is obstructed
		Motorcycle is obstructed
	Free Comment (if any)	

1 OVERVIEW

The corridor database contains information that can be used to check the physical characteristics of road sections, identify traffic management issues, and formulate necessary countermeasures. The information is collected from site surveys, road inventory survey, and street view data.

The database was developed based on the results of traffic demand analysis, traffic count survey, Waze data, and inventory data. Based on these, the database will be able to cover both the demand and the supply side to identify traffic management issues.

The demand side is based initially on the demand forecast and will, later on, be supplemented by traffic count surveys for accuracy.

The supply side is based on the inventory data. By inspecting the corridors, inconsistencies in the road widths, bike lanes, and pedestrians can be studied. For example, sections with inconsistent road width tend to generate bottlenecks. Knowing this, future bottlenecks may be prevented, and current chokepoints may be resolved.

In this report, “corridor” refers to the circumferential roads, C1 to C6, and radial roads, R1 to R10. However, the procedures in this manual is also applicable to other roads.

As shown in Figure 1.1, the corridor database is composed of the 1) corridor profile, and 2) corridor analysis sheets. The corridor profile covers longer road segments and was developed by following the flowchart in Figure. It contains information on the corridors’ physical characteristics, traffic count, and travel speed. On the other hand, corridor analysis sheets are developed to identify the factor of Congestion (FOC) and countermeasures from road inventory data.

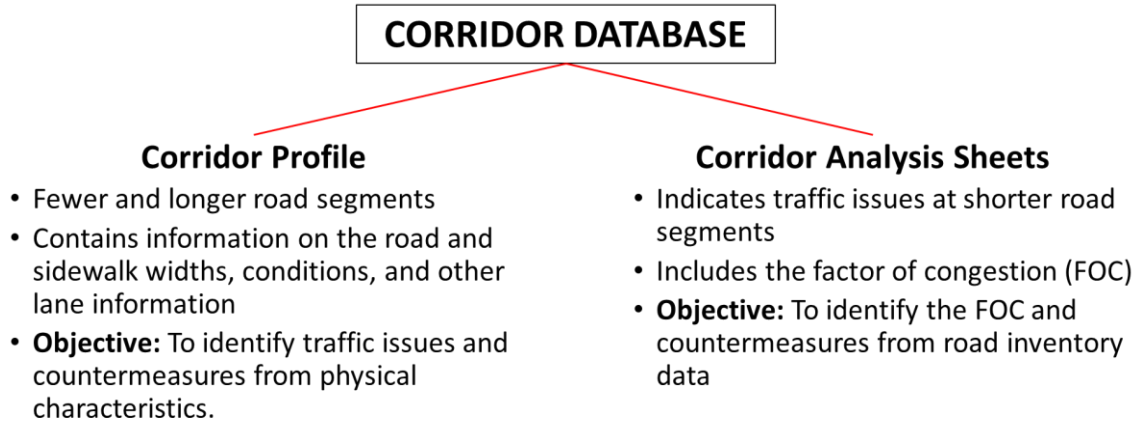


Figure 1.1 Corridor database

Table 1.1 shows the factor of congestion (FOC) which were developed for the corridor analysis sheets, wherein detailed issues can be identified at each location. Some FOC items were added for the corridor traffic issues from the bottleneck database.

Table 1.1: Factor of congestion (FOC)

2 CORRIDOR PROFILE

Data in the corridor profile data show each road's physical characteristics per segment. Based on this, traffic issues can be identified using the criteria in Table 2.1.

Table 2.1: Criteria and issues

Criteria and Issue	
ROW	ROW width is inconsistent
	ROW has a narrow section
	Limited capacity (VCR>0.9)
Carriageway	Carriageway width is inconsistent[1]
	Carriageway has a narrow section [2]
	Poor road marking (Poor length>0%)
	Poor road pavement (Poor length>0%)
Bike Lane	Unavailable/Low availability (% of length<50%)
	Different width between direction (diff.= > 20%)
Sidewalk	Unavailable/Low availability (% of length<80%)
	Different width between direction (diff.= > 20%)
	Poor condition (Poor length>0%)
	Sidewalk has a narrow section 2
Traffic Light	Streetlight is not enough (no./km = < 20/km)

[1] Minimum width is less than 60% of average width. Maximum width is more than 140% of average width.
[2] Minimum width is less than 60% of average width.

The corridor profile was developed using the flowchart in Figure 2.1.

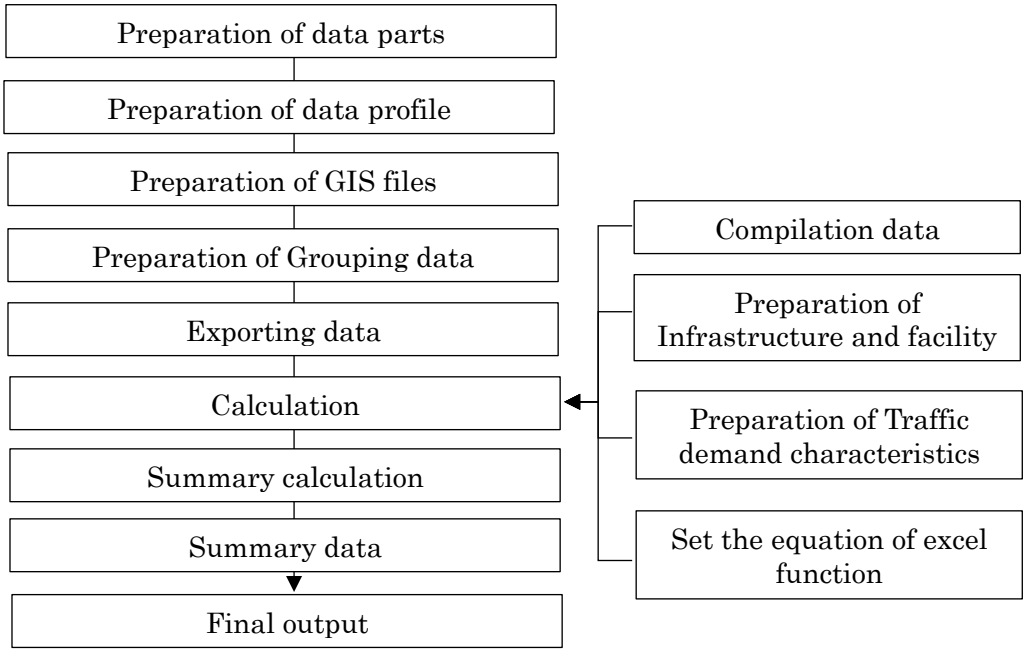


Figure 2.1: Workflow of development of corridor profile

2.1 Methodology

2.1.1 Preparation of Profile Sheet

The profile sheet is in PowerPoint format with columns and rows as shown 2.2. the profile sheets format should be prepared for each section. Adjust the number of columns and rows, if necessary.

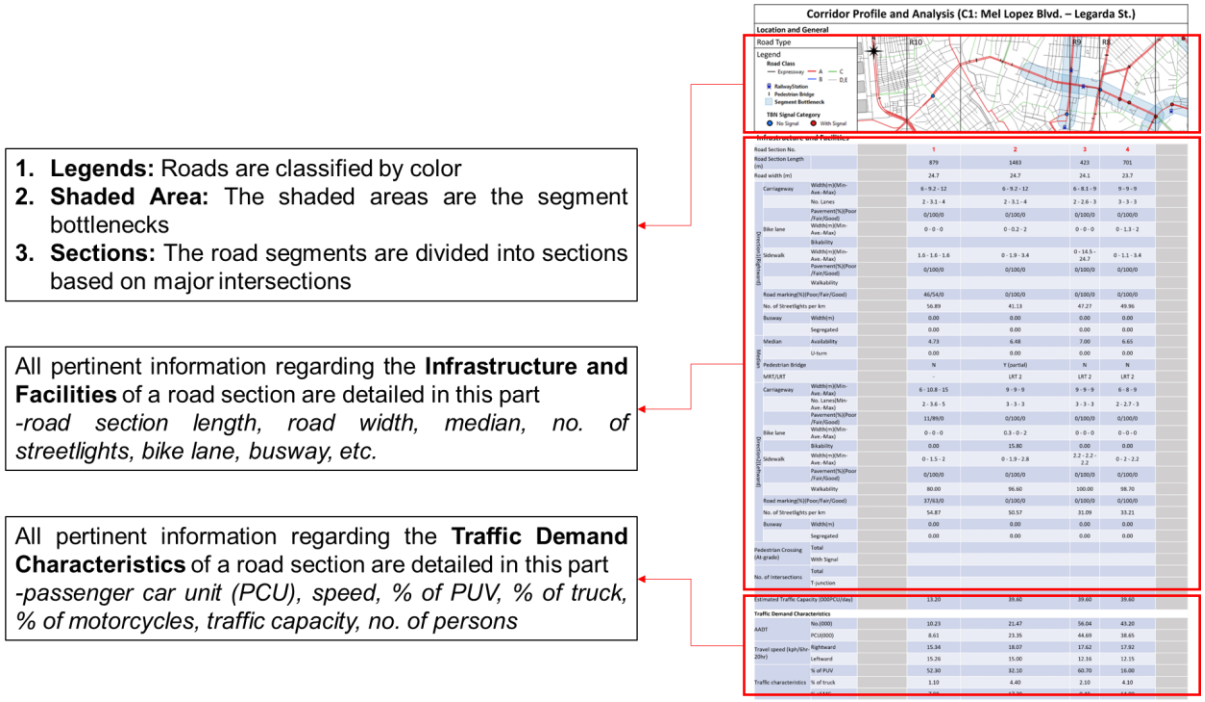
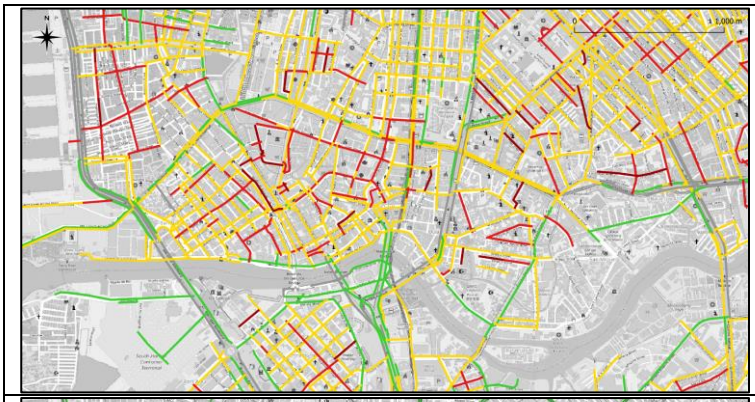
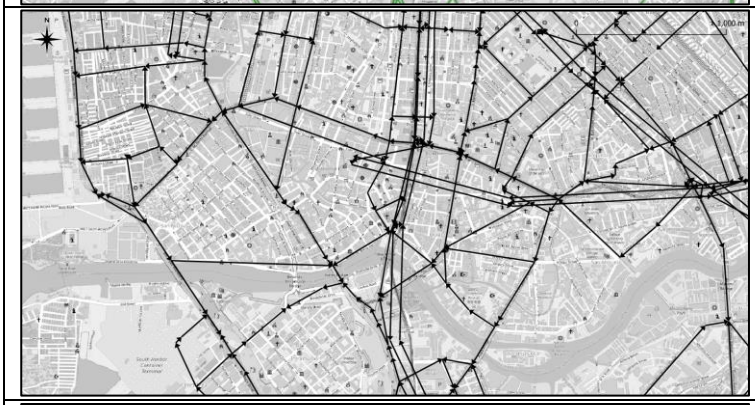
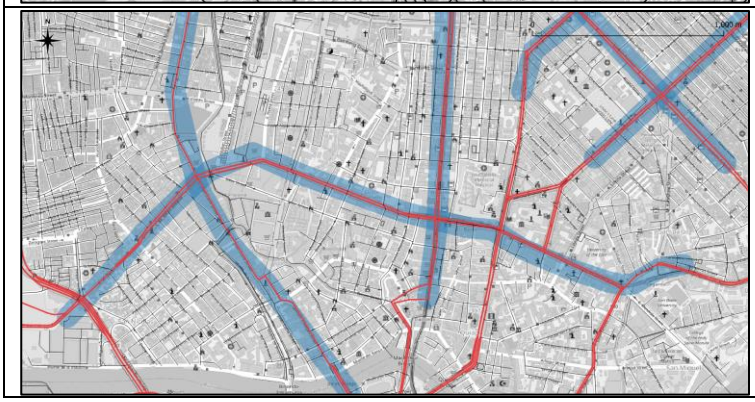


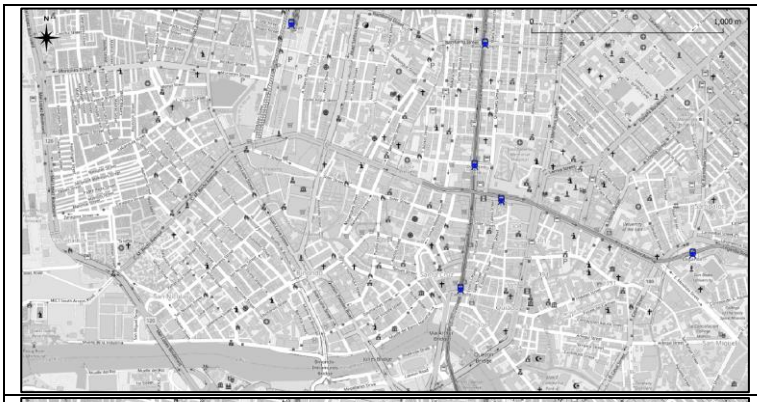
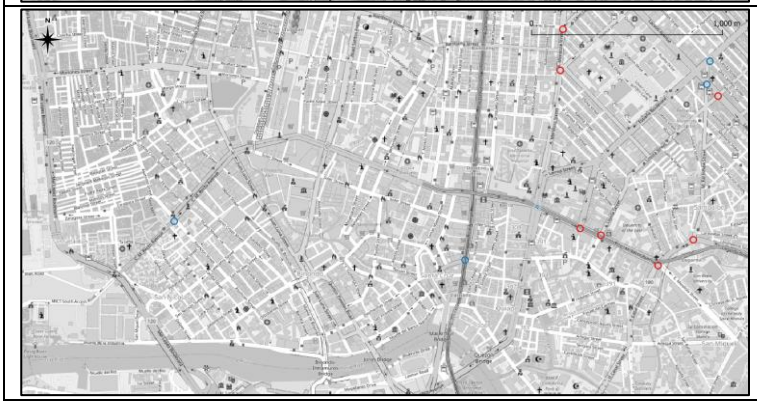
Figure 2.2: Corridor profile sheet

Road inventory data was visualized using QGIS software, and then organized using corridor profile sheets. The details of the shape files used can be found in Table 2.3.

Table 2.2: Data items for corridor profile

	**File Name:** Existing Iwata **Contents:** Roads are classified by color. Red – Class A roads; Blue – Class B roads, Green – Class C roads; Gray – Class D, E roads **Road Class** Expressway A C B D,E

	**File Name:** all link 6am-20pm **Contents:** Speeds (kph) are classified by color. Data that will be used are speed and length from the attributes table. ☑ 0 - 5 ☑ 5 - 10 ☑ 10 - 20 ☑ 20 - 30 ☑ 30 - 80
	**File Name:** Profile **Contents:** Data that will be used are *length, total width, sidewalk width, carriageway width, no. of lanes, median, railway line, pedestrian crossing, pedestrian bridge, streetlights, bus lane, bus width, bike lane, bike lane width, U-turn, carriageway pavement condition, sidewalk pavement condition, and road markings* in the attributes table
	**File Name:** EstVol **Contents:** Data that will be used are *LB code, % of truck, % of PUV, % of motorcycles, capacity, and no. of persons* in the attributes table
	**File Name:** Segment **Contents:** Segment TBNs are classified based on these criteria: at least 1 intersection TBN overlaps with LOC 3 and 4, from TBN to the end of LOC 3 and 4 link, at least 500m long

	**File Name:** Railway Station **Contents:** Railway station points
	**File Name:** Pedestrian Bridge **Contents:** Areas with pedestrian bridges
	**File Name:** Traffic Signal Category of TBNs **Contents:** Traffic Signal Category of TBN points

2.1.2 Preparation of Profile Map

The Profile map should contain 5 layers: the road network files, railway station, pedestrian bridge, traffic signal category of TBNs data, and segment layers. The scale bar and North should also be displayed as shown from Figure 2.3 to Figure 2.7.

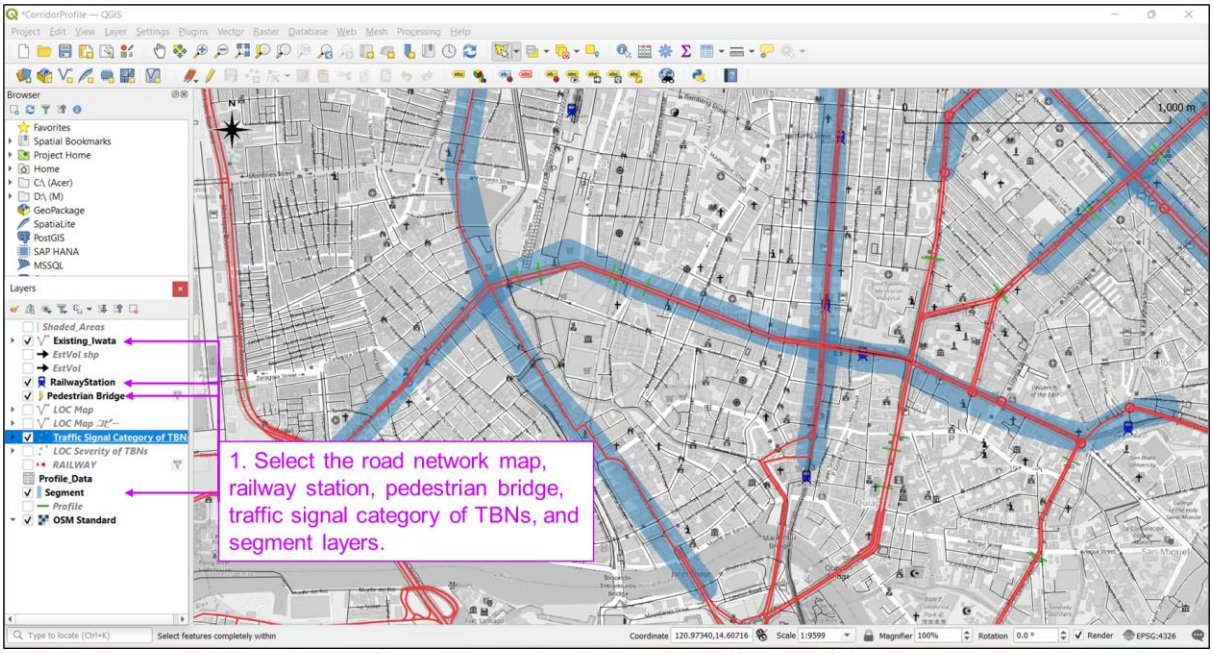


Figure 2.3: Preparation Profile Map (1)

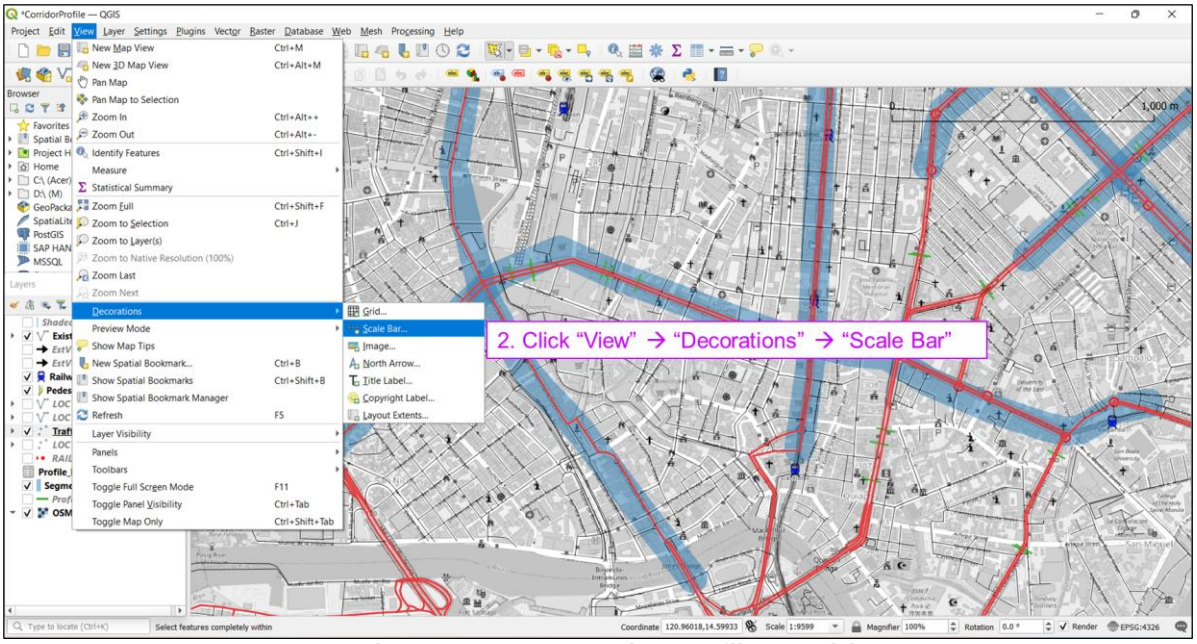


Figure 2.4: Preparation Profile Map (2)

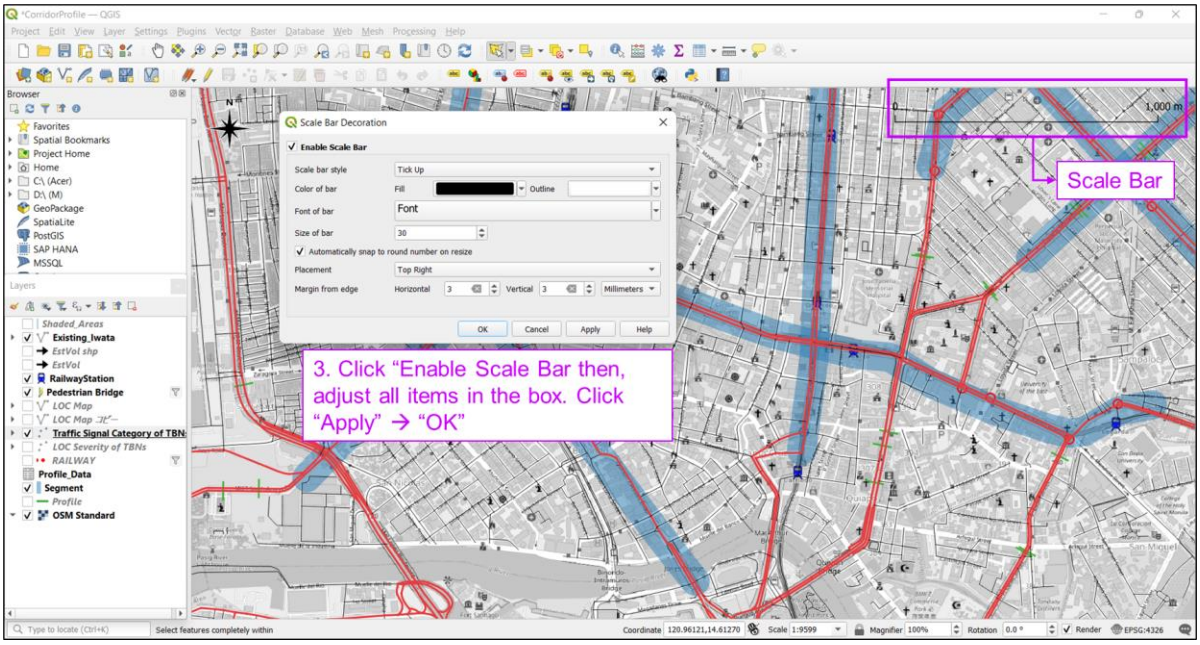


Figure 2.5: Preparation Profile Map (3)

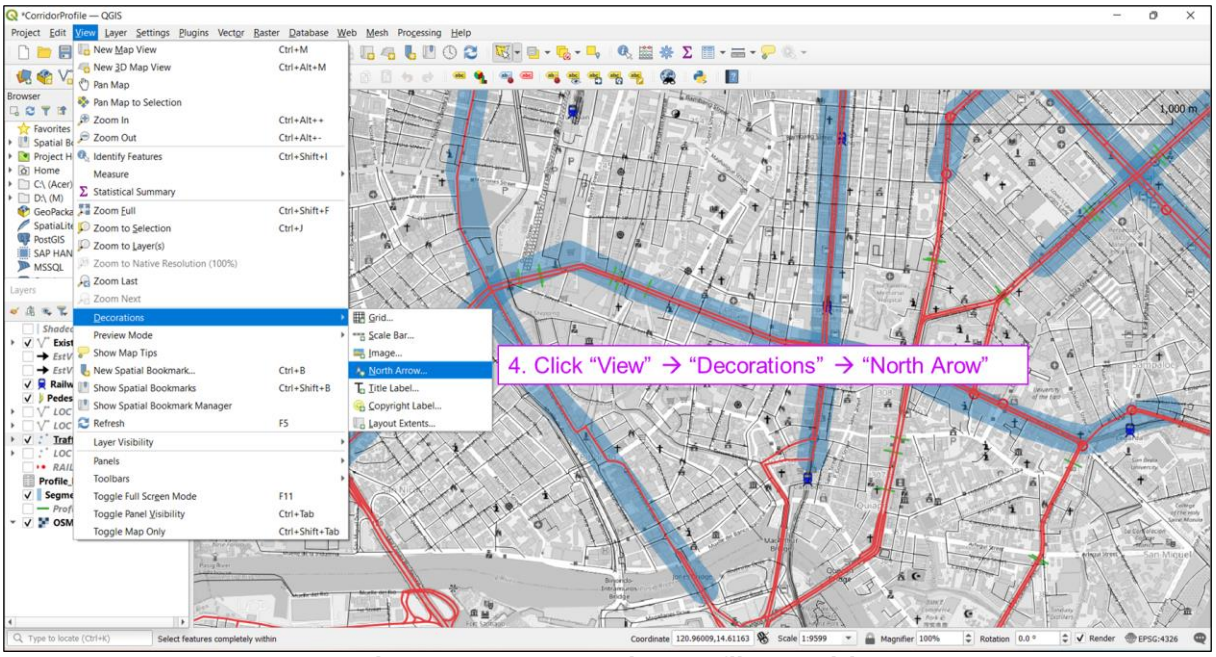


Figure 2.6: Preparation Profile Map (4)

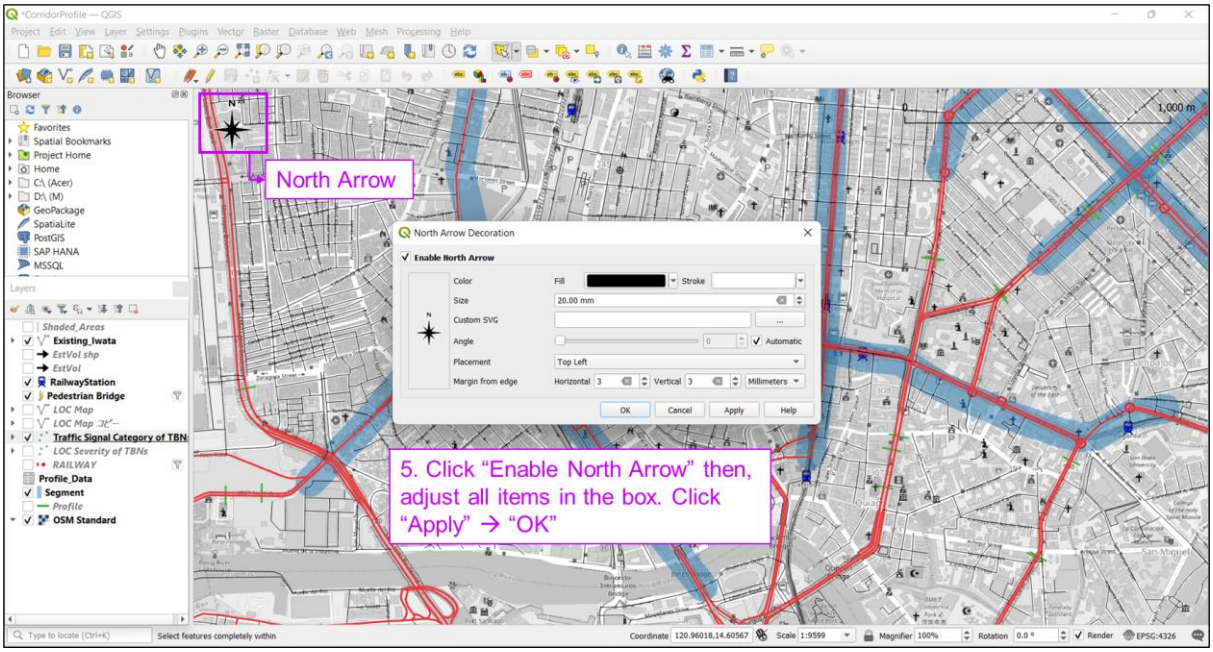


Figure 2.7: Preparation Profile Map (5)

For the final corridor map in the Corridor Database Profile Sheet, the extent of the road segments should reflect 1000m in the scale bar. The road segments should be in horizontal orientation.

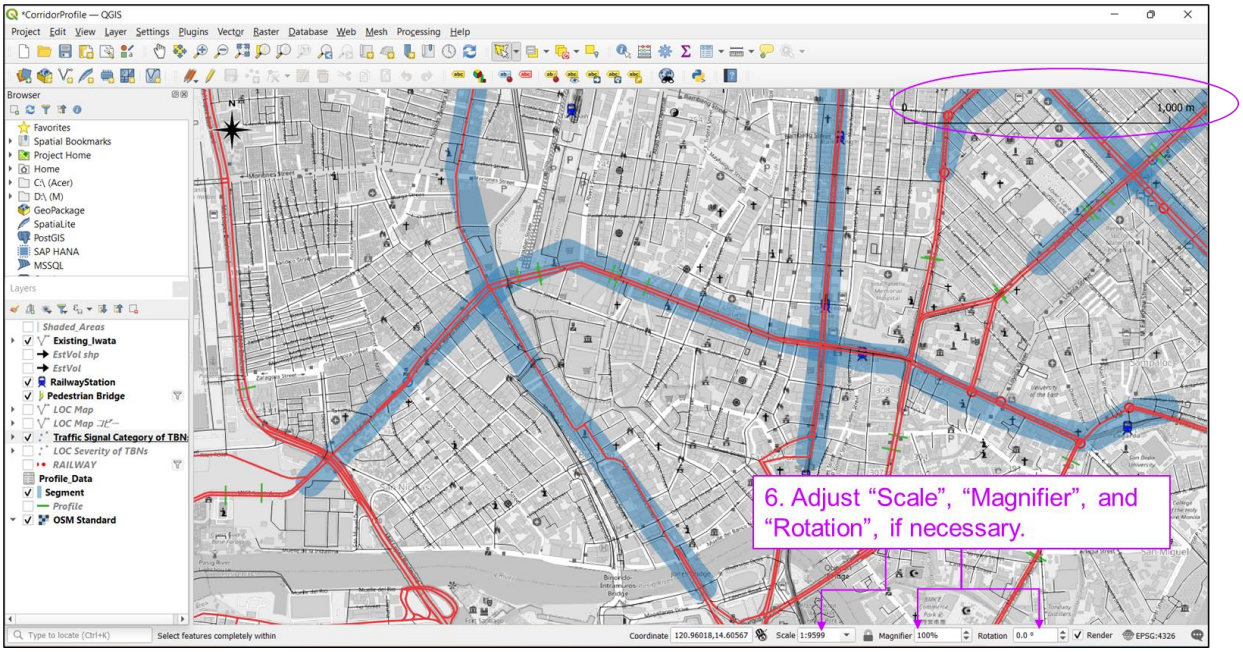


Figure 2.8: Preparation Profile Map (6)

Unselect the OpenStreetMap layer and only select the road network map, railway station, pedestrian bridge, traffic signal category of TBNs, and segment layers. If the road segment reflects 1000m in scale bar and horizontal in orientation, screenshot the map. The north arrow and scale bar should be included.

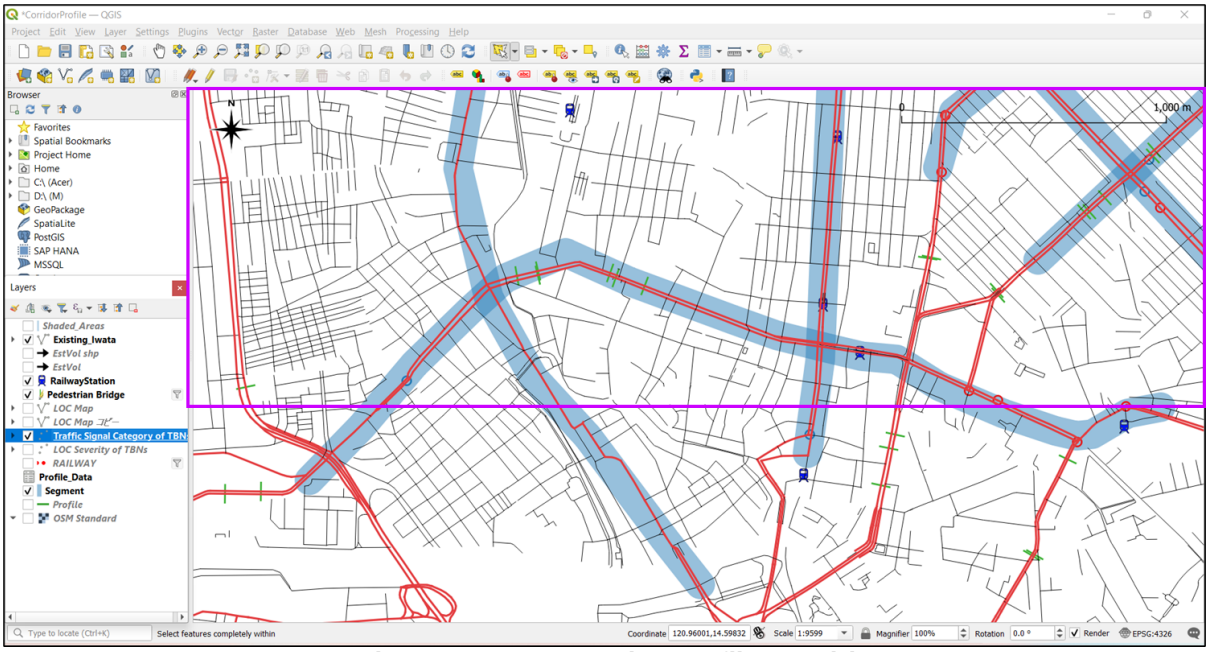
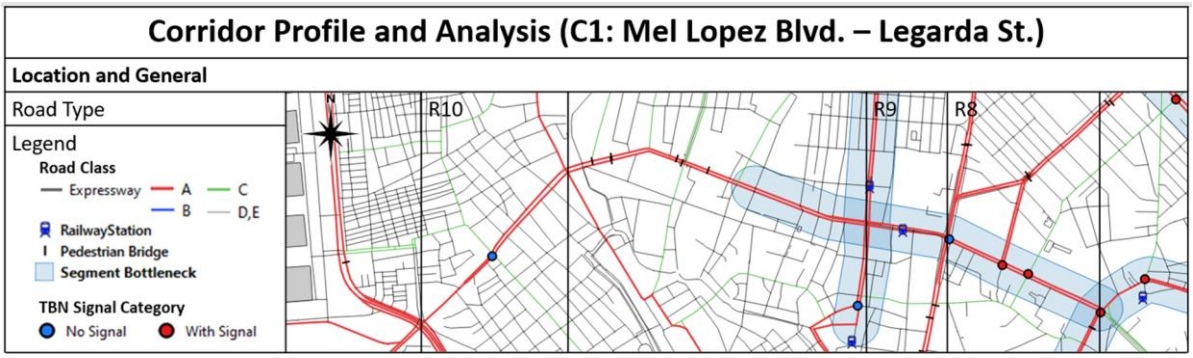


Figure 2.9: Preparation Profile Map (7)

Paste the screenshot in the Corridor Database Profile Sheet. Divide the road segment into sections based on major intersections. Add/delete columns, if necessary.



2.1.3 Grouping of data

To summarize the data in each section, the group name should be input for each link based on the division of road segments. Firstly, a new field should be added to the attribute table of the inventory survey data. Set the data type as string and length at 10. The preparation for the grouping of data is described in Figures 2.10, 2.11, and 2.12. The basis for naming each group is described in Figure 2.13.

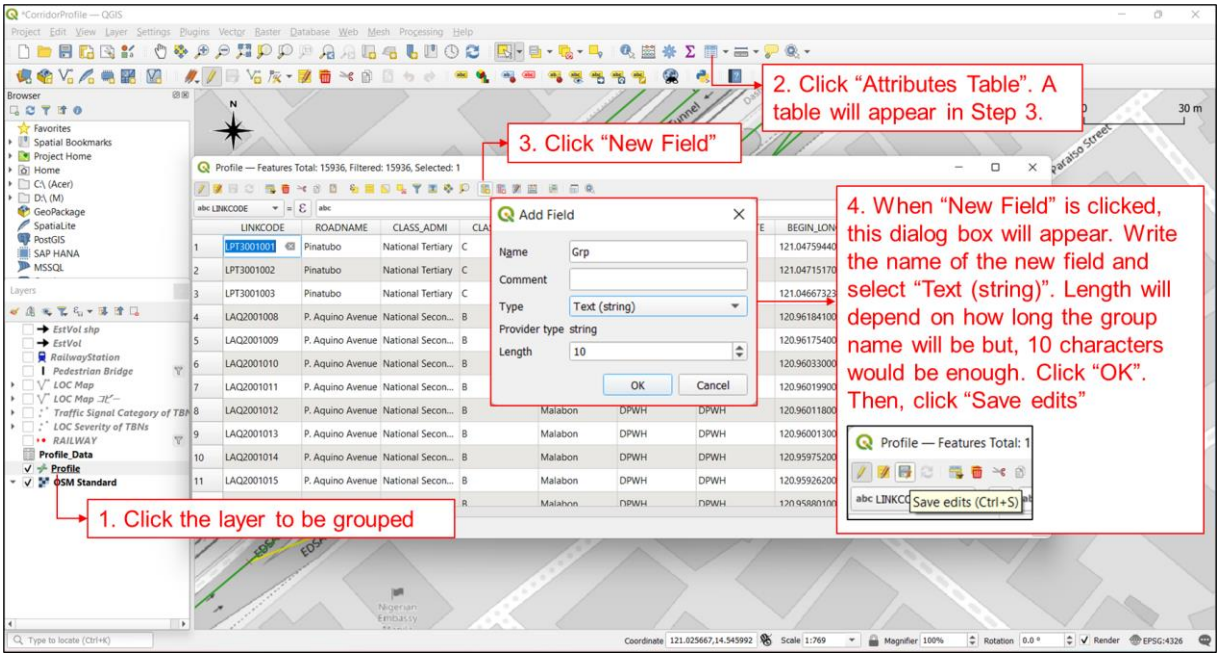


Figure 2.10: Preparation of Grouping Data (1)

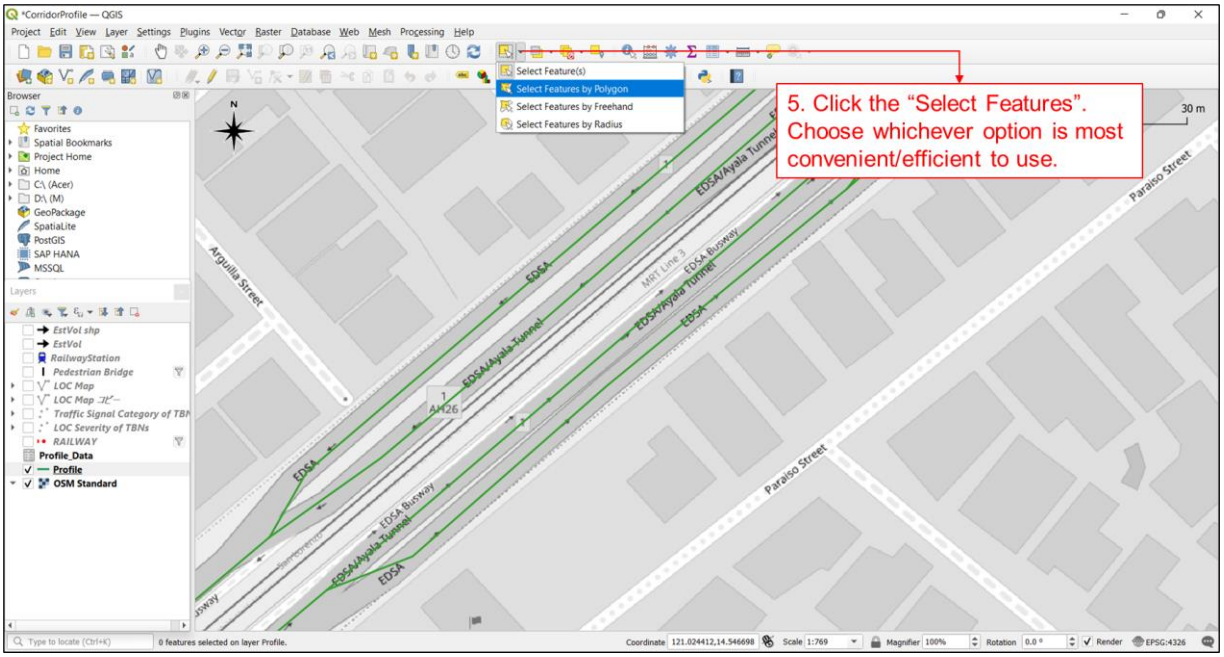


Figure 2.11: Preparation of Grouping Data (2)

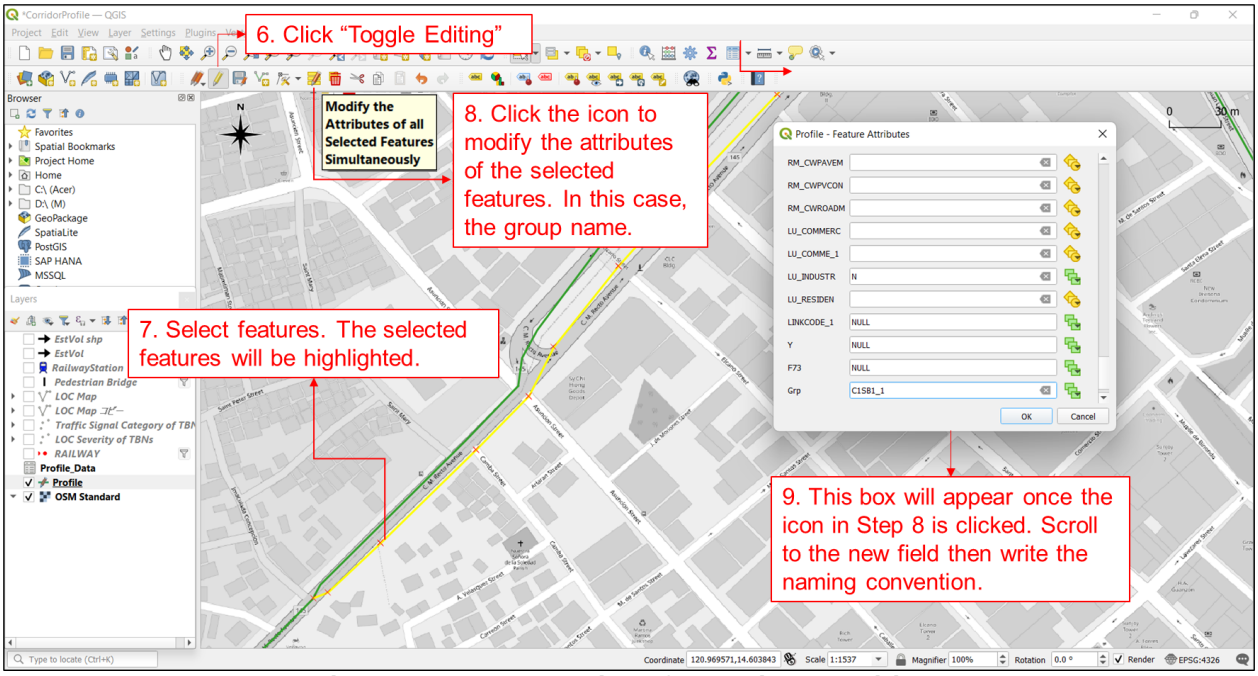


Figure 2.12: Preparation of Grouping Data (3)

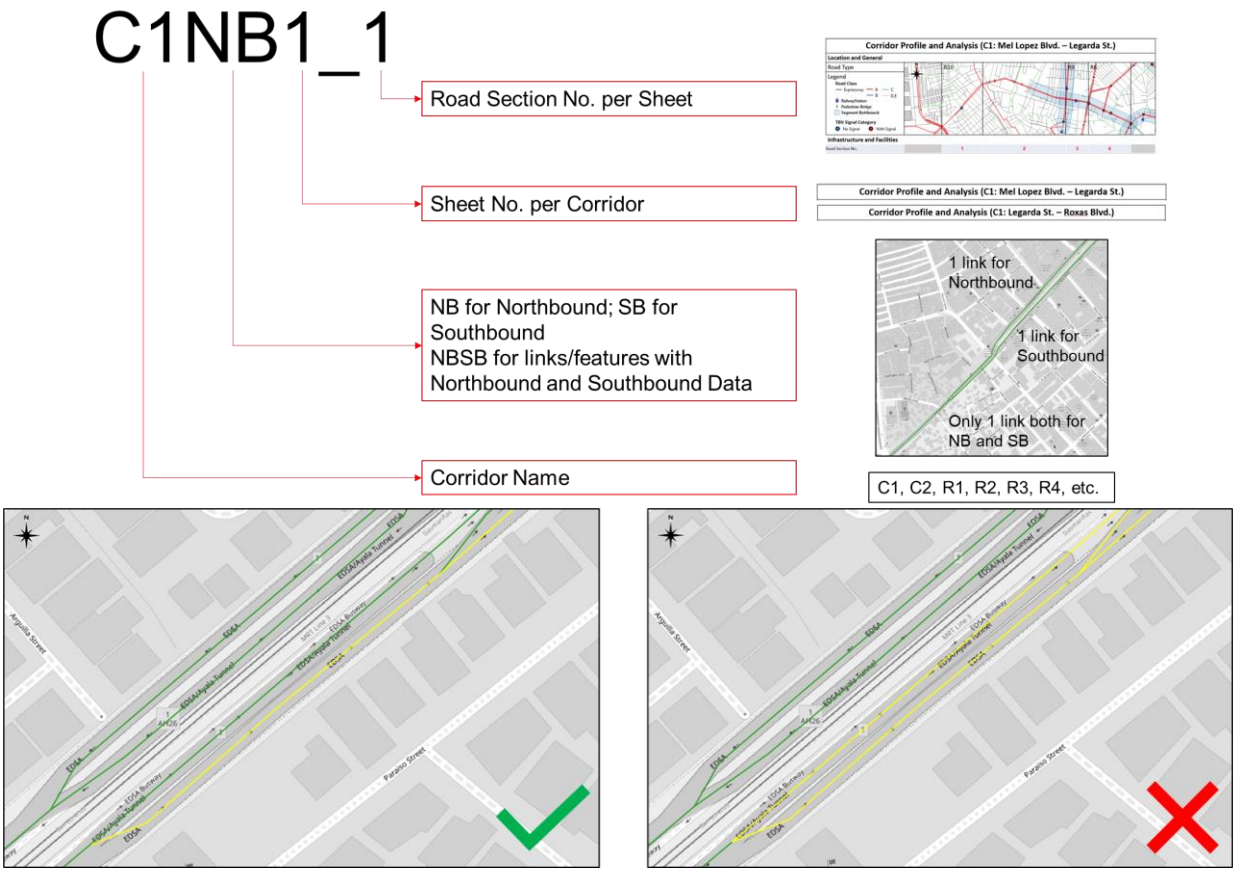


Figure 2.13: Preparation of Grouping Data (4)

2.1.4 Exporting of data

After grouping all required profile and speed data, export data in .csv format. The EstVol data are not to be grouped but need to be exported the same way as the profile and speed data. EstVol

data is generated from the demand forecast results.

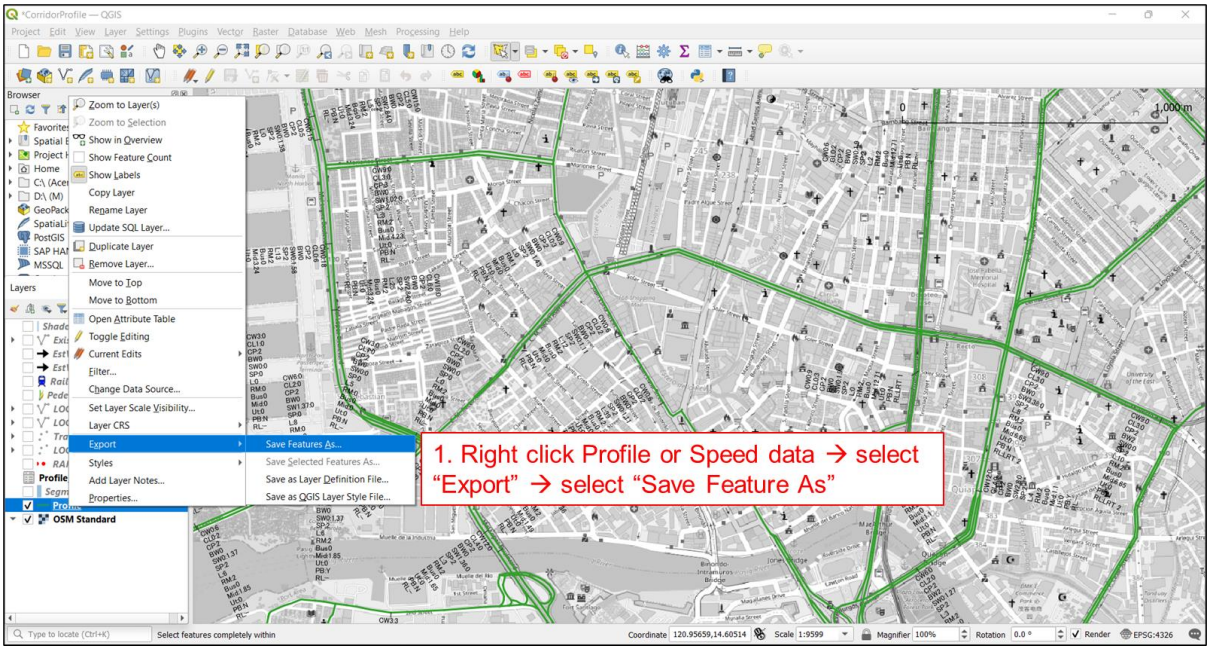


Figure 2.14: Preparation of Exporting Data (1)

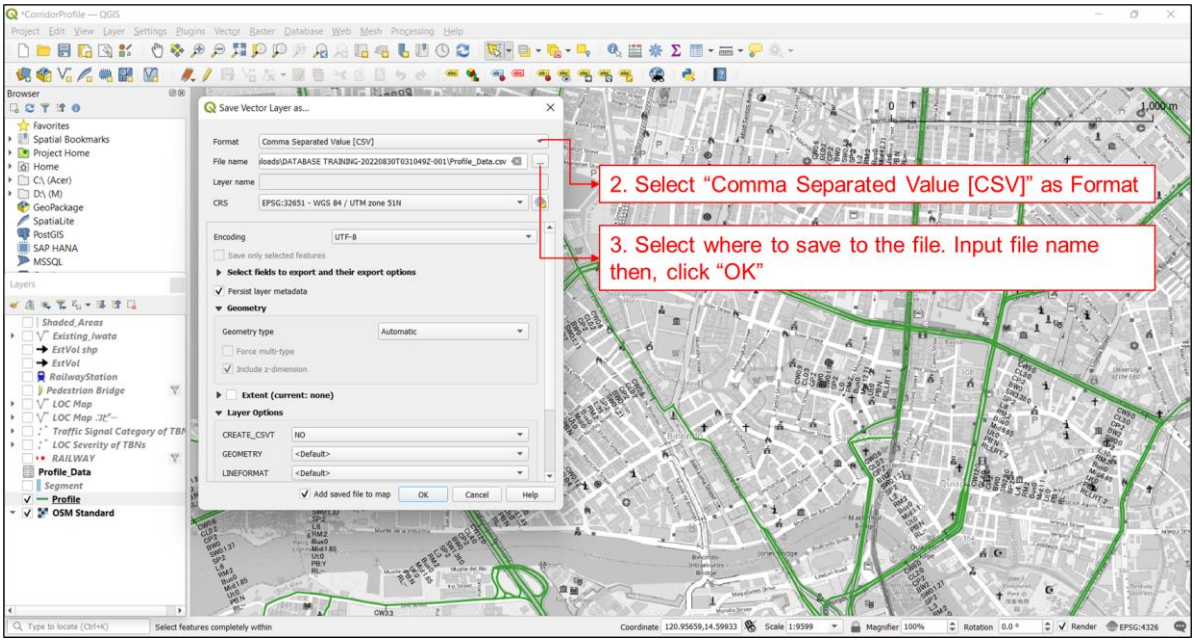


Figure 2.15: Preparation of Exporting Data (2)

If the .csv file is Read-Only, save it as an Excel file (.xlsx format).

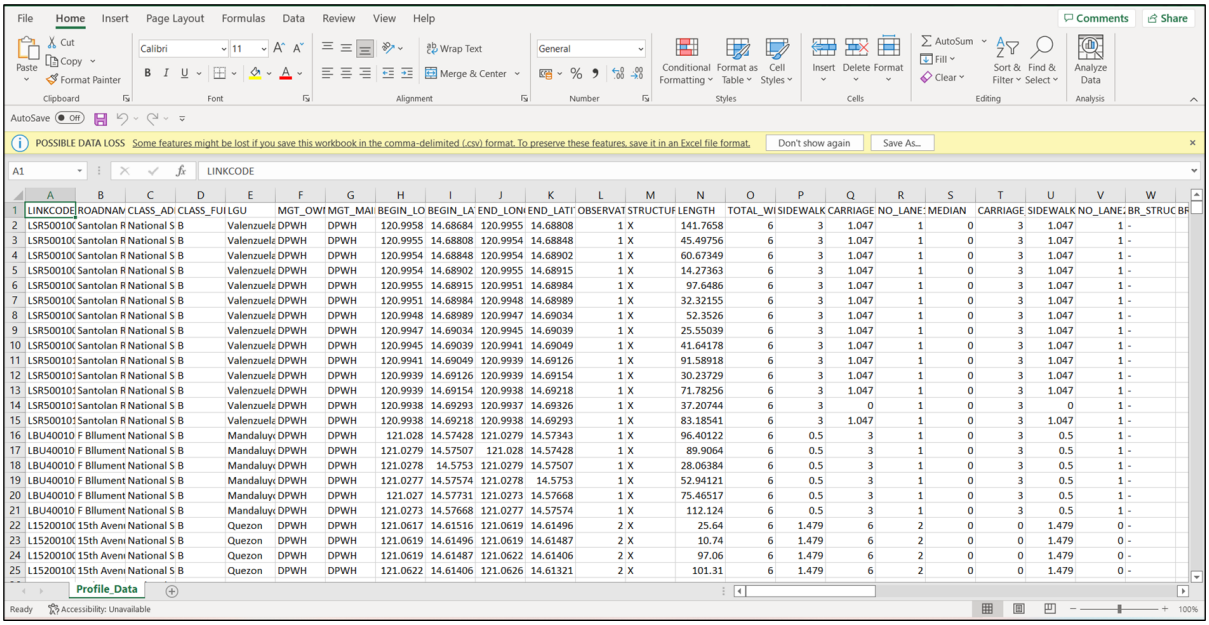


Figure 2.16: Preparation of Exporting Data (3)

2.1.5 Calculations for the compiled values

2.1.5.1 Preparation of data on infrastructure and facilities

1. Compile all profile, speed, and Estvol data in 1 Excel file. Separate speed and profile into "Sheets"

2. Move the group name of speed and profile data to the first column of each sheet in Excel file

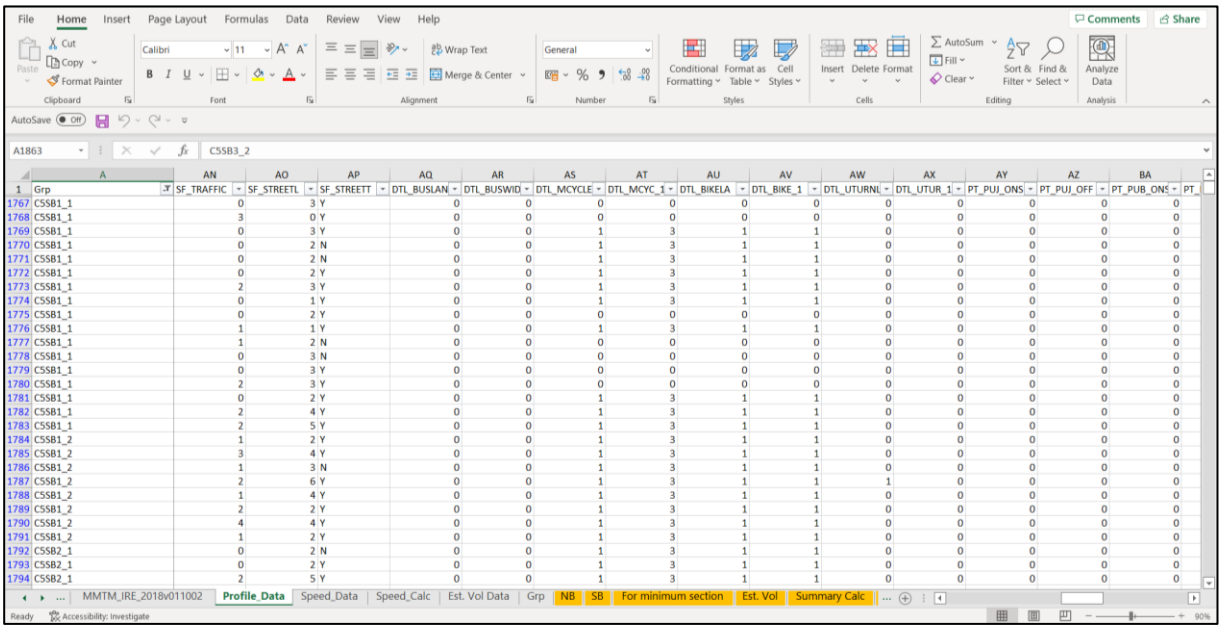


Figure 2.17: Calculation works (1)

3. Create another 2 sheets in the same Excel file for Northbound and Southbound "Infrastructure and Facilities" data

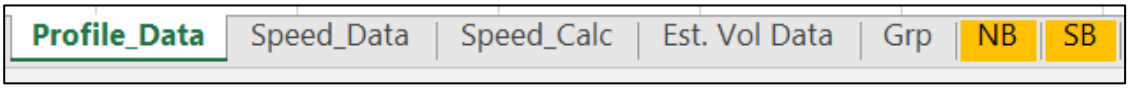
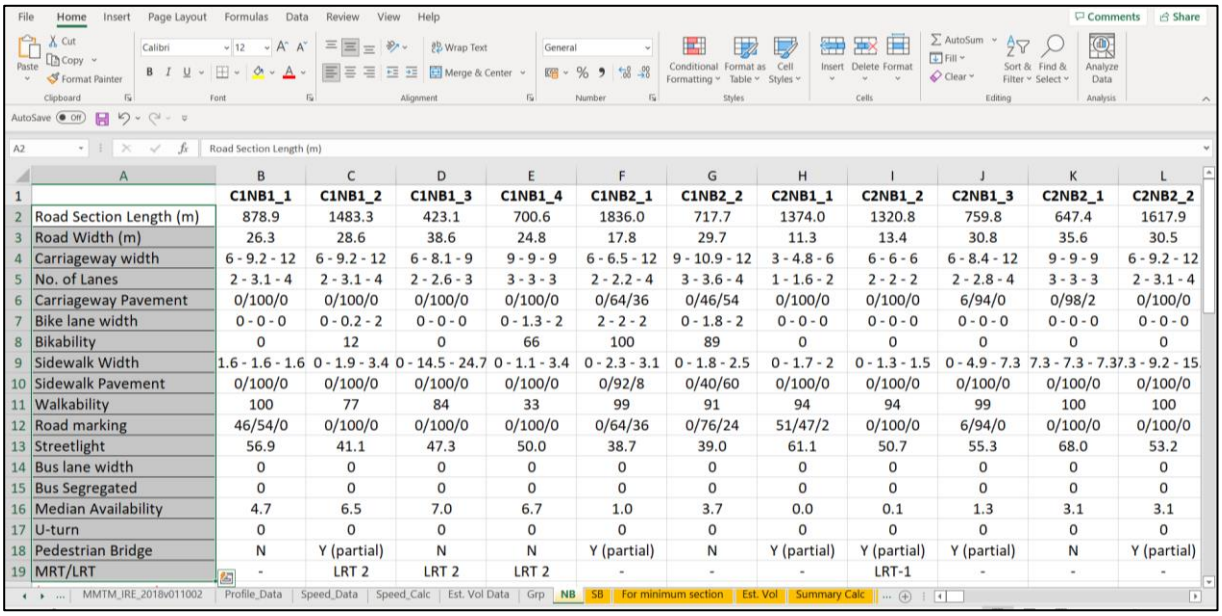


Figure 2.18: Calculation works (2)

3. In “NB” sheet, the following items should be calculated based on the exported profile data.



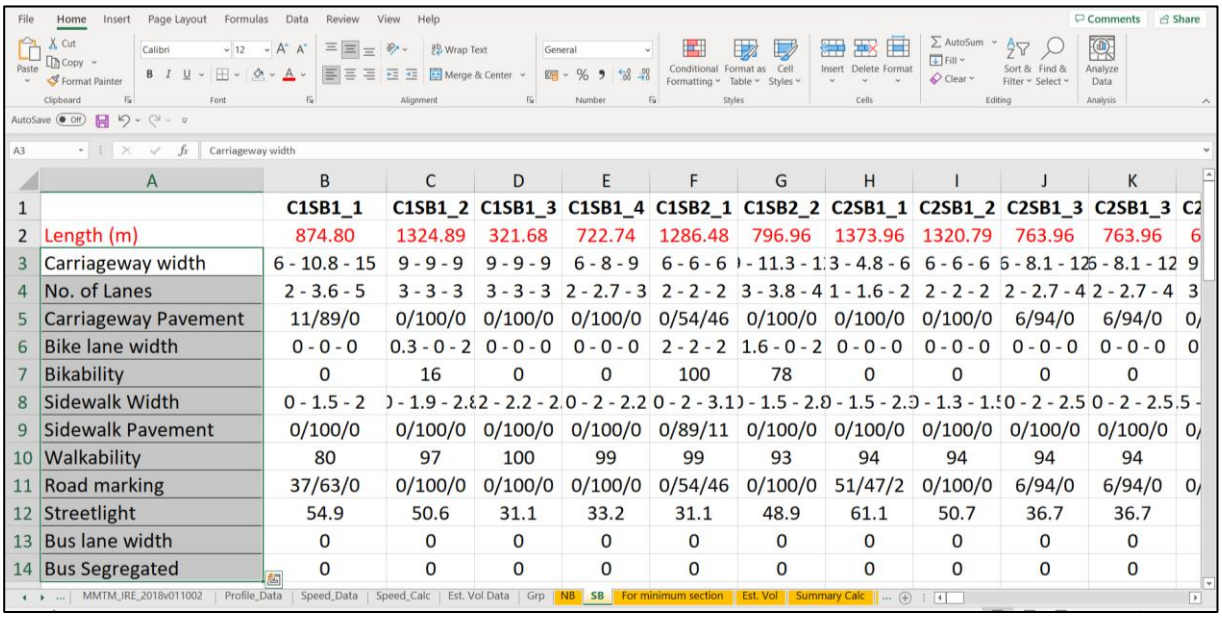
	A	B	C	D	E	F	G	H	I	J	K	L
1		C1NB1_1	C1NB1_2	C1NB1_3	C1NB1_4	C1NB2_1	C1NB2_2	C2NB1_1	C2NB1_2	C2NB1_3	C2NB2_1	C2NB2_2
2	Road Section Length (m)	878.9	1483.3	423.1	700.6	1836.0	717.7	1374.0	1320.8	759.8	647.4	1617.9
3	Road Width (m)	26.3	28.6	38.6	24.8	17.8	29.7	11.3	13.4	30.8	35.6	30.5
4	Carriageway width	6 - 9.2 - 12	6 - 9.2 - 12	6 - 8.1 - 9	9 - 9 - 9	6 - 6.5 - 12	9 - 10.9 - 12	3 - 4.8 - 6	6 - 6 - 6	6 - 8.4 - 12	9 - 9 - 9	6 - 9.2 - 12
5	No. of Lanes	2 - 3.1 - 4	2 - 3.1 - 4	2 - 2.6 - 3	3 - 3 - 3	2 - 2.2 - 4	3 - 3.6 - 4	1 - 1.6 - 2	2 - 2 - 2	2 - 2.8 - 4	3 - 3 - 3	2 - 3.1 - 4
6	Carriageway Pavement	0/100/0	0/100/0	0/100/0	0/100/0	0/64/36	0/46/54	0/100/0	0/100/0	6/94/0	0/98/2	0/100/0
7	Bike lane width	0 - 0 - 0	0 - 0.2 - 2	0 - 0 - 0	0 - 1.3 - 2	2 - 2 - 2	0 - 1.8 - 2	0 - 0 - 0	0 - 0 - 0	0 - 0 - 0	0 - 0 - 0	0 - 0 - 0
8	Bikability	0	12	0	66	100	89	0	0	0	0	0
9	Sidewalk Width	1.6 - 1.6 - 1.6	0 - 1.9 - 3.4	0 - 14.5 - 24.7	0 - 1.1 - 3.4	0 - 2.3 - 3.1	0 - 1.8 - 2.5	0 - 1.7 - 2	0 - 1.3 - 1.5	0 - 4.9 - 7.3	7.3 - 7.3 - 7.37	3 - 9.2 - 15.
10	Sidewalk Pavement	0/100/0	0/100/0	0/100/0	0/100/0	0/92/8	0/40/60	0/100/0	0/100/0	0/100/0	0/100/0	0/100/0
11	Walkability	100	77	84	33	99	91	94	94	99	100	100
12	Road marking	46/54/0	0/100/0	0/100/0	0/100/0	0/64/36	0/76/24	51/47/2	0/100/0	6/94/0	0/100/0	0/100/0
13	Streetlight	56.9	41.1	47.3	50.0	38.7	39.0	61.1	50.7	55.3	68.0	53.2
14	Bus lane width	0	0	0	0	0	0	0	0	0	0	0
15	Bus Segregated	0	0	0	0	0	0	0	0	0	0	0
16	Median Availability	4.7	6.5	7.0	6.7	1.0	3.7	0.0	0.1	1.3	3.1	3.1
17	U-turn	0	0	0	0	0	0	0	0	0	0	0
18	Pedestrian Bridge	N	Y (partial)	N	N	Y (partial)	N	Y (partial)	Y (partial)	Y (partial)	N	Y (partial)
19	MRT/LRT	-	LRT 2	LRT 2	LRT 2	-	-	-	LRT-1	-	-	-

Figure 2.19: Calculation works (3)

5. Each item in NB should be calculated using Profile data based on the following:

a **Road Section Length:** total length all road sections with same group name
b **Road Width:** average width of all road sections with same group name
c **Carriageway width:** minimum – mean – maximum carriageway width of all road sections with same group name
d **No. of Lanes:** minimum – mean – maximum number of lanes of all road sections with same group name
e **Carriageway Pavement:** % of poor / % of fair / % of good carriageway condition in road sections with same group name
f **Bike lane width:** minimum – mean – maximum bike lane width of all road sections with same group name
g **Bikeability:** bikeability of all road sections with same group name
h **Sidewalk Width:** minimum – mean – maximum sidewalk width of all road sections with same group name
i **Sidewalk Pavement:** % of poor / % of fair / % of good sidewalk pavement condition in road sections with same group name
j **Walkability:** walkability of all road sections with same group name
k **Road marking:** % of poor / % of fair / % of good road marking condition in road sections with same group name
l **Streetlights:** number of streetlights per kilometer of road sections with same group name
m **Bus lane width:** bus lane width of all road sections with same group name
n **Bus segregated:** presence of bus lane physical barrier of all road sections with same group name based on Google Streetview or Mapillary
o **Median Availability:** median width of all road sections with same group name
p **U-turn:** total number of U-turns in all road sections with same group name
q **Pedestrian Bridge:** presence of bus lane physical barrier of all road sections with same group name
r **MRT/LRT:** railway line in all road sections with same group name

6. In the “SB” sheet, the following items should be calculated based on the exported profile data.



	A	B	C	D	E	F	G	H	I	J	K	
1		C1SB1_1	C1SB1_2	C1SB1_3	C1SB1_4	C1SB2_1	C1SB2_2	C2SB1_1	C2SB1_2	C2SB1_3	C2SB1_3	C2
2	Length (m)	874.80	1324.89	321.68	722.74	1286.48	796.96	1373.96	1320.79	763.96	763.96	6
3	Carriageway width	6 - 10.8 - 15	9 - 9 - 9	9 - 9 - 9	6 - 8 - 9	6 - 6 - 6	) - 11.3 - 1	3 - 4.8 - 6	6 - 6 - 6	5 - 8.1 - 12	5 - 8.1 - 12	9
4	No. of Lanes	2 - 3.6 - 5	3 - 3 - 3	3 - 3 - 3	2 - 2.7 - 3	2 - 2 - 2	3 - 3.8 - 4	1 - 1.6 - 2	2 - 2 - 2	2 - 2.7 - 4	2 - 2.7 - 4	3
5	Carriageway Pavement	11/89/0	0/100/0	0/100/0	0/100/0	0/54/46	0/100/0	0/100/0	0/100/0	6/94/0	6/94/0	0/
6	Bike lane width	0 - 0 - 0	0.3 - 0 - 2	0 - 0 - 0	0 - 0 - 0	2 - 2 - 2	1.6 - 0 - 2	0 - 0 - 0	0 - 0 - 0	0 - 0 - 0	0 - 0 - 0	0
7	Bikability	0	16	0	0	100	78	0	0	0	0	
8	Sidewalk Width	0 - 1.5 - 2	) - 1.9 - 2.8	2 - 2.2 - 2.	0 - 2 - 2.2	0 - 2 - 3.1	) - 1.5 - 2.0	0 - 1.5 - 2.3	0 - 1.3 - 1.5	0 - 2 - 2.5	0 - 2 - 2.5	5 -
9	Sidewalk Pavement	0/100/0	0/100/0	0/100/0	0/100/0	0/89/11	0/100/0	0/100/0	0/100/0	0/100/0	0/100/0	0/
10	Walkability	80	97	100	99	99	93	94	94	94	94	
11	Road marking	37/63/0	0/100/0	0/100/0	0/100/0	0/54/46	0/100/0	51/47/2	0/100/0	6/94/0	6/94/0	0/
12	Streetlight	54.9	50.6	31.1	33.2	31.1	48.9	61.1	50.7	36.7	36.7	
13	Bus lane width	0	0	0	0	0	0	0	0	0	0	
14	Bus Segregated	0	0	0	0	0	0	0	0	0	0	

Figure 2.20: Calculation works (4)

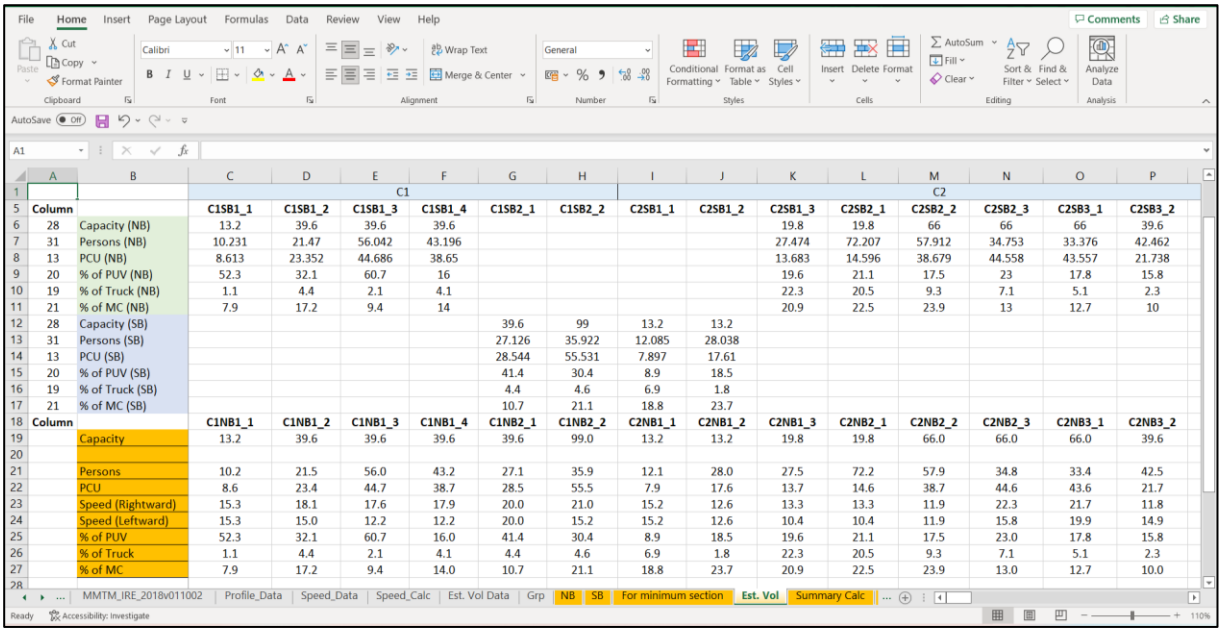
7. Each item in SB should be calculated using Profile data based on the following:

a **Road Section Length:** total length all road sections with same group name
b **Carriageway width:** minimum – mean – maximum carriageway width of all road sections with same group name
c **No. of Lanes:** minimum – mean – maximum number of lanes of all road sections with same group name
d **Carriageway Pavement:** % of poor / % of fair / % of good carriageway condition in road sections with same group name
e **Bike lane width:** minimum – mean – maximum bike lane width of all road sections with same group name
f **Bikeability:** bikeability of all road sections with same group name
g **Sidewalk Width:** minimum – mean – maximum sidewalk width of all road sections with same group name
h **Sidewalk Pavement:** % of poor / % of fair / % of good sidewalk pavement condition in road sections with same group name
i **Walkability:** walkability of all road sections with same group name
j **Road marking:** % of poor / % of fair / % of good road marking condition in road sections with same group name
k **Streetlights:** number of streetlights per kilometer of road sections with same group name
l **Bus lane width:** bus lane width of all road sections with same group name
m **Bus segregated:** presence of bus lane physical barrier of all road sections with same group name based on Google Streetview or Mapillary

2.1.5.2 Preparation of data on traffic demand characteristics

For the Estimated Traffic Capacity, PCU, Persons, % of Truck, % of PUV, and % of MC, the data will be from the exported data of EstVol. Grouping of links is not necessary because these data are manually entered.

For the speed, the northbound and southbound data will be from the exported Waze data. Grouping of links is also necessary for all sets of data to correspond.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1			C1								C2					
5	Column		C1SB1_1	C1SB1_2	C1SB1_3	C1SB1_4	C1SB2_1	C1SB2_2	C2SB1_1	C2SB1_2	C2SB1_3	C2SB2_1	C2SB2_2	C2SB2_3	C2SB3_1	C2SB3_2
6	28	Capacity (NB)	13.2	39.6	39.6	39.6					19.8	19.8	66	66	66	39.6
7	31	Persons (NB)	10.231	21.47	56.042	43.196					27.474	72.207	57.912	34.753	33.376	42.462
8	13	PCU (NB)	8.613	23.352	44.686	38.65					13.683	14.596	38.679	44.558	43.557	21.738
9	20	% of PUV (NB)	52.3	32.1	60.7	16					19.6	21.1	17.5	23	17.8	15.8
10	19	% of Truck (NB)	1.1	4.4	2.1	4.1					22.3	20.5	9.3	7.1	5.1	2.3
11	21	% of MC (NB)	7.9	17.2	9.4	14					20.9	22.5	23.9	13	12.7	10
12	28	Capacity (SB)					39.6	99	13.2	13.2						
13	31	Persons (SB)					27.126	35.922	12.085	28.038						
14	13	PCU (SB)					28.544	55.531	7.897	17.61						
15	20	% of PUV (SB)					41.4	30.4	8.9	18.5						
16	19	% of Truck (SB)					4.4	4.6	6.9	1.8						
17	21	% of MC (SB)					10.7	21.1	18.8	23.7						
18	Column		C1NB1_1	C1NB1_2	C1NB1_3	C1NB1_4	C1NB2_1	C1NB2_2	C2NB1_1	C2NB1_2	C2NB1_3	C2NB2_1	C2NB2_2	C2NB2_3	C2NB3_1	C2NB3_2
19		Capacity	13.2	39.6	39.6	39.6	39.6	99.0	13.2	13.2	19.8	19.8	66.0	66.0	66.0	39.6
20																
21		Persons	10.2	21.5	56.0	43.2	27.1	35.9	12.1	28.0	27.5	72.2	57.9	34.8	33.4	42.5
22		PCU	8.6	23.4	44.7	38.7	28.5	55.5	7.9	17.6	13.7	14.6	38.7	44.6	43.6	21.7
23		Speed (Rightward)	15.3	18.1	17.6	17.9	20.0	21.0	15.2	12.6	13.3	13.3	11.9	22.3	21.7	11.8
24		Speed (Leftward)	15.3	15.0	12.2	12.2	20.0	15.2	15.2	12.6	10.4	10.4	11.9	15.8	19.9	14.9
25		% of PUV	52.3	32.1	60.7	16.0	41.4	30.4	8.9	18.5	19.6	21.1	17.5	23.0	17.8	15.8
26		% of Truck	1.1	4.4	2.1	4.1	4.4	4.6	6.9	1.8	22.3	20.5	9.3	7.1	5.1	2.3
27		% of MC	7.9	17.2	9.4	14.0	10.7	21.1	18.8	23.7	20.9	22.5	23.9	13.0	12.7	10.0
28																

MMTM_IRE_2018v011002 | Profile_Data | Speed_Data | Speed_Calc | Est. Vol Data | Grp | NB | SB | For minimum section | Est. Vol | Summary Calc

Figure 2.21: Calculation works (5)

1. For speed data, create another sheet for speed calculations. The data are calculated based on the exported data of Speed shp file.

2. The values for speed are calculated based on the following:

a Total Length: total length of all road sections with same group name

b Total Time: total time based on the speed and length of all road sections with same group name

$$Time_i = \frac{Length_i}{Speed_i}$$

$$Total\ Time = \sum Time_i$$

c Average Speed: average based on the total length and total time of all road sections with same group name

$$Average\ Speed = \frac{Total\ Length}{Total\ Time}$$

	A	B	C	D	E	F	G
1		C1NB1_1	C1NB1_2	C1NB1_3	C1NB1_4	C1NB2_1	C1NB2_2
2	Total Length (m)	1335.52317	1332.58008	327.07548	735.57617	1862.79954	1022.62336
3	Total Time (s)	0.087057779	0.07374737	0.018565764	0.041039931	0.093264665	0.048744622
4	Rightward	15.34065284	18.06952692	17.61712977	17.92342594	19.97326151	20.97920385
5							
6		C1SB1_1	C1SB1_2	C1SB1_3	C1SB1_4	C1SB2_1	C1SB2_2
7	Total Length (m)	1315.42957	1307.39714	328.53026	728.40759	1862.79954	1027.48445
8	Total Time (s)	0.086181574	0.087177861	0.027013484	0.059934348	0.093264665	0.06742523
9	Leftward	15.26346647	14.99689399	12.16171359	12.15342486	19.97326151	15.23887194

Figure 2.22: Calculation works (6)

3. Create another sheet for calculations of Traffic Capacity, PCU, Persons, % of Truck, % of PUV, and % of MC.

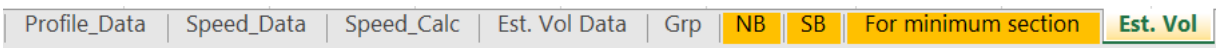


Figure 2.23: Calculation works (7)

3. Using QGIS, zoom to the road section being considered based on the corridor database profile map. Select a link (line feature) within its extent.

5. In the excel sheet, input the unique “LB” code for each NB and SB link in Rows 2 and 3. The cells below should be automatically filled out. If a road section has only 1 link both for NB and SB, check the arrowhead if it is going NB or SB and input the code in either NB or SB and leave the other as blank.

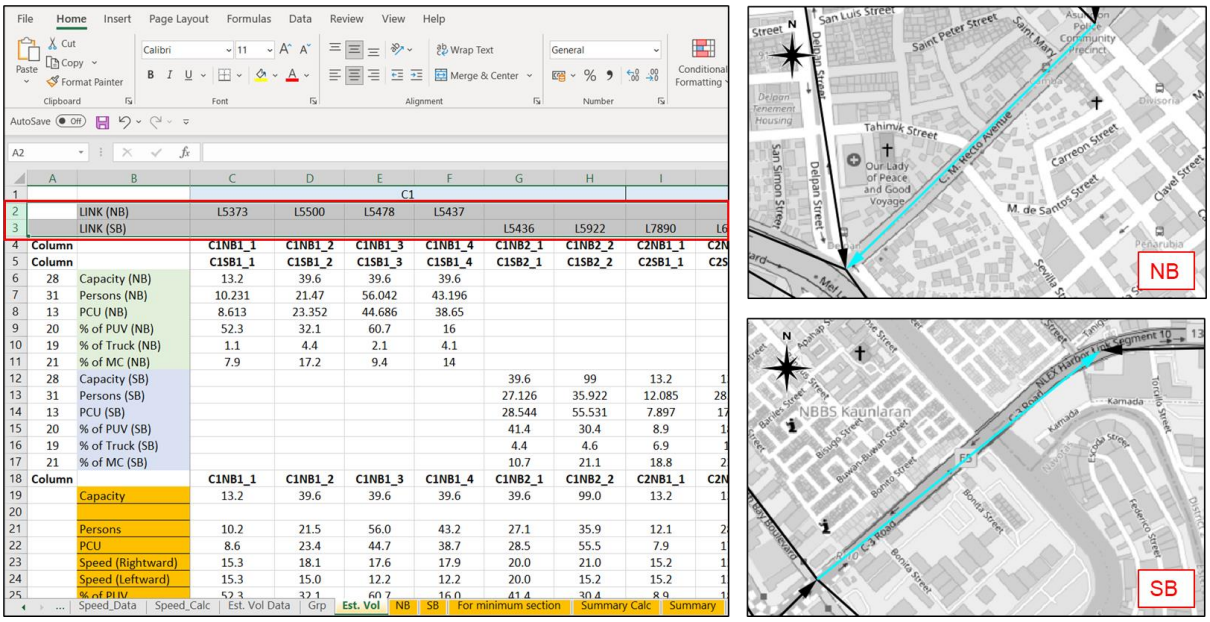


Figure 2.24: Calculation works (8)

6. The data are calculated to get the average values of Capacity, Persons, PCU, % of PUV, % of truck, % of MC for NB and SB.

7. For speed, the values are from the sheet where speed calculations were made.

	A	B	C	D	E	F	G
1			C1				
19		Capacity	13.2	39.6	39.6	39.6	39.6
20							
21		Persons	10.2	21.5	56.0	43.2	27.1
22		PCU	8.6	23.4	44.7	38.7	28.5
23		Speed (Rightward)	15.3	18.1	17.6	17.9	20.0
24		Speed (Leftward)	15.3	15.0	12.2	12.2	20.0
25		% of PUV	52.3	32.1	60.7	16.0	41.4
26		% of Truck	1.1	4.4	2.1	4.1	4.4
27		% of MC	7.9	17.2	9.4	14.0	10.7

Figure 2.25: Calculation works (9)

MS Excel functions used for the calculations can be found in Table 9.3.

Table 2.3: Useful Excel functions using in the calculation of indicators

IF	Logical function that returns value if a condition is true or a condition is false
SUMIF	Calculates the sum of a range based on a condition

SUMPRODUCT	Sums the product of a range
CONCATENATE	Joins two or more text strings into one string
MAXIF	Returns the maximum value of a range based on a condition
MINIF	Returns the minimum value of a range based on a condition
AVERAGEIF	Returns the average value of a range based on a condition
VLOOKUP	Finds the value in a range by row
INDEX	Returns the value in a range by row and column
MATCH	Locates the specified item in a range and returns the lookup value
IFERROR	Returns a specified value if the formula evaluates an error
LEFT	Returns the first character in a text string based on specified number of characters
OR	Logical function that returns true if any of the condition is true, and false if neither is true
AND	Logical function that returns true if both conditions are true, and false if any or none is true
ROUND	Rounds a number to a specified number of digits

2.1.5.3 Setting the equations of the excel function

1. Create another sheet for summary calculations.

2. Copy the format of the corridor database profile sheets. Align the sheets of each corridor by row.

3. On the left side, calculate the average, minimum, maximum, and total values per item. These values will be used in Summary.

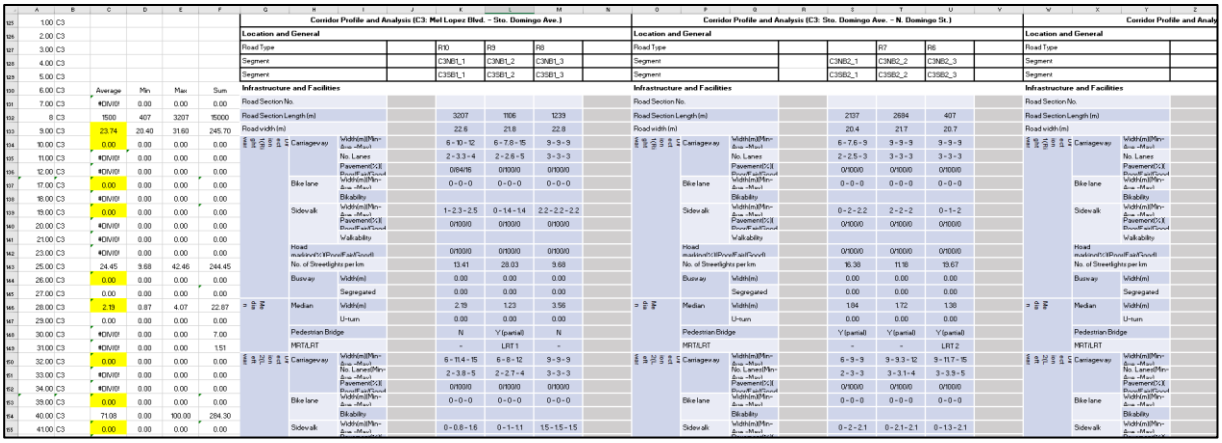


Table 2.4: Calculation works (1)

2.1.6 Summary of Data

1. Create another sheet to calculate the minimum, maximum, average, and total values per item on each corridor.

2. The table below shows the format for the Summary data.

1		Corridor		C1	C2	C3	C4	C5	C6	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
2	8	Length (km)		6.0	11.2	15.0	28.3	36.1	16.2	10.2	17.0	24.4	14.0	8.6	13.6	28.0	22.7	15.3	6.2
3	9	Total Width Ave (m)		25.4	23.8	23.7	32.9	37.1	28.4	43.0	21.7	21.3	18.5	14.4	19.3	27.5	24.0	20.7	17.0
4	9	Total Width Min (m)		17.8	11.3	20.4	16.7	24.7	27.3	34.8	11.6	16.1	10.6	13.1	13.4	15.4	10.5	9.8	16.3
5	9	Total Width Max (m)		38.6	35.6	31.6	45.7	43.5	29.1	58.5	29.2	30.7	25.1	17.0	27.0	47.9	34.0	30.2	17.9
6	10	NB	Carriageway width (m)	8.5	8.0	9.6	13.2	10.0	6.0	13.9	7.1	6.2	5.1	6.7	8.7	13.0	5.9	6.9	14.0
7	10		Carriageway width Min (m)	6.0	3.0	6.0	6.0	3.0	6.0	6.0	3.0	3.0	3.0	6.0	6.0	3.0	3.0	6.0	9.0
8	10		Carriageway width Max (m)	12.0	12.0	15.0	21.0	18.0	9.0	30.0	15.0	12.0	12.0	9.0	15.0	27.0	15.0	18.0	18.0
9	15		No. of Lanes	2.8	2.6	3.2	4.4	3.4	2.0	2.9	2.6	3.1	3.0	2.5	2.9	4.3	2.0	2.3	4.7
10	13		No. of Lanes Min	2	1	2	2	2	2	2	1	1	1	2	2	1	1	2	3
11	14		No. of Lanes Max	4	4	5	7	9	3	5	6	6	9	6	5	9	5	6	6
12	16		Carriageway Pavement(%) (Poor/Fair/Good)	0/83/17	0/97/3	0/91/9	0/59/41	0/83/17	0/100/0	0/30/70	0/92/8	0/93/7	0/82/18	0/75/25	0/28/72	1/62/37	0/76/24	0/100/0	0/92/8
13	17		Bike lane width(m)	1.0	0.1	0.3	1.6	1.5	0.0	1.0	0.3	0.3	0.7	1.8	1.5	1.4	1.0	0.0	0.0
14	17		Bike lane width(m) Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	17		Bike lane width(m) Max	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	1.5	2.0	2.0	2.0	2.0	2.0	0.0	0.0
16	17		Bike lane % of available length	51	4	19	81	90	-	49	28	20	37	91	100	81	49	-	-
17	19		Sidewalk Width (m)	2.8	4.8	2.0	2.3	0.6	0.0	1.2	1.4	2.1	1.5	1.7	0.1	0.4	1.2	0.0	0.0
18	19		Sidewalk Width (m) Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	19		Sidewalk Width (m)Max	24.7	27.1	3.9	18.0	12.0	1.2	5.4	2.1	3.4	2.6	2.8	1.8	4.0	2.7	0.0	0.0
20	22		Sidewalk condition(%) (Poor/Fair/Good)	0/91/9	1/97/3	0/100/0	0/96/4	0/77/23	0/100/0	0/51/49	0/97/3	0/90/10	1/94/5	0/92/8	0/77/23	0/82/18	0/77/23	0/97/3	0/93/7
21	19		Sidewalk % of available length	94	96	99	93	95	25	67	99	94	90	98	97	54	93	97	92
22	24		Road marking(%) (Poor/Fair/Good)	7/79/14	16/84/0	0/94/5	0/50/50	0/79/21	80/20/0	0/48/52	0/100/0	0/90/10	27/58/14	0/77/23	0/29/71	8/56/36	0/73/27	0/100/0	0/95/5
23	25		Streetlight(No./km)	43.9	44.3	21.1	26.4	23.2	16.3	54.4	59.2	25.0	35.7	38.3	29.9	38.8	37.6	34.3	29.6
24	26		Bus lane width(m)	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	27		Bus Segregated(%)	-	-	-	82	-	-	-	-	-	-	-	-	-	-	-	-
26	28	Median	Median width(m)	4.30	1.61	2.19	1.97	3.37	2.71	2.10	3.17	1.21	0.92	0.49	4.71	6.93	0.39	5.28	2.94
27	29		U-turn	0.00	0.00	0.00	7.00	0.00	0.00	0.00	10.00	0.00	0.00	1.00	152.00	47.00	5.00	0.00	0.00

Figure 2.26: Summary data (1)

1		Corridor		C1	C2	C3	C4	C5	C6	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
28	30	Median	Pedestrian Bridge	2	5	7	15	15	1	0	0	0	0	0	7	13	9	4	0
29	31		MRT/LRT(%)	43%	12%	10%	83%	0%	0%	0%	0%	0%	0%	0%	100%	43%	0%	49%	0%
30	32	SB	Carriageway width (m)	8.8	8.1	10.1	13.2	10.7	6.0	11.9	6.9	7.0	4.9	6.7	8.4	13.4	6.1	6.9	13.2
31	32		Carriageway width Min (m)	6.0	3.0	6.0	6.0	6.0	6.0	6.0	3.0	3.0	3.0	6.0	6.0	3.0	3.0	6.0	9.0
32	32		Carriageway width Max (m)	15.0	12.0	15.0	18.0	18.0	9.0	18.0	15.0	18.0	9.0	9.0	15.0	27.0	15.0	18.0	18.0
33	37		No. of Lanes	2.9	2.7	3.4	4.4	3.5	2.0	2.6	3.6	2.2	1.9	2.2	2.8	4.5	2.0	2.3	3.8
34	35		No. of Lanes Min	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	1.0	2.0	2.0	1.0	1.0	2.0	2.0
35	36		No. of Lanes Max	5.0	6.0	5.0	6.0	6.0	3.0	5.0	9.0	6.0	3.0	3.0	5.0	9.0	5.0	6.0	6.0
36	38		Carriageway Pavement(%) (Poor/Fair/Good)	2/87/11	1/98/1	0/81/19	0/78/22	0/75/25	0/100/0	0/65/35	0/100/0	0/78/22	0/87/13	0/64/36	0/33/67	1/43/55	0/77/23	0/85/15	0/97/3
37	39		Bike lane width(m)	0.8	0.2	0.4	1.6	1.6	0.0	1.5	0.3	0.6	0.6	1.8	1.4	1.4	0.9	0.0	0.0
38	39		Bike lane width(m) Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	39		Bike lane width(m) Max	2.0	2.0	2.0	3.0	2.0	0.0	2.0	2.0	3.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0
40	39		Bike lane % of available length	40	12	21	80	95	-	76	35	40	34	91	93	80	44	-	-
41	41		Sidewalk Width (m)	1.8	3.0	1.6	1.9	0.6	0.0	1.4	1.6	1.1	1.4	1.7	0.1	0.3	1.4	0.0	0.0
42	41		Sidewalk Width (m) Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	41		Sidewalk Width (m)Max	3.1	27.1	3.6	8.1	2.6	0.6	2.6	2.6	4.6	2.6	2.8	2.5	4.0	2.7	0.0	0.0
44	44		Sidewalk condition(%) (Poor/Fair/Good)	0/97/3	0/99/1	0/90/10	0/73/27	0/89/11	0/100/0	0/71/29	0/97/3	1/80/19	1/95/4	0/95/5	0/80/20	0/78/22	0/78/22	0/69/31	8/92/0
45	44		Sidewalk % of available length	94	93	99	94	98	99	65	99	100	96	98	95	83	94	99	90
46	46		Road marking(%) (Poor/Fair/Good)	6/83/11	12/88/0	12/71/17	0/78/22	11/66/22	80/20/0	0/70/30	0/100/0	3/76/21	27/64/9	0/68/32	1/30/69	5/37/58	7/66/26	1/89/10	0/98/2
47	47		Streetlight(No./km)	37.8	34.2	19.8	35.0	20.5	10.1	46.9	51.1	28.2	38.9	40.8	30.0	40.7	31.7	34.1	39.5
48	48		Bus lane width(m)	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	49		Bus Segregated(%)	-	-	-	75	-	-	-	-	-	-	-	-	-	-	-	-
50			VCR	0.70	0.68	0.90	1.72	0.60	0.70	0.50	0.50	0.76	1.11	0.67	1.00	0.70	0.91	0.82	1.35
51	54		Ave. Capacity(000)	42.8	40.8	26.1	145.2	108.5	30.8	89.5	38.9	60.1	12.3	46.7	51.2	110.5	36.1	28.5	23.7
52	54		Min Capacity(000)	13.2	13.2	13.2	13.2	15.4	30.8	15.4	33.0	16.5	8.8	16.5	26.4	15.4	13.2	16.5	19.8
53	54		Max Capacity(000)	99.0	66.0	39.6	180.0	165.0	30.8	132.0	49.5	132.0	24.8	66.0	132.0	165.0	66.0	39.6	26.4

1		Corridor		C1	C2	C3	C4	C5	C6	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
54	56	Demand	Ave. Pax(000)	28.2	36.7	28.2	114.1	79.6	42.1	80.8	67.7	100.8	17.2	23.8	79.6	71.2	52.1	34.3	40.2
55	56		Min Pax(000)	10.2	12.1	2.7	12.5	10.0	21.2	12.8	4.3	13.8	1.5	8.2	13.8	6.6	4.0	16.3	14.9
56	56		Max Pax(000)	56.0	72.2	49.9	171.1	196.7	47.8	129.7	107.4	210.3	90.4	39.0	204.3	228.9	132.2	50.1	70.2
57	57		Ave. PCU(000)	29.9	27.7	23.6	250.0	65.4	21.6	44.5	19.6	45.9	13.6	31.1	51.2	77.1	32.9	23.4	32.0
58	57		Min PCU(000)	8.6	7.9	7.7	15.4	10.8	21.6	12.2	7.5	8.3	2.7	18.9	15.5	14.2	13.7	16.0	15.9
59	57		Max PCU(000)	55.5	44.6	35.8	393.4	150.1	21.6	80.2	29.0	126.3	38.3	60.6	115.4	150.2	61.3	35.1	46.8
60	60		% of PUV	39	18	33	18	20	21	17	39	21	32	26	25	19	21	16	13
61	60		% of PUV Min	16	9	1	8	0	19	14	20	7	12	20	8	10	9	7	10
62	60		% of PUV Max	61	23	96	29	63	24	20	65	31	67	35	54	44	35	31	16
63	61		% of truck	4	9	11	8	6	3	8	1	8	0	5	10	10	10	11	30
64	61		% of truck Min	1	2	0	1	0	0	0	0	3	0	3	2	5	1	2	23
65	61		% of truck Max	5	22	29	16	15	4	21	8	24	1	8	21	21	23	27	39
66	62		% of MC	13	19	15	16	13	55	13	28	33	6	15	10	19	18	27	18
67	62		% of MC Min	8	13	2	9	0	29	0	9	6	0	9	4	9	8	9	14
68	62		% of MC Max	21	24	25	39	27	62	25	49	65	28	21	15	32	31	48	22

Figure 2.27: Summary data (1)

3. In the same sheet as the summary data, the table below reflects the problems that need to be addressed per corridor. The check marks are based on the values of the summary data.

		C1	C2	C3	C4	C5	C6	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
ROW	ROW is inconsistency		✓											✓	✓	✓	
	ROW has narrowing section		✓		✓				✓		✓			✓	✓	✓	
	Low capacity(VCR>0.9)			✓	✓						✓		✓		✓		✓
Carriageway	Carriageway is inconsistency		✓	✓	✓	✓		✓	✓	✓	✓			✓	✓		
	Carriageway has narrowing section		✓	✓	✓	✓		✓	✓	✓	✓			✓	✓		
	Poor road marking (length>0)	✓	✓	✓		✓	✓			✓	✓		✓	✓	✓	✓	
	Poor road pavement (length>0)	✓	✓											✓			
Bike lane	Unavailable/Low availability (% of length<50%)	✓	✓	✓			✓	✓	✓	✓	✓				✓	✓	✓
	Different width between direction (difference more		✓	✓			✓	✓	✓	✓	✓					✓	✓
Sidewalk	Unavailable/Low availability (% of length<80%)						✓	✓						✓			
	Different width between direction (difference more	✓	✓	✓	✓	✓	✓			✓			✓	✓		✓	✓
	Poor condition (length>0)		✓							✓	✓						✓
	Sidewalk has narrowing section	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		
Traffic light	Streetlight is not enough (No/km is lower than 20			✓			✓										

Figure 2.28: Summary data (1)

2.1.7 Final Output

The final output for the corridor profile is compiled in a PPT file, a sample of which is Figure 2.29. There will be a sheet for each segment of each corridor, showing the physical characteristics for each road section. The following steps were taken for the compilation and analysis:

1. Copy and paste the values from the Summary Calculations to the corridor database profile sheet.

2. To efficiently copy and paste, arrange the cells in Summary Calculations in a way that follows the order of the items in corridor database profile sheet.

3. The corridor profile sheet is in .ppt format.

The Corridor Profile should be used to identify the reason for congestion to formulate traffic management measures. Examples of identifying and solving problems using physical characteristics followings:

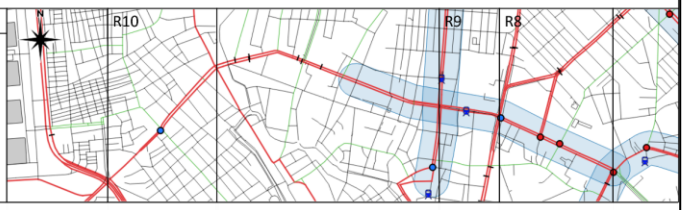
- ✓ Low speed and narrow width → consider widening the road
- ✓ Narrow sidewalk width and many pedestrians → widen and improve sidewalks
- ✓ Not enough streetlights → installation of additional lights
- ✓ Inconsistencies in upstream and downstream side → widening of road, carriageway, and sidewalk or increase in no. of lanes
- ✓ Few road markings → install additional
- ✓ Poor sidewalk conditions → improve or smoothen the sidewalk
- ✓ No bike lane and no sidewalk → consider installing
- ✓ Inconsistencies in each corridor (large gap) → sections should be uniform

Corridor Profile and Analysis (C1: Mel Lopez Blvd. – Legarda St.)

Location and General

Road Type

Legend
Road Class
Expressway A C
B D,E
RailwayStation
Pedestrian Bridge
Segment Bottleneck
TBN Signal Category
No Signal With Signal



Infrastructure and Facilities

Road Section No.				1	2	3	4	
Road Section Length (m)				879	1483	423	701	
Road width (m)				24.7	24.7	24.1	23.7	
Direction1(Rightward)	Carriageway	Width(m)(Min-Ave.-Max)		6 - 9.2 - 12	6 - 9.2 - 12	6 - 8.1 - 9	9 - 9 - 9	
		No. Lanes		2 - 3.1 - 4	2 - 3.1 - 4	2 - 2.6 - 3	3 - 3 - 3	
		Pavement(%)(Poor /Fair/Good)		0/100/0	0/100/0	0/100/0	0/100/0	
	Bike lane	Width(m)(Min-Ave.-Max)		0 - 0 - 0	0 - 0.2 - 2	0 - 0 - 0	0 - 1.3 - 2	
		Bikability						
	Sidewalk	Width(m)(Min-Ave.-Max)		1.6 - 1.6 - 1.6	0 - 1.9 - 3.4	0 - 14.5 - 24.7	0 - 1.1 - 3.4	
		Pavement(%)(Poor /Fair/Good)		0/100/0	0/100/0	0/100/0	0/100/0	
		Walkability						
	Road marking(%)(Poor/Fair/Good)			46/54/0	0/100/0	0/100/0	0/100/0	
	No. of Streetlights per km			56.89	41.13	47.27	49.96	
	Busway	Width(m)		0.00	0.00	0.00	0.00	
		Segregated		0.00	0.00	0.00	0.00	
Median	Median	Availability		4.73	6.48	7.00	6.65	
		U-turn		0.00	0.00	0.00	0.00	
	Pedestrian Bridge			N	Y (partial)	N	N	
	MRT/LRT			-	LRT 2	LRT 2	LRT 2	
Direction2(Leftward)	Carriageway	Width(m)(Min-Ave.-Max)		6 - 10.8 - 15	9 - 9 - 9	9 - 9 - 9	6 - 8 - 9	
		No. Lanes(Min-Ave.-Max)		2 - 3.6 - 5	3 - 3 - 3	3 - 3 - 3	2 - 2.7 - 3	
		Pavement(%)(Poor /Fair/Good)		11/89/0	0/100/0	0/100/0	0/100/0	
	Bike lane	Width(m)(Min-Ave.-Max)		0 - 0 - 0	0.3 - 0 - 2	0 - 0 - 0	0 - 0 - 0	
		Bikability		0.00	15.80	0.00	0.00	
	Sidewalk	Width(m)(Min-Ave.-Max)		0 - 1.5 - 2	0 - 1.9 - 2.8	2.2 - 2.2 - 2.2	0 - 2 - 2.2	
		Pavement(%)(Poor /Fair/Good)		0/100/0	0/100/0	0/100/0	0/100/0	
		Walkability		80.00	96.60	100.00	98.70	
	Road marking(%)(Poor/Fair/Good)			37/63/0	0/100/0	0/100/0	0/100/0	
	No. of Streetlights per km			54.87	50.57	31.09	33.21	
	Busway	Width(m)		0.00	0.00	0.00	0.00	
		Segregated		0.00	0.00	0.00	0.00	
Pedestrian Crossing (At-grade)		Total						
		With Signal						
No. of Intersections		Total						
		T-junction						
Estimated Traffic Capacity (000PCU/day)				13.20	39.60	39.60	39.60	
Traffic Demand Characteristics								
AADT		No.(000)		10.23	21.47	56.04	43.20	
		PCU(000)		8.61	23.35	44.69	38.65	
Travel speed (kph/6hr-20hr)		Rightward		15.34	18.07	17.62	17.92	
		Leftward		15.26	15.00	12.16	12.15	
Traffic characteristics		% of PUV		52.30	32.10	60.70	16.00	
		% of truck		1.10	4.40	2.10	4.10	
		% of MC		7.90	17.20	9.40	14.00	

Figure 2.29: Corridor profile sheet

3 CORRIDOR ANALYSIS SHEETS

The corridor analysis sheets can be used to identify bottlenecks and countermeasures using the corridor database. In addition, the information can be used to justify the budget for proposed countermeasures. The contents are based on the results of the inventory survey.

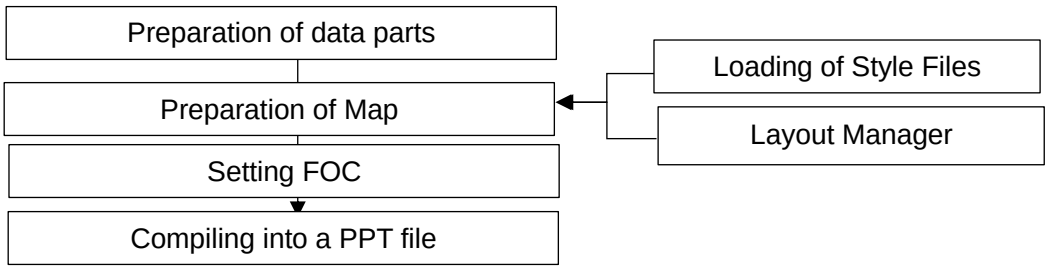


Figure 3.1: Workflow of the development of corridor analysis sheets

Throughout the preparation of the corridor analysis sheets, the following files will be used:

a 01_Longlist of Potential TBN

Excel file. Input 1 on the applicable traffic problems for all corridors.

The file will generate the check marks, which corresponds with the PPT file.

b 20220721_PP3_All

PPT Format

This will be the final output. The input will come from the Excel file.

c GIS Files

For checking of the accuracy of the road inventory items

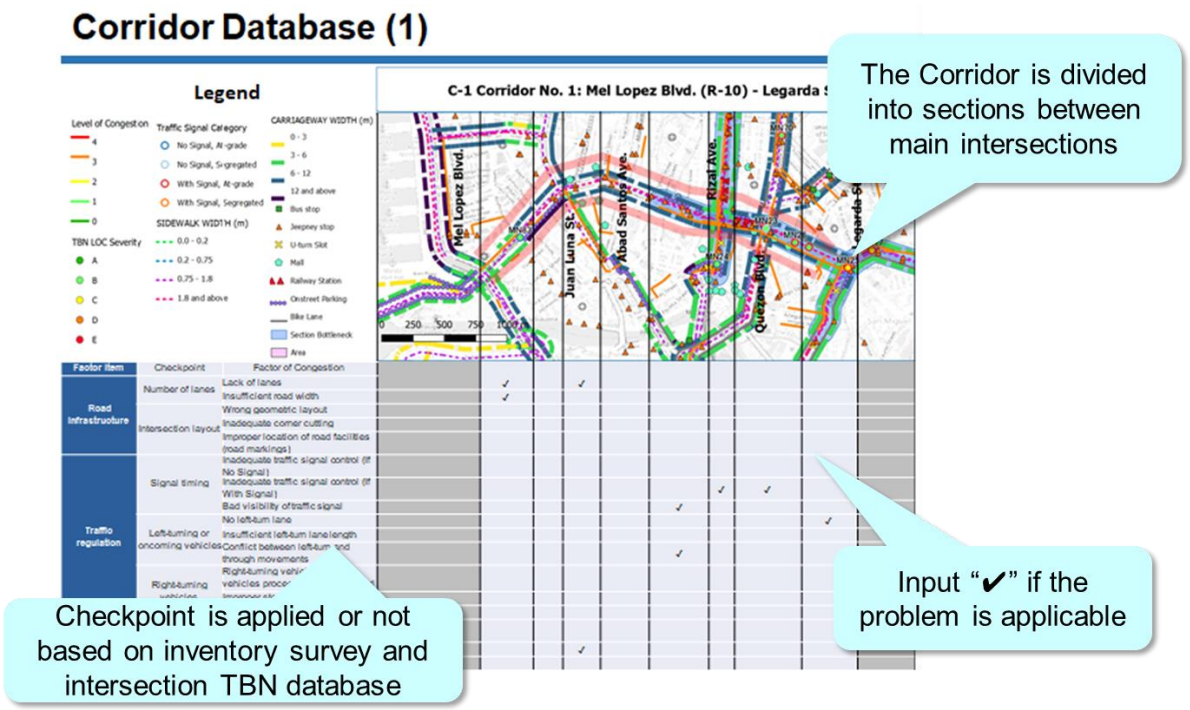


Figure 3.2: Corridor analysis sheets

The Factor of Congestion (FOC) is applicable to an intersection or segment if it contributes to the traffic congestion. The staff of developing the database to check section data whether it is applied or not, and if the criteria is applied, the checkmark should be marked in each section in the row of the FOC.

Table 3.1: Factor of Congestion (FOC)

Factor item	Checkpoint	Factor of Congestion
Road infrastructure	Number of lanes	Lack of lanes
		Insufficient road width
	Intersection layout	Wrong geometric layout
		Inadequate corner cutting
		Improper location of road facilities (road markings)
Traffic regulation	Signal timing	Inadequate traffic signal control (If no Signal)
		Inadequate traffic signal control (If with Signal)
		Bad visibility of traffic signal
	Left-turning or oncoming vehicles	No left-turn lane
		Insufficient left-turn lane length
		Conflict between left-turn and through movements
	Right-turning vehicles	Right-turning vehicles blocking vehicles proceeding straight ahead
		Improper stop line position
		Improper channelization
Traffic situation	Large vehicle	Speed reduction due to large vehicle
		Obstruction by motorcycles
		Obstruction by bicycles
		Obstruction by pedestrians
Environment of Roadside and intersection	Railway Crossing	Stopped traffic at at-grade railway crossings
	Driveway from roadside shop	Traffic flow in/out from intersections and narrow streets
		Traffic flow in/out from ICs at expressways

Factor item	Checkpoint	Factor of Congestion
	PUJ, PUV	Speed reduction due to PUV stops
		Speed reduction due to PUJ stops
		Lane reduction with dedicated bus and priority lanes
	On-street parking	Obstruction of travel by on-street parking
Traffic Demand	Over capacity	Excess traffic capacity at intersections
		Excess traffic capacity at non-intersections
	Concentrated traffic	Concentration of traffic at specific times
		Concentration of traffic on roadside facilities at specific times and periods
		Concentration of traffic at specific periods during events or incidents
Others	Construction	Lane blockage due to construction
	Clogging of downstream	Clogging with congestion downstream
	Other	Pedestrian is obstructed
		Bike is obstructed
		Motorcycle is obstructed
	Free Comment (if any)	

3.1 Parts of the Corridor Analysis Sheet

The corridor analysis sheets were compiled in a PPT file and were developed using the format shown in Figures 3.3 and 3.4.

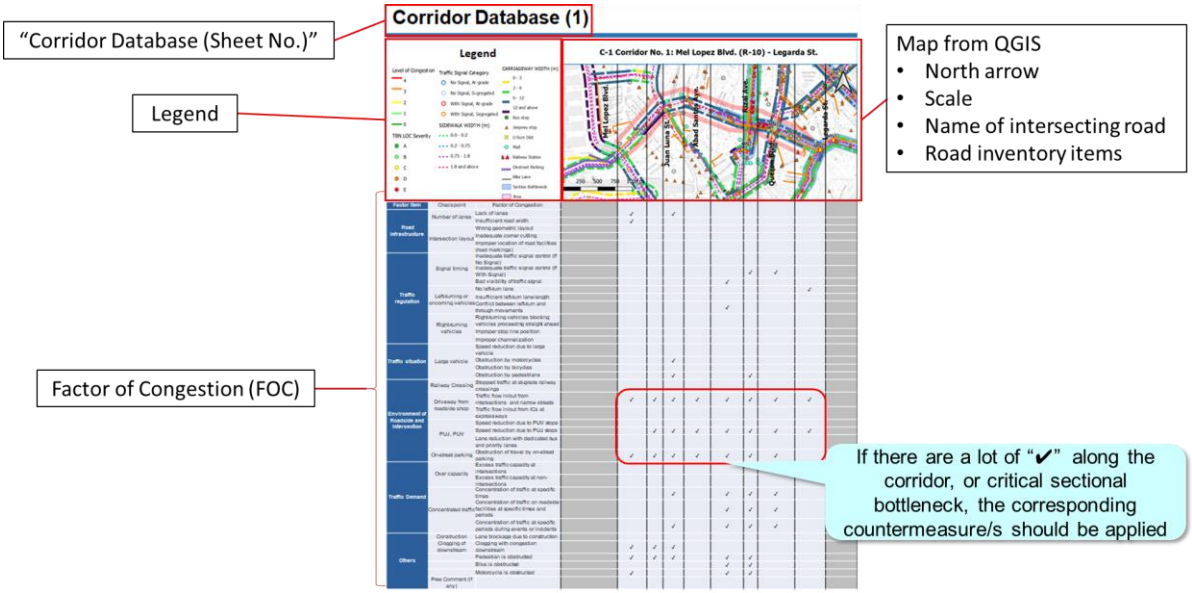


Figure 3.3: Parts of the Corridor Analysis Sheet

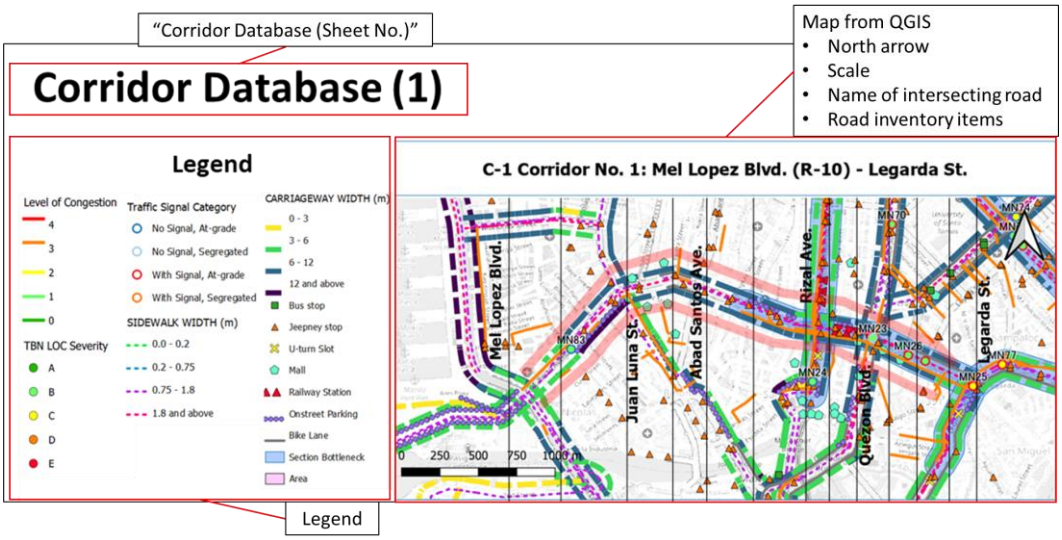


Figure 3.4: Legend

3.2 Preparation of the Maps

The map for each corridor analysis was developed by loading the pre-set style files and formulated using the layout manager in QGIS.

3.2.1 Loading of Style Files

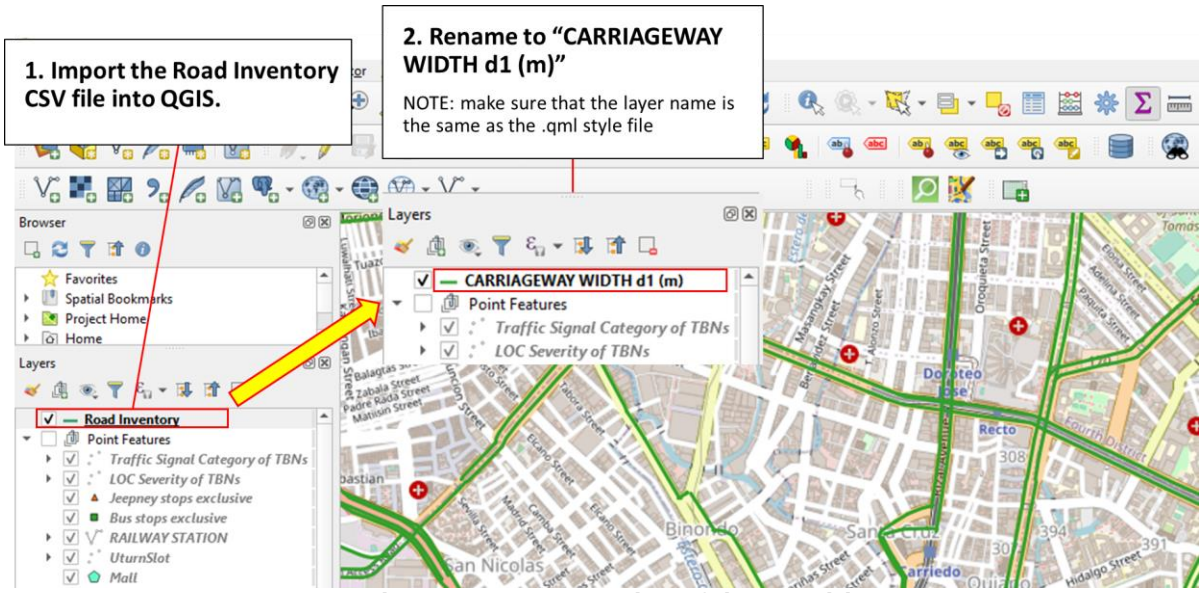


Figure 3.5: Preparation of the Map (1)

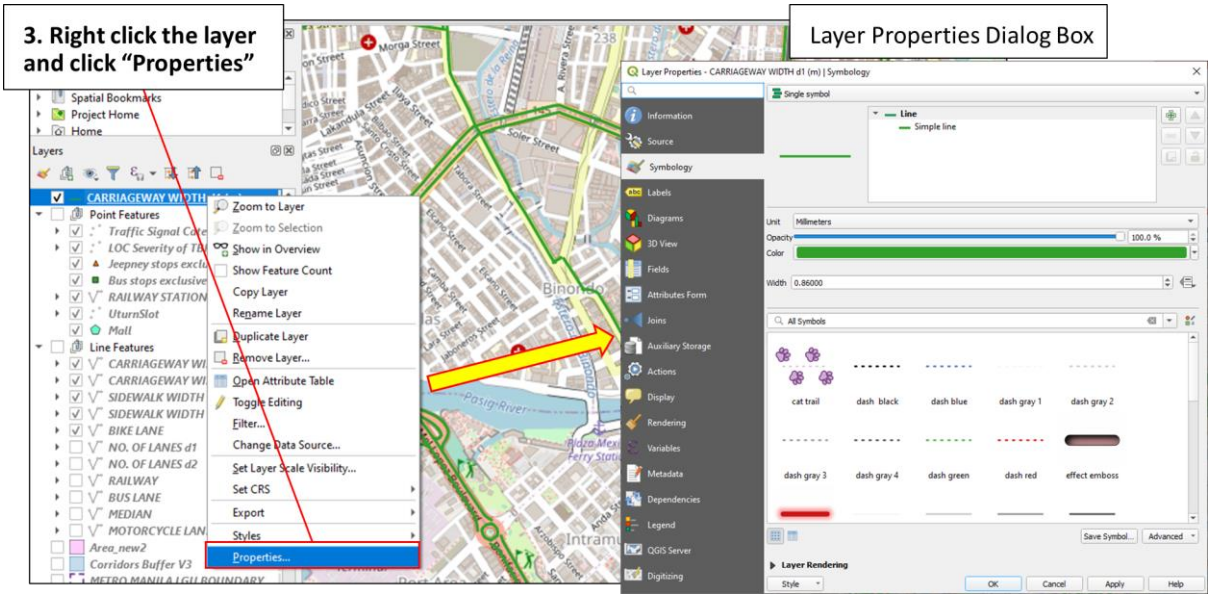


Figure 3.6: Preparation of the Map (2)

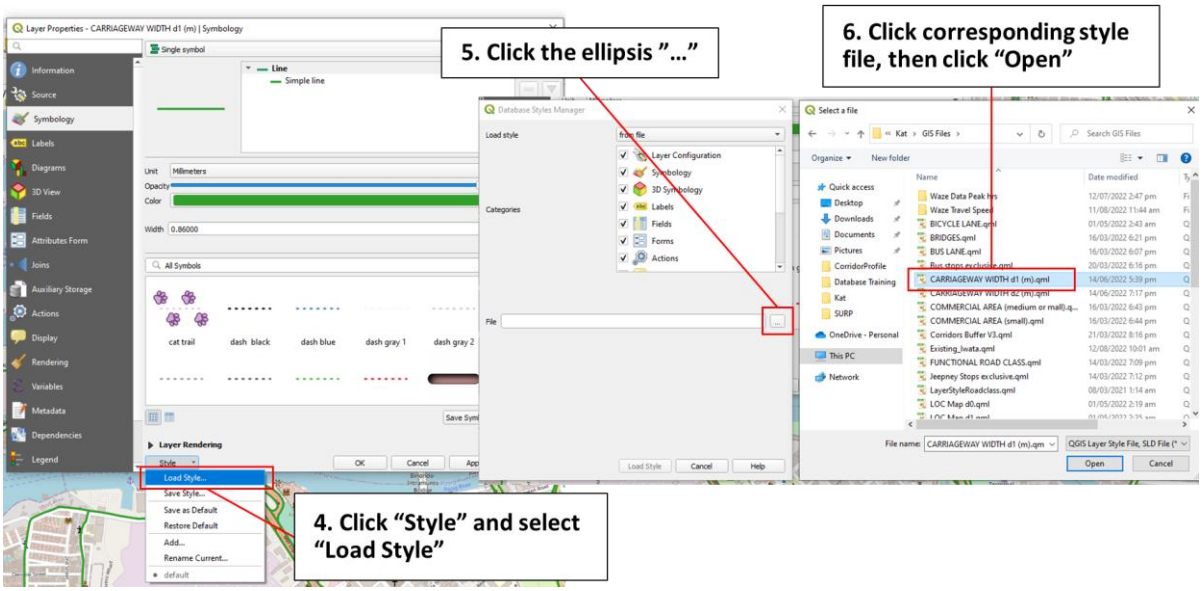


Figure 3.7: Preparation of the Map (3)

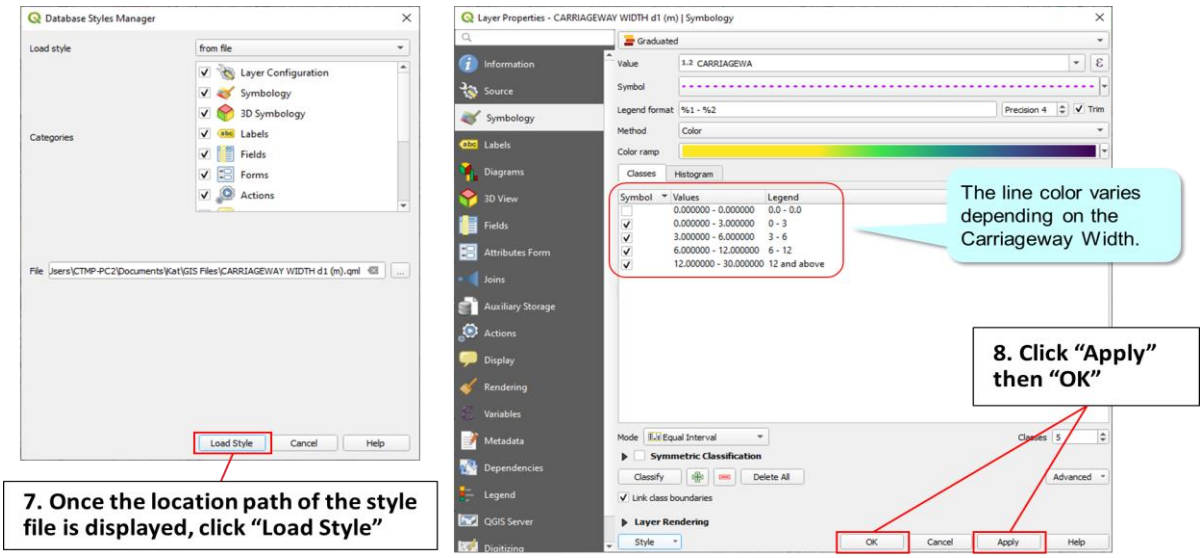


Figure 3.8: Preparation of the Map (4)

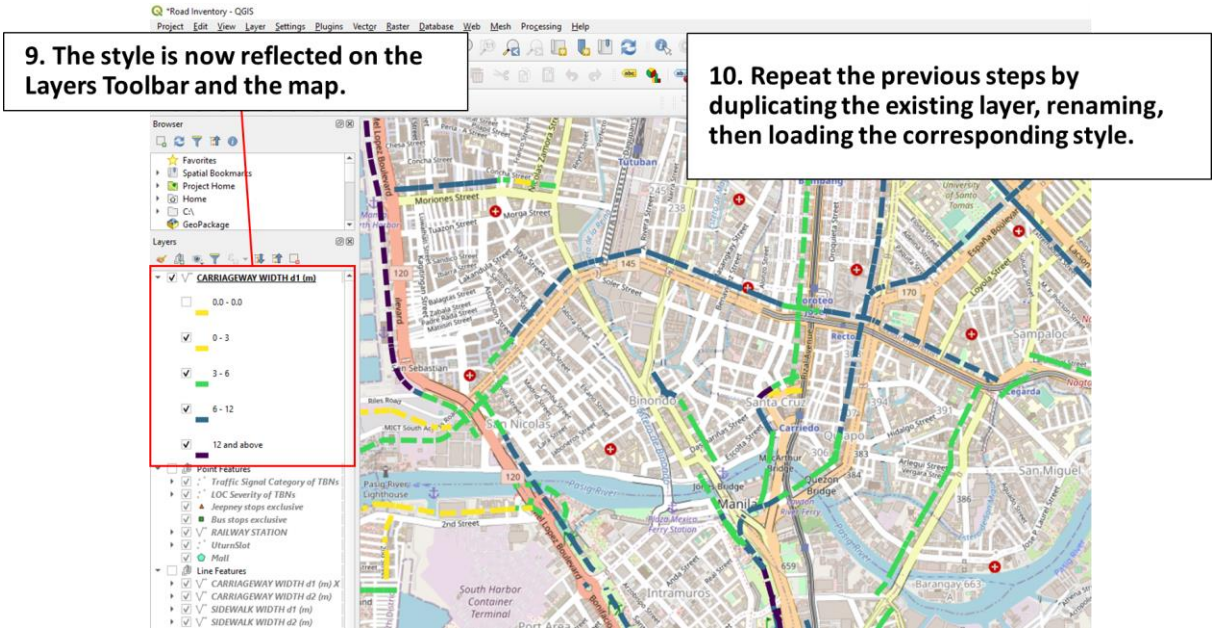


Figure 3.9: Preparation of the Map (5)

3.2.2 Layout Manager

After loading the corresponding style files, the layout manager can be used to create the map part of corridor analysis sheets as follows:

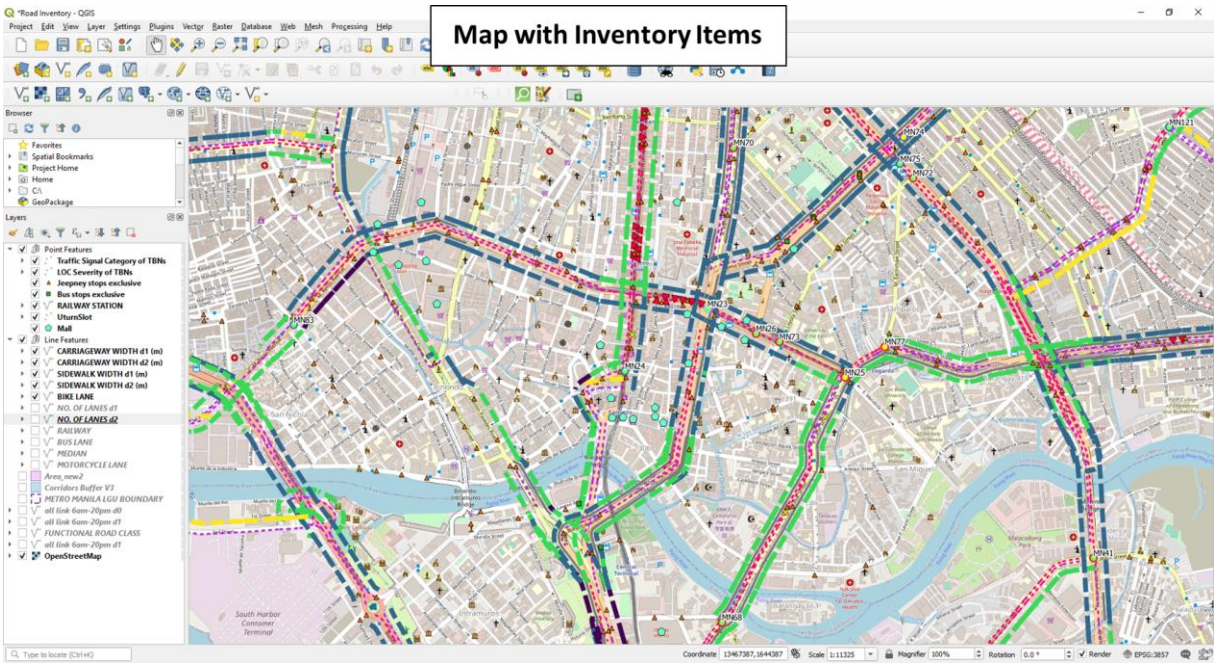


Figure 3.10: Layout Manager (1)

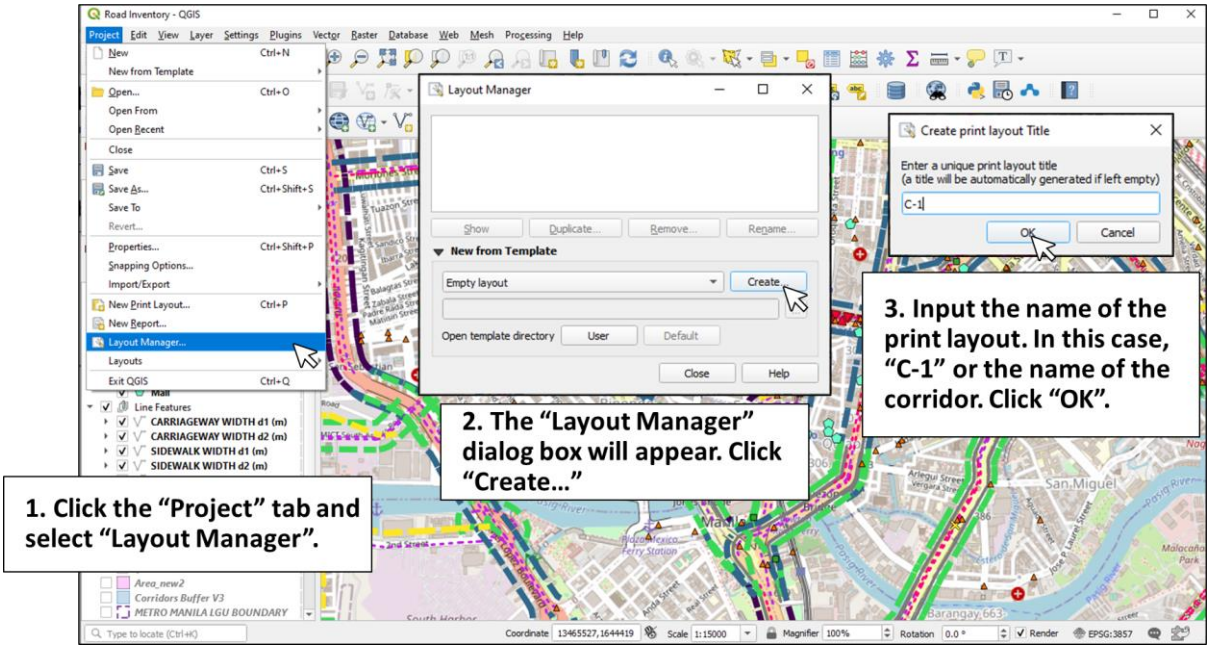


Figure 3.11: Layout Manager (2)

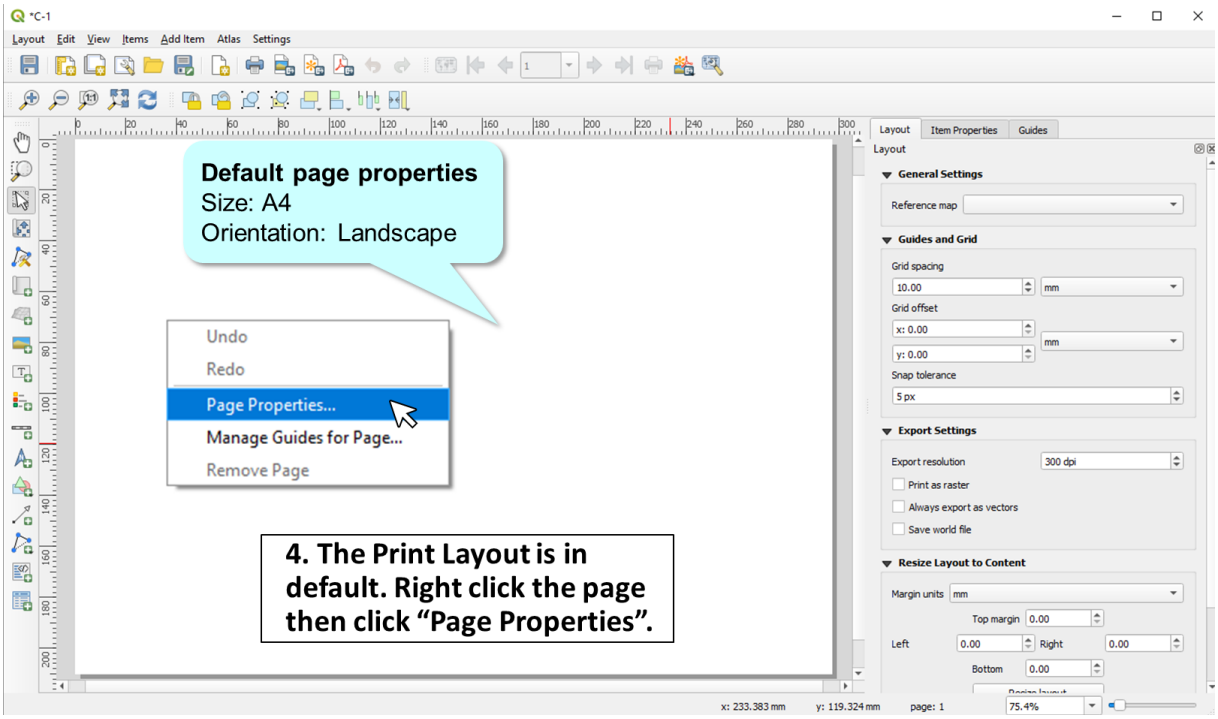


Figure 3.12: Layout Manager (3)

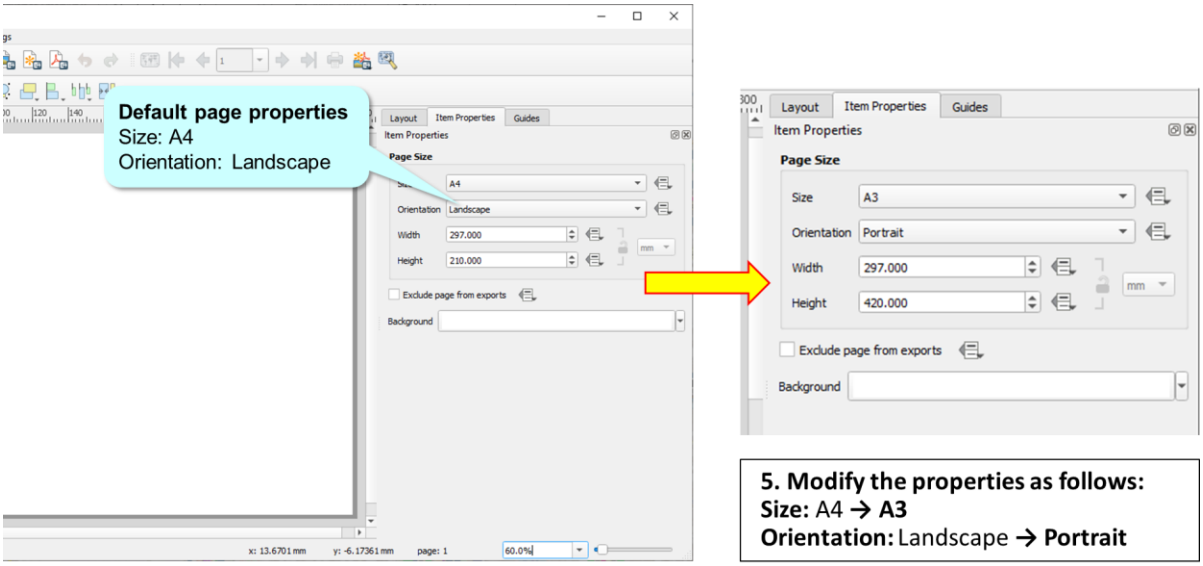


Figure 3.13: Layout Manager (4)

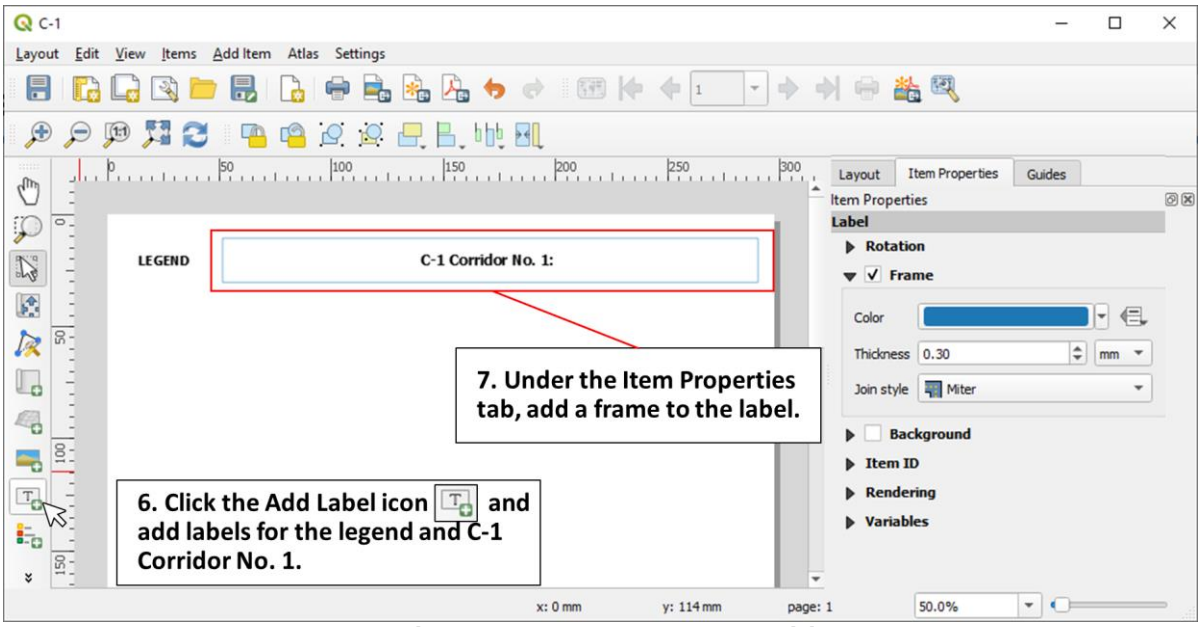


Figure 3.14: Layout Manager (5)

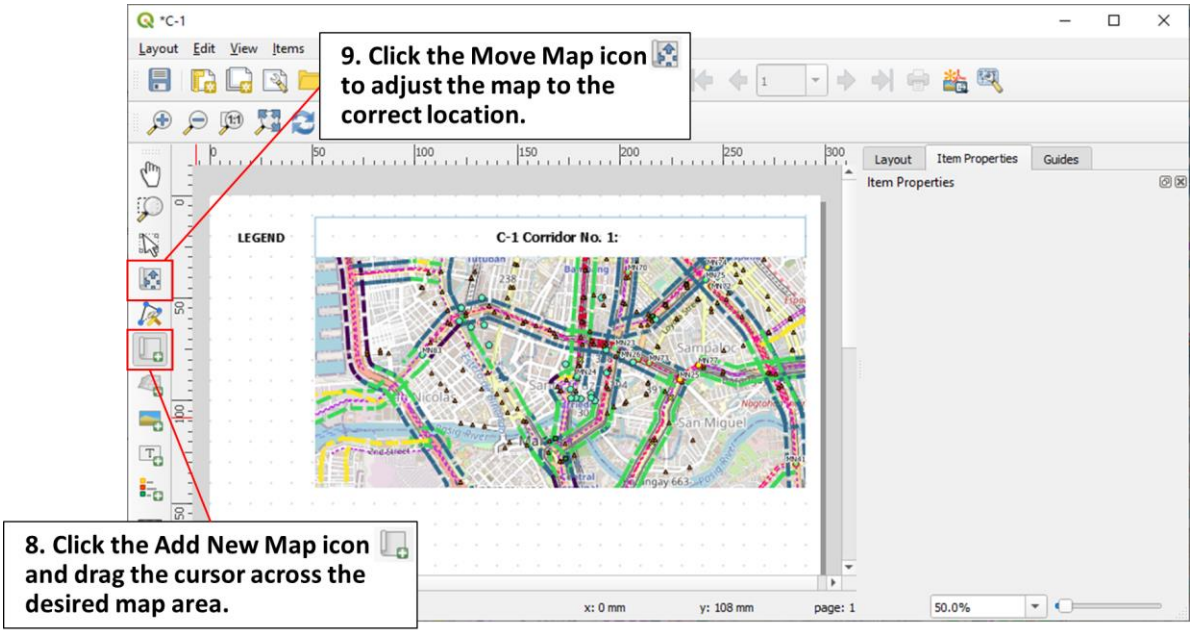


Figure 3.15: Layout Manager (6)

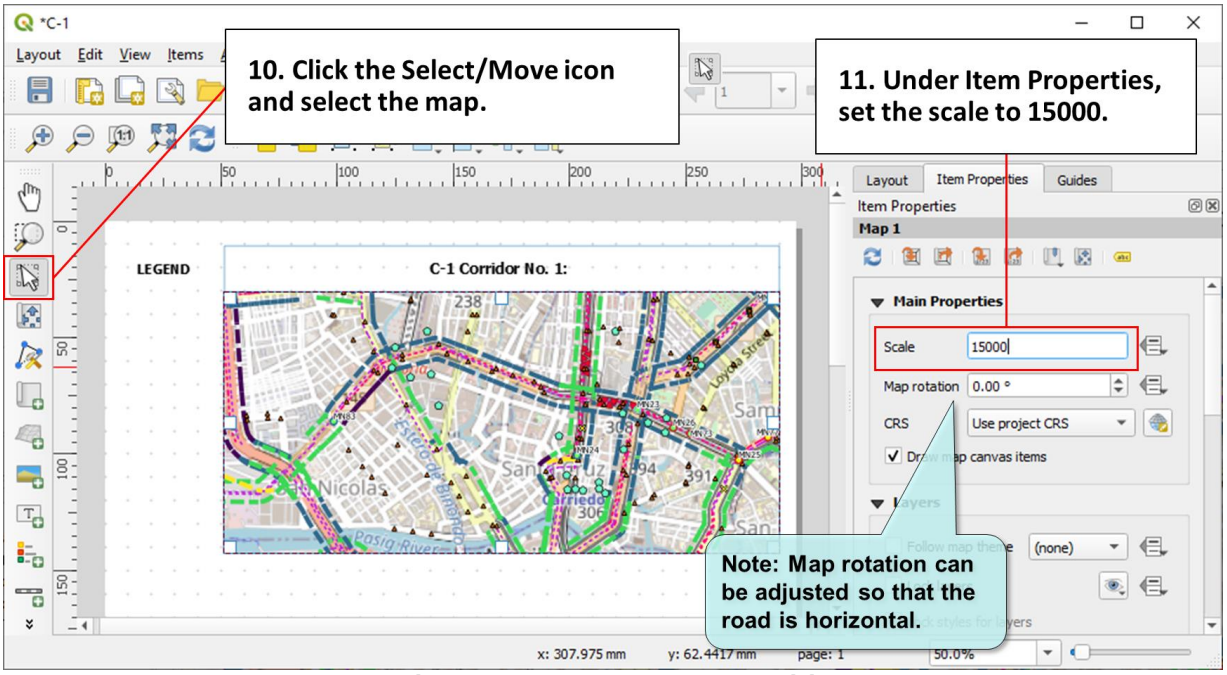


Figure 3.16: Layout Manager (7)

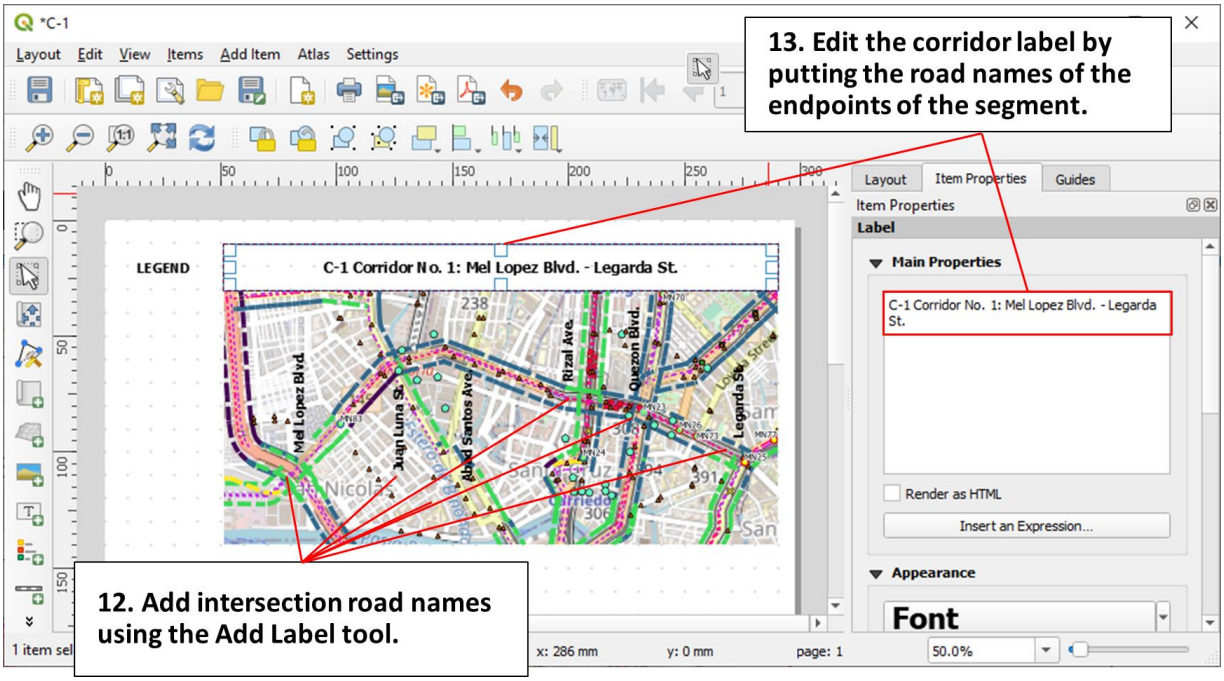


Figure 3.17: Layout Manager (8)

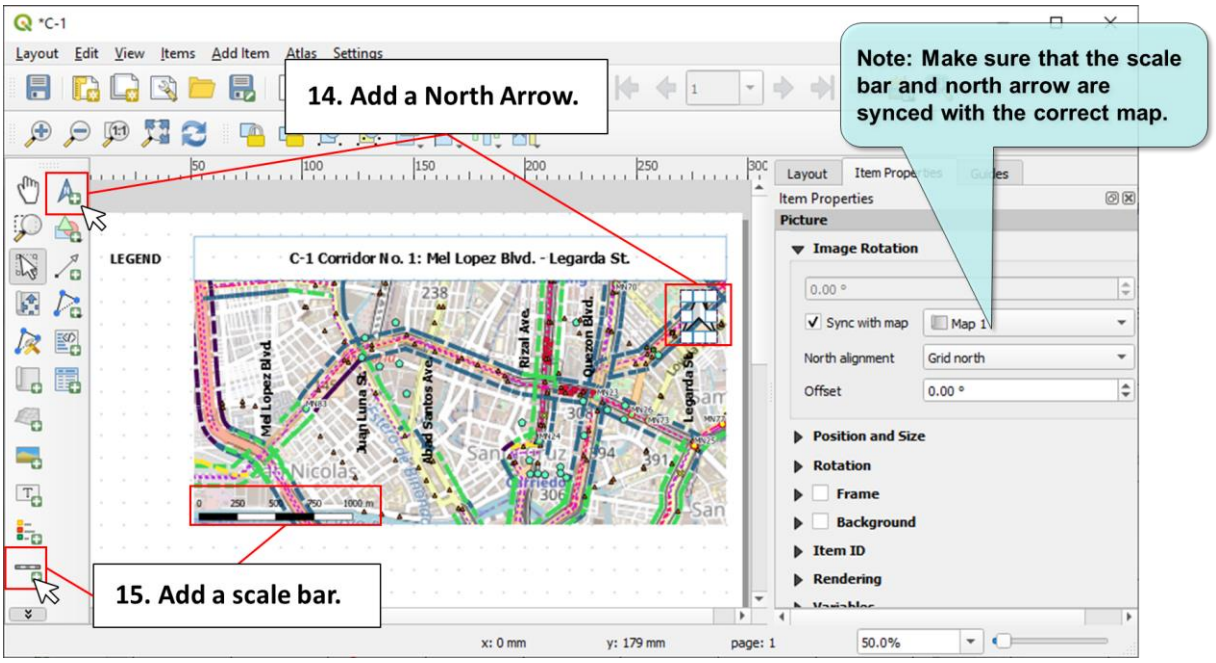


Figure 3.18: Layout Manager (9)

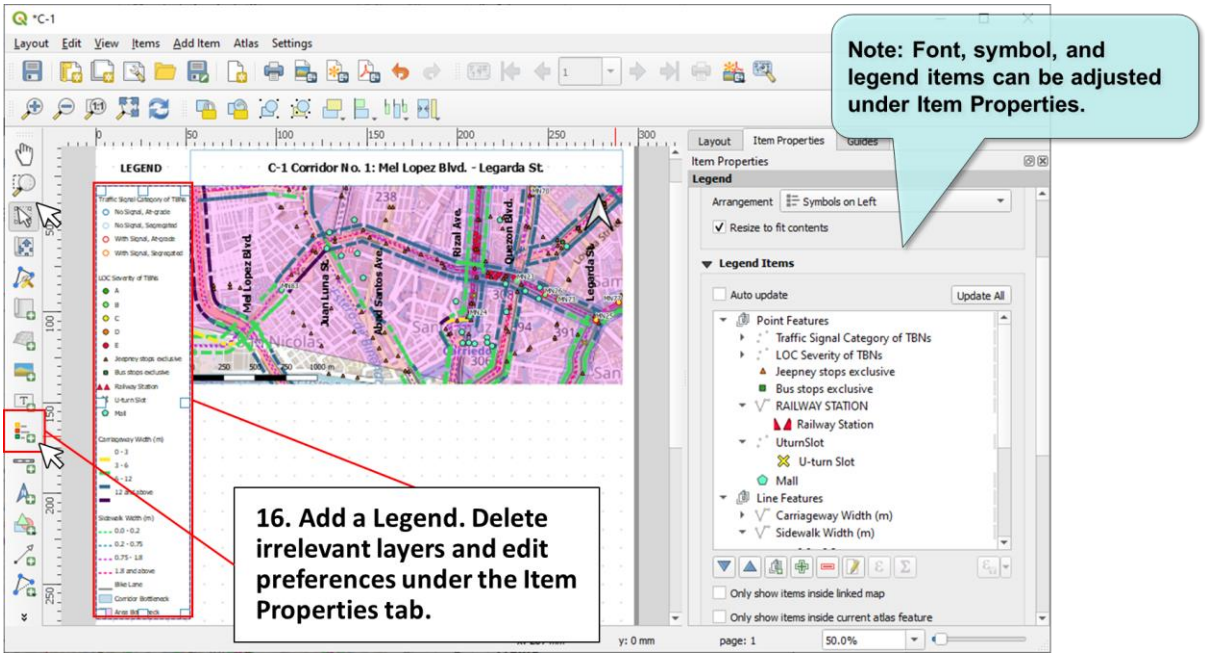


Figure 3.19: Layout Manager (10)

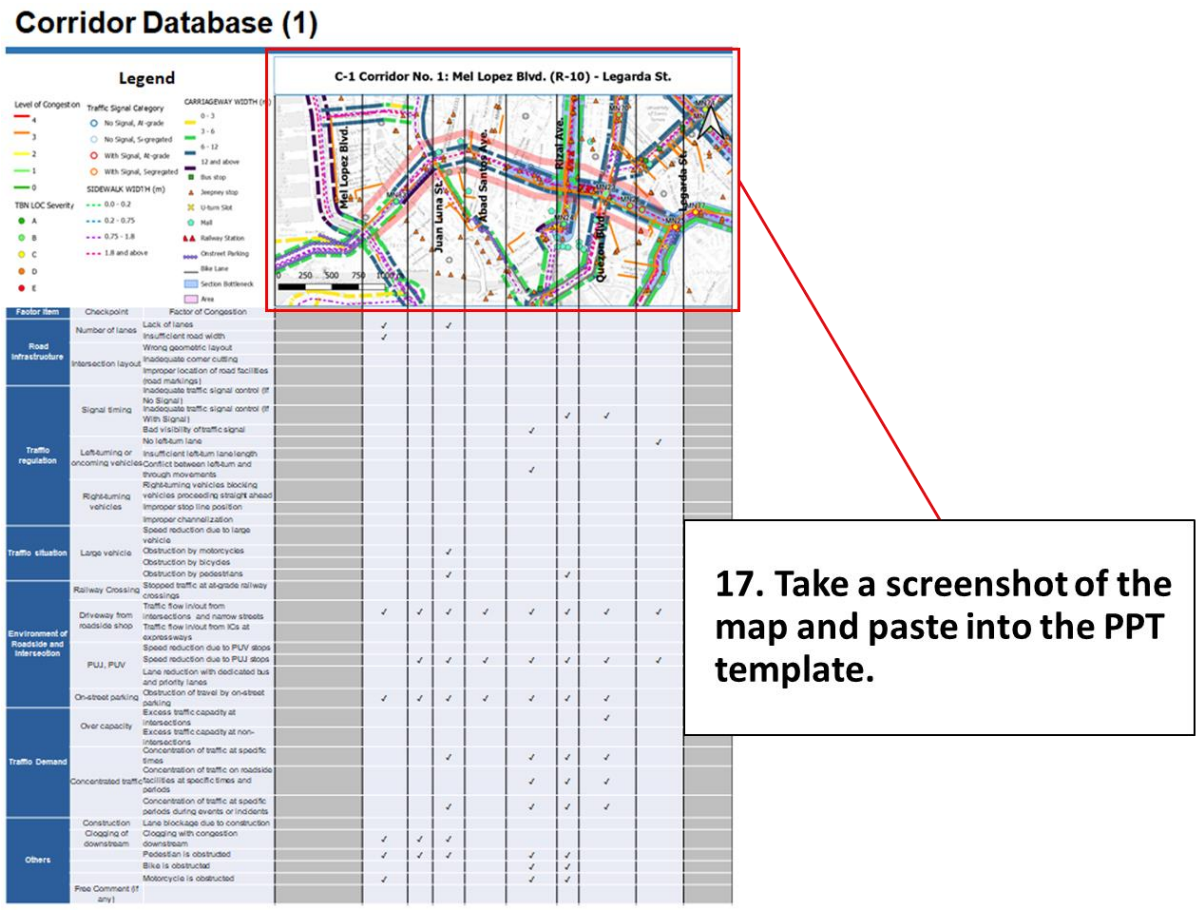


Figure 3.20: Layout Manager (11)

3.3 Identifying the factors of congestion

The factors of congestion (FOC) are enumerated in Table 3.2. To identify the FOC for each segment, MMDA should input a check mark "✓" if the said factor is applicable to the road segment or intersection. This will be based on actual site surveys and/or knowledge of field personnel,

especially traffic enforcers.

Table 3.2: Factor of congestion (FOC)

Factor item	Checkpoint	Factor of Congestion
Road infrastructure	Number of lanes	Lack of lanes
		Insufficient road width
	Intersection layout	Wrong geometric layout
		Inadequate corner cutting
		Improper location of road facilities (road markings)
Traffic regulation	Signal timing	Inadequate traffic signal control (If No Signal)
		Inadequate traffic signal control (If With Signal)
		Bad visibility of traffic signal
	Left-turning or oncoming vehicles	No left-turn lane
		Insufficient left-turn lane length
		Conflict between left-turn and through movements
	Right-turning vehicles	Right-turning vehicles blocking vehicles proceeding straight ahead
		Improper stop line position
		Improper channelization
Traffic situation	Large vehicle	Speed reduction due to large vehicle
		Obstruction by motorcycles
		Obstruction by bicycles
		Obstruction by pedestrians
Environment of Roadside and intersection	Railway Crossing	Stopped traffic at at-grade railway crossings
	Driveway from roadside shop	Traffic flow in/out from intersections and narrow streets
		Traffic flow in/out from ICs at expressways
	PUJ, PUV	Speed reduction due to PUV stops
		Speed reduction due to PUJ stops
		Lane reduction with dedicated bus and priority lanes
	On-street parking	Obstruction of travel by on-street parking
Traffic Demand	Over capacity	Excess traffic capacity at intersections
		Excess traffic capacity at non-intersections
	Concentrated traffic	Concentration of traffic at specific times
		Concentration of traffic on roadside facilities at specific times and periods
		Concentration of traffic at specific periods during events or incidents
Others	Construction	Lane blockage due to construction
	Clogging of downstream	Clogging with congestion downstream
		Pedestian is obstructed
		Bike is obstructed
		Motorcycle is obstructed
	Free Comment (if any)	

3.4 Compiling into a PPT File

After identifying applicable FOCs for each road segment, the information should be reflected on the MS Excel file by indicating “1” as described in Figures 3.21 and 3.22.

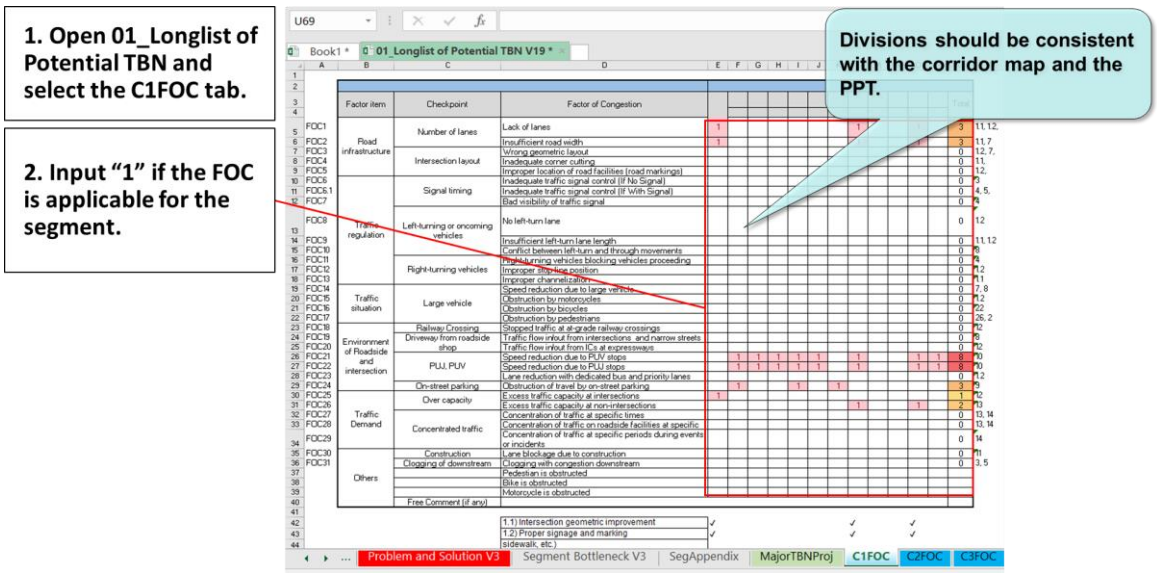


Figure 3.21: Compiling into a PPT File (1)

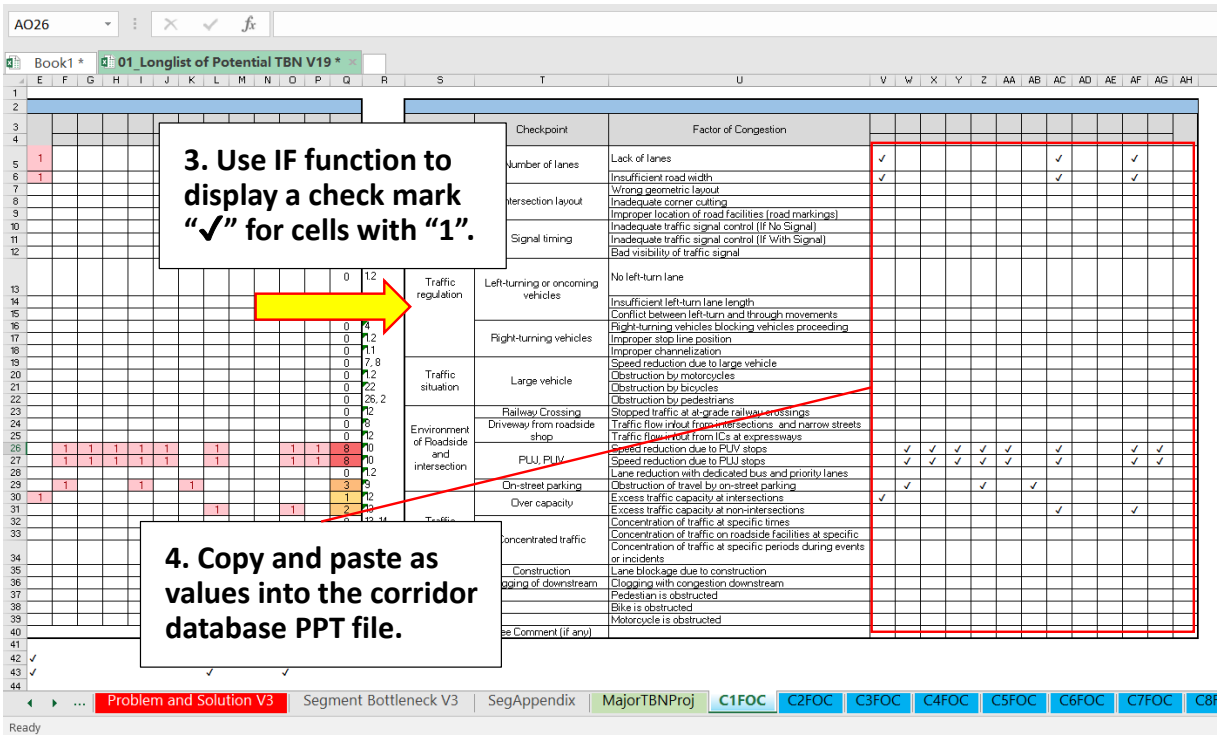


Figure 3.22: Compiling into a PPT File (2)

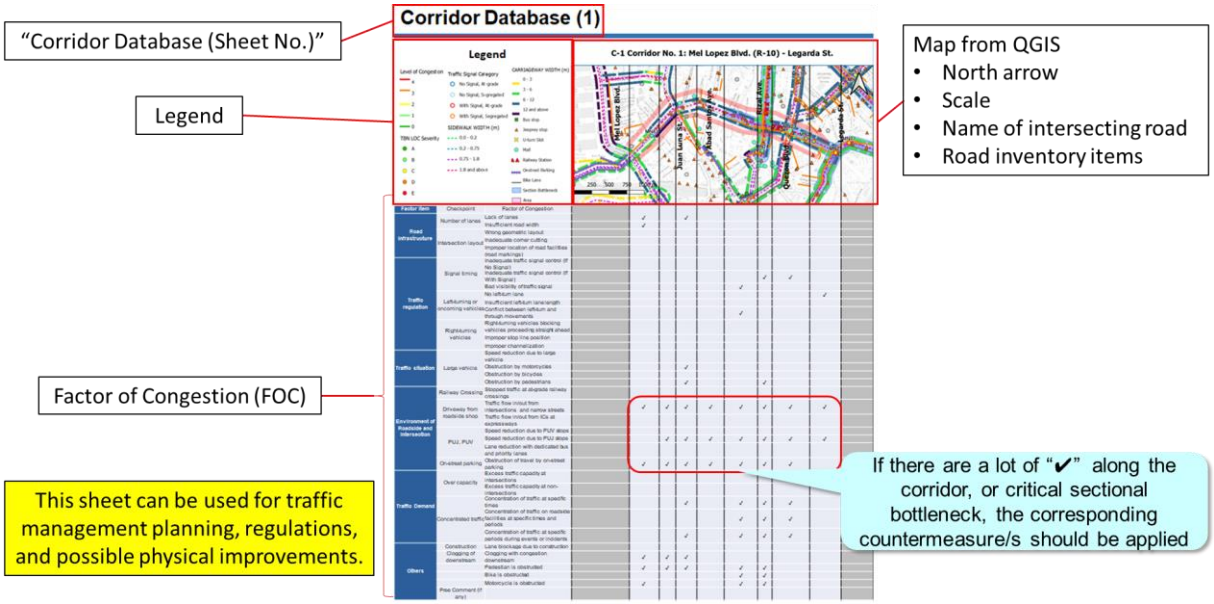


Figure 3.23: Compiling into a PPT File (3)

Figure 3.23 shows the final format and contents of the corridor analysis sheets in PPT format.

3.5 Next steps for the Corridor Analysis Sheets

Moving forward, the following steps must be taken to ensure the accuracy and timeliness of the database information:

1. Verify the situation along the corridor using Mapillary and/or Google Street view by checking the following information:

- ✓ Inventory Survey Data: Carriageway Width, PUB and PUJ stops, U-turn slots, Malls, Railway Stations, Onstreet Parking, and Bike Lanes

- ✓ Traffic Issues

2. As needed, apply the correct and updated information using QGIS if there are inconsistencies.a

3.6 Applications of the Corridor Analysis Sheets

Using the corridor analysis sheet, MMDA can identify traffic management issues based on the FOC. With this site surveys, will only be necessary if further investigation is needed. In addition, it is a useful tool to complement the corridor profile. The following are examples of information that may be analyzed using the corridor database:

a Exact location and factor of congestion of traffic facilities

b Effects of various traffic regulations

c Possible traffic management countermeasure for each factor of congestion

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE PROJECT FOR COMPREHENSIVE TRAFFIC MANAGEMENT PLAN FOR METRO MANILA

TECHNICAL REPORT NO. 8

MANUAL ON TRAFFIC BOTTLENECK DATABASE

November 2022

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

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

CTMP	Comprehensive Traffic Management Plan
JICA	Japan International Cooperation Agency
JPT	JICA Project Team
LGU	local government unit
MMDA	Metropolitan Manila Development Authority
TBN	traffic bottleneck

1 Objectives

In this project, 209 potential traffic bottlenecks (TBNs) were identified by travel speed data and based on the opinion of MMDA and the LGUs. Related data, such as traffic volume, inventory, and factors of congestion for each bottleneck, were collected and compiled into datasheets, to support an evidence-based approach when analyzing traffic congestion and considering appropriate countermeasures for bottlenecks. These data can also be used to prioritize and manage the progress of implementation. To this end, the JICA Project Team developed a “Database on Intersection Bottlenecks” to store and allow a search of collected data on intersections and to visualize these locations for better appreciation. Moreover, MMDA can update the database on demand.

Specifically, the objectives of the database are as follows:

(i) To store an inventory of bottleneck data such as traffic volume, speed data from Waze, road geometry, degree, and congestion factors, among others.

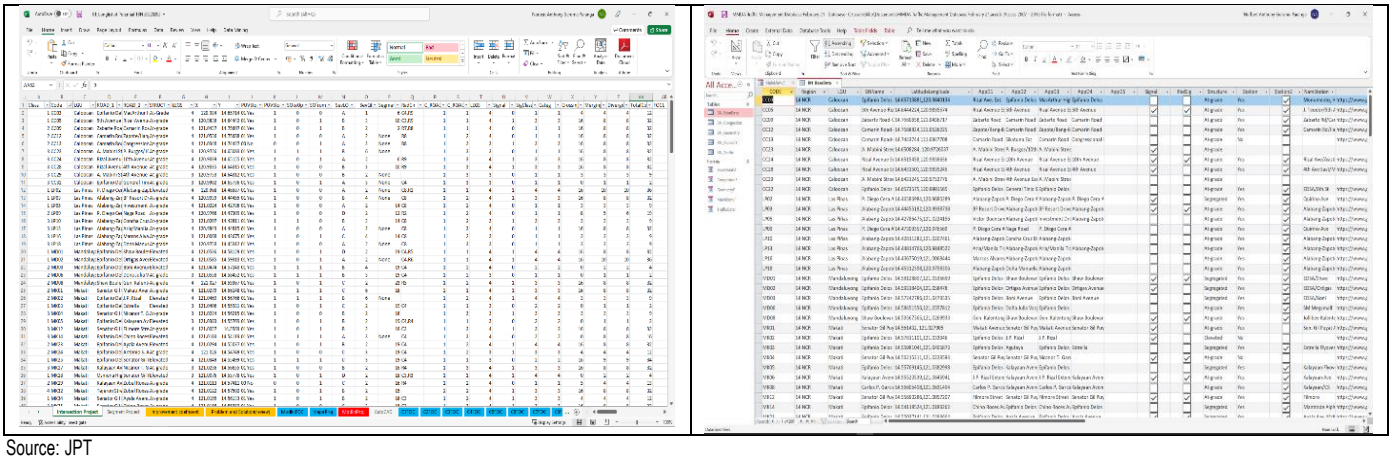
(ii) To integrate and be able to search the different data types from various sources in a cloud-based server; and

(iii) To serve as a guide in the analysis of congestion, its factors, and proper interventions for the bottlenecks.

As a prerequisite to understand and appreciate the use of this database program, said Program includes this instruction manual for reference before using it. The filename of this Database program is called “MMDA Traffic Bottleneck Database.”

2 Function of Database

To handle data management easily, this database was developed by Microsoft Access. Microsoft Access is a DBMS (also known as Database Management System) from Microsoft that combines the relational database engine with a graphical user interface and software-development tools. It is a member of the Microsoft Office suite of applications, included in the Professional and higher editions or sold separately. Microsoft Access stores data in its own format based on the database engine. It can also import or link directly to data stored in other applications and databases.

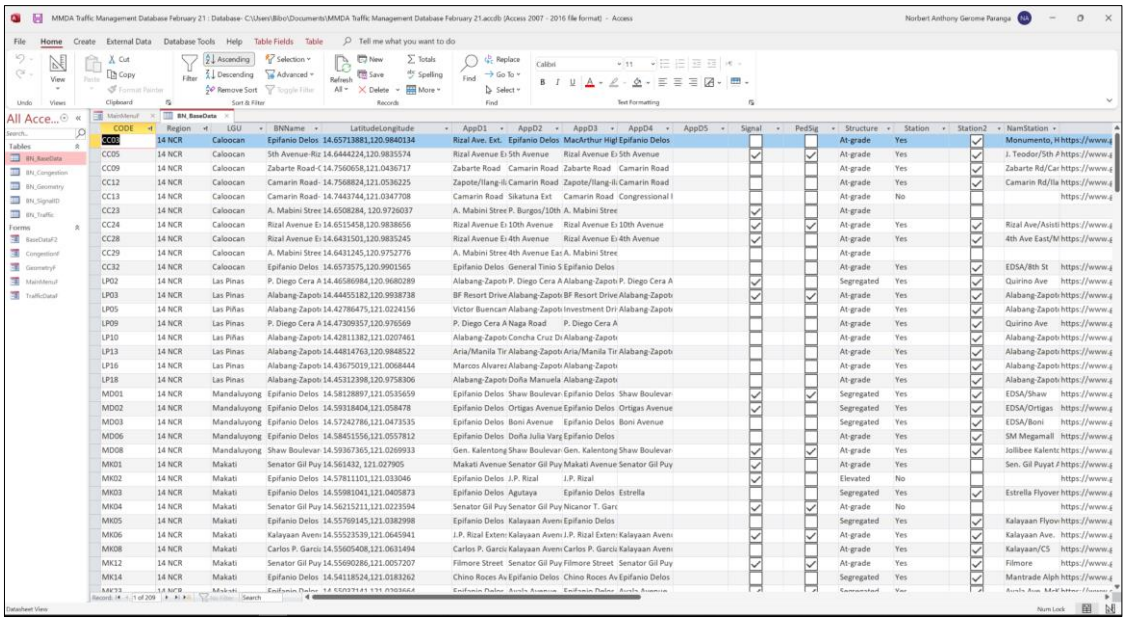


Source: JPT

Figure 2.1: Example of Microsoft Excel Interface (Left) and Access Interface (Right)

This database does not deal with tables alone. It has other components that it can do, namely:

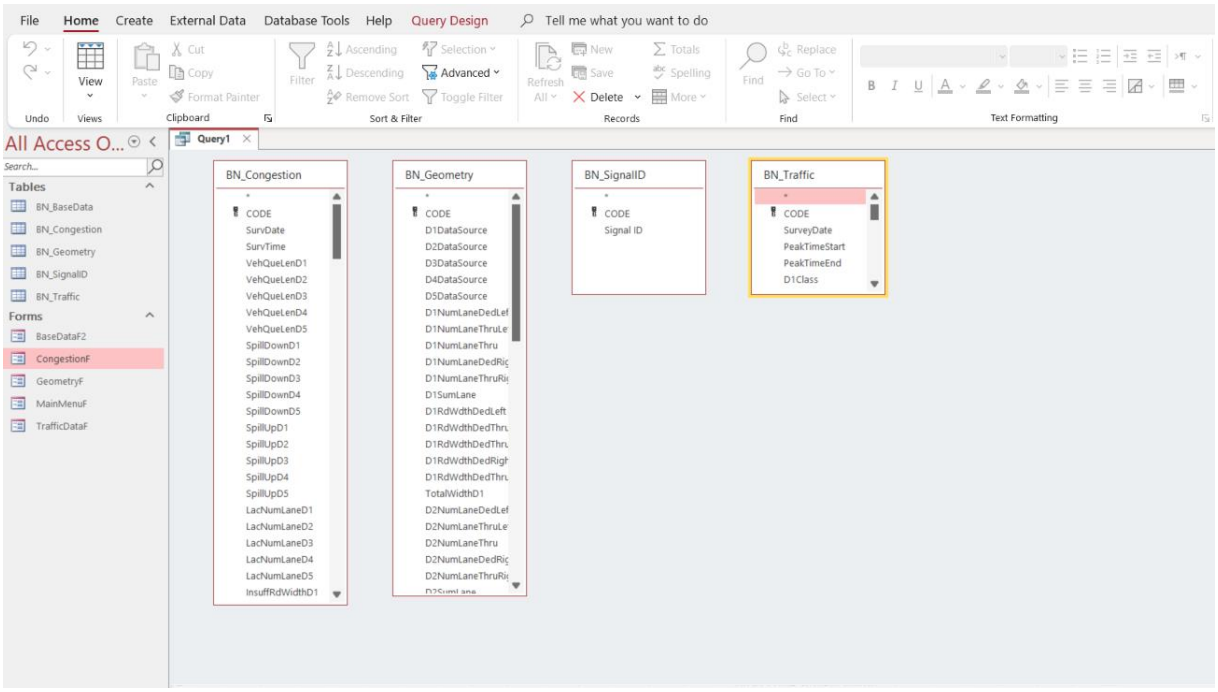
(a) **Table:** the key objects in the Access file, as they contain the data that is stored in the database. Tables are made up of rows and columns and allow for direct data entry into their grids. The row is the record that contains the individual data pieces making up an individual record.



Source: JPT

Figure 2.2: Tables in Traffic Bottlenecks Database

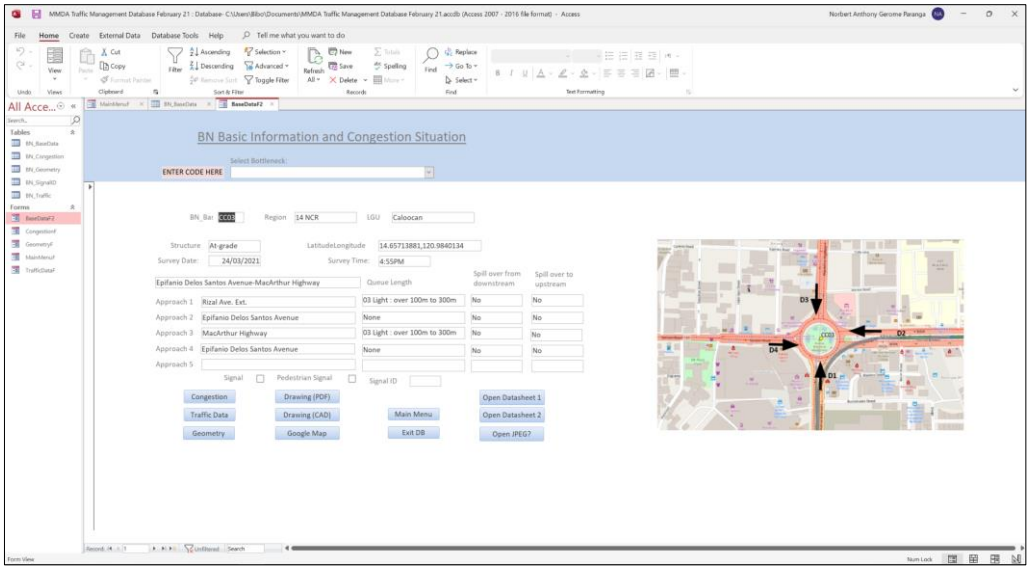
(b) **Query/Queries** are a way of searching for and compiling data from one or more tables. Running a query is like asking a detailed question of your database. When you build a query in Access, you are defining specific search conditions to find exactly the data you want.



Source: JPT

Figure 2.3: Query/Queries in Traffic Bottlenecks Database

(c) **Forms:** A form in Access is a database object that you can use to create a user interface for a database application. A "bound" form is one that is directly connected to a data source such as a table or query, and can be used to enter, edit, or display data from that data source.



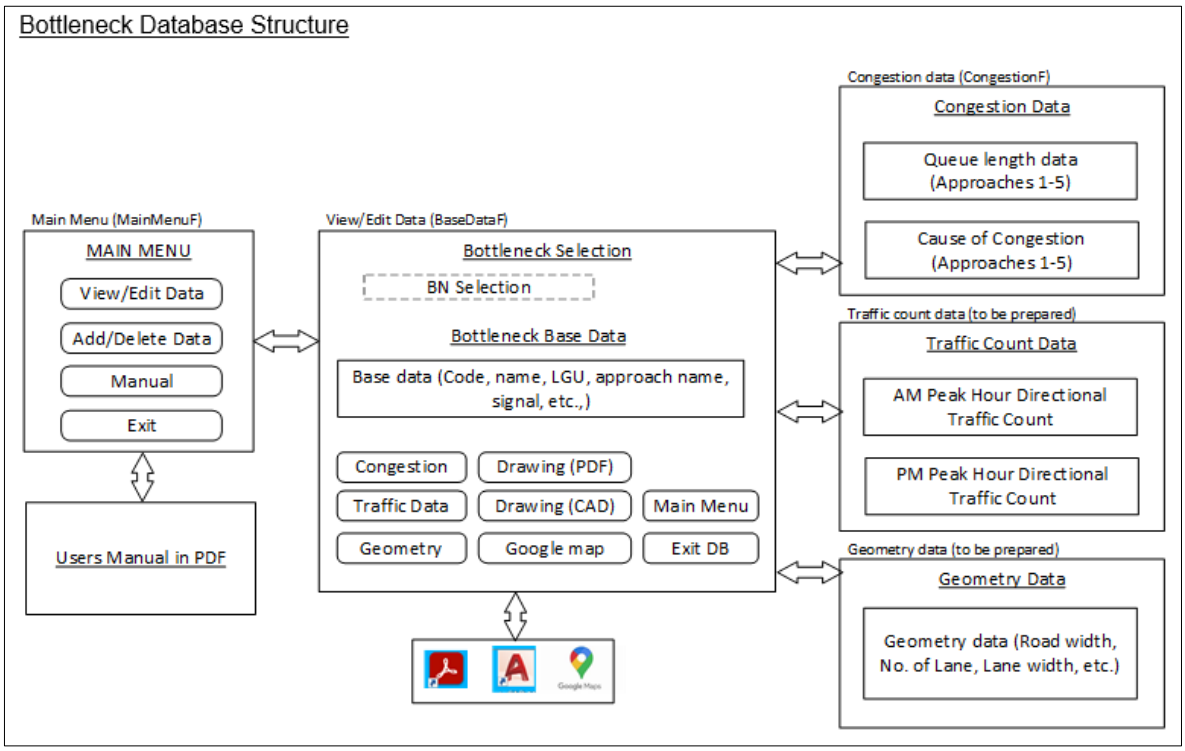
Source: JPT

Figure 2.4: Forms in Traffic Bottlenecks Database

3 Traffic Bottleneck Database System

The TBN database should be able to integrate data of different types from various sources to analyze TBNs in Metro Manila. Given this requirement, the concept of the database is that of a relational database designed for query and analysis. The relational database consists of tables of relevant data collected from various sources and consolidated. The user, MMDA, will use these queried and visualized data to analyze traffic bottleneck improvement. In addition to functioning as a relational data warehouse, the database includes hyperlinked indexes to categorize data correctly and optimize queries. The database was developed using Microsoft Access to allow easy updating of data and upgrading of functions.

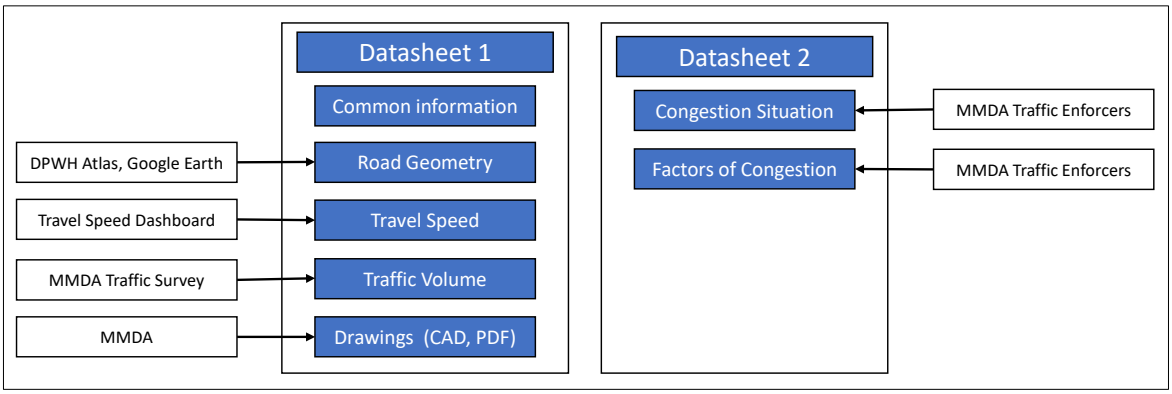
Figure 3.1 shows the database framework in integrating data from various sources such as Datasheet 1 (standard data/information such as intersection drawings, traffic volume, travel speed data, etc.) and Datasheet 2 (congestion situation, factors of congestion).



Source: JPT

Figure 3.1: Database Framework for Data Integration

In the development of the database, the design of the data model for optimal performance is essential in queries and in establishing data integrity. The data were gathered from various sources. Travel speed data came from the Travel Speed Dashboard developed using Waze data (*refer to TR4 Identification of Traffic Bottlenecks and Monitoring*) as was the basis of LOC calculation. Second, traffic volume counts were obtained from MMDA's traffic survey stations. Forty-nine (49) of the identified TBNs have traffic volume data. Then, the road geometry (no. of lanes, road widths, etc.) were investigated by using the DPWH Atlas, Google Earth, and Google Maps. The information from these sources were collated in Datasheet 1 for each bottleneck. On the other hand, Datasheet 2 contains information on the congestion situation and congestion factors, as observed by MMDA enforcers in 2021.



Source: JPT

Figure 3.2: Data Sources

Table 3.1: Sample of Datasheet 1 on Basic Information/ Data about Potential TBNs

Common Information													
CODE	PY04							Sheet No.					
REGION	14 NCR	CITY	Pasay										
Name of Intersection	EDSA-Taft Ave.						Administrator (Main Road)				MMDA		
Latitude / Longitude (Center of Intersection)	14.5375177, 121.0007001												
Intersection Type	A x B						Structure				01 At-grade		
Signalization	01 Signalized						Pedestrian Signal				00 No		
Station	01 Yes		Name of Station								Taft		
Existing Layout (CAD)	URL		https://drive.google.com/drive/folders/10G2optZZAfXIiENqtECyVFYztzfYY5Z1?usp=sharing										
Photo	Date	2021/3/16	Time	8:00	URL	ve/folders/1vXTT281C1Ob2ajQuFtLb							
Google Map (URL)	https://www.google.com/maps/@14.5378334,121.0005801,19.03z?hl=ja												
Layout (Inventory)													
	Approach (toward)	No. of Lane						Road Width(m)						Data Source
		Dedicated Left	Left-Through	Through	Dedicated Right	Right-Through	Total	Dedicated Left	Left-Through	Through	Dedicated Right	Right-Through	Total	
D1	EDSA West	1	0	4	0	1	6	3.5	0.0	14.0	0.0	3.5	21	03 DPWH Atlas
D2	EDSA East	0	0	4	1	0	5	0.0	0.0	13.6	3.4	0.0	17	03 DPWH Atlas
D3	Taft North			3			3						7	03 DPWH Atlas
D4	Taft South			3			3						6.8	03 DPWH Atlas
D5														03 DPWH Atlas
Traffic Volume														
Date of Traffic Volume Survey	Wednesday, March 06, 2019													
Peak Time	From	08:00:00 AM	-	To	09:00:00 AM									
	Approach (toward)	Class	Peak Hour Traffic Volumes (PCUs)				Total Volume	PUB	PUJ	PUV	PUT%			
			Left	Through	Right	Total								
D1	EDSA West	A	255	3,840	13	4,108	4,096	135	471	299	22.1%			
D2	EDSA East	A	0	3,163	332	3,495	3,627	81	527	279	24.5%			
D3	Taft North	A	345	30	456	831	917	0	176	56	25.3%			
D4	Taft South	A	12	25	134	171	203	0	44	6	24.6%			
D5											#DIV/0!			
Traffic Volume Survey Data (Excel)	https://drive.google.com/drive/folders/1gOSUI9MSJXEtqUkKahlMjnaRxcj6Mt6f?usp=sharing													
Travel Speed from Waze, LOC														
Source	2019/ Weekday / Daily(6-20)/ Inflow													
	Approach (toward)	Class	In/Out	Km/h	LOC									
D1	EDSA West	A	Inflow	13.7	4									
D2	EDSA East	A	Inflow	15.1	3									
D3	Taft North	A	Inflow	13.4	3									
D4	Taft South	A	Inflow	0.0	0	No Data								
D5			Inflow											
D1_O	EDSA West	A	Outflow	17.6	3									
D2_O	EDSA East	A	Outflow	22.5	2									
D3_O	Taft North	A	Outflow	0.0	0	No Data								
D4_O	Taft South	A	Outflow	19.8	2									
D5_O			Outflow											
Signal Data														
Signal Phase Data	URL													
CCTV Data	URL													

Source: JPT

Table 3.2: Sample of Datasheet 2 on Results of Site Observation

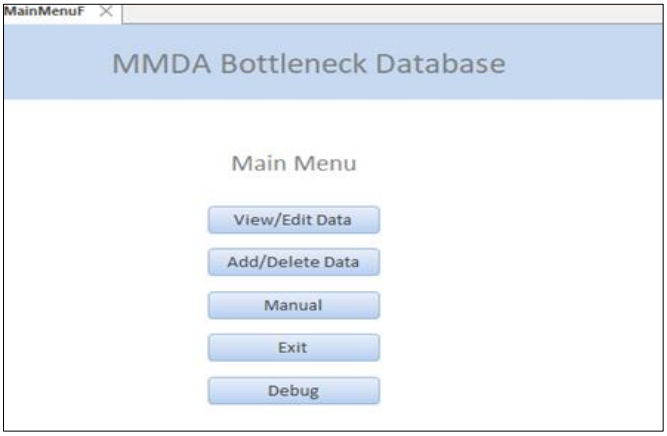
Congestion Situation				
	Approach (toward)	**Vehicle Queue Length**	**Spill over from downstream intersection**	**Spill over to upstrear intersection**
D1	Taft South	02 Moderate : over 300m to 500m	Yes	No
D2	Taft North	02 Moderate : over 300m to 500m	No	No
D3	A. Arnaiz West	None	Yes	No
D4	A. Arnaiz East	02 Moderate : over 300m to 500m	Yes	No
D5				

Checklist for Factor of Congestion (intersection)								
1:STRONGLY AGREE, 2:AGREE, 3:DISAGREE								
Factor item	Checkpoint	Factor of Congestion	D1	D2	D3	D4	D5
Road infrastructure	Number of lanes	Lack of number of lanes	1	3	1	1	
		Insufficient road width	2	3	2	2	
	Intersection layout	Wrong geometric intersection layout	3	1	3	3	
		Inadequate corner cutting	1	2	1	1	
		Improper location of road facilities (road markings)	2	3	2	2	
Traffic regulation	Signal timing	Inadequate of traffic signal control	1	1	1	1	
		Bad visibility of traffic signal	1	2	1	1	
	Right-turning or oncoming vehicles	No left-turn lane	1	1	1	1	
		Insufficient left-turn lane length	1	2	1	1	
		Conflict between a left-turning car and an oncoming straight car	1	3	1	1	
	Left-turning vehicles	Right-turning vehicles blocking vehicles proceeding straight ahead	1	1	1	1	
		Improper stop line position	1	2	1	1	
		Improper channelization	1	3	1	1	
Traffic situation	Large vehicle	Speed reduction due to large vehicle	1	1	1	1	
		Obstruction by motorcycles	1	2	1	1	
		Obstruction by bicycles	1	1	1	1	
		Obstruction by pedestrian	1	2	1	1	
Environment of Roadside and intersection	Railway Crossing	Stopping traffic at railway crossing	1	3	1	1	
	Driveway from roadside shop	Traffic flow in/out from intersections and narrow streets	1	1	1	1	
		Traffic flow in/out from IC at expressway	1	2	1	1	
	PUJ, PUV	Speed reduction due to PUV stop	1	3	1	1	
		Speed reduction due to PUJ stop	1	1	1	1	
		Lane reduction with dedicated bus and priority lanes	1	2	2	1	
	On-street parking	Obstruction of travel by on-street parking	1	1	3	1	
Traffic Demand	Over capacity	Excess traffic capacity at intersections	1	1	1	1	
		Excess traffic capacity at non-intersections	1	2	2	1	
	Concentrated traffic	Concentration of traffic at specific time	1	3	1	1	
		Concentration of traffic on roadside facilities at specific times and periods	1	1	1	1	
		Concentration of traffic during specific periods during events or incidents	1	2	1	1	
Others	Construction	Lane blockage due to construction	1	1	1	1	
	Clogging of downstream	Clogging with congestion of downstream	1	2	1	1	
	Free Comment (if any)	Due to traffic accident, tenporaly congestion occurs					

Source: JPT

4 User Manual

The database structure is straightforward since the functions are presented in a query-based warehouse structure. Figure 4.1 shows the main menu in the database. The user will select the TBNs, or intersection of interest, and the database performs a query to call the data on the TBNs. The Main Menu form has five (5) buttons. The uppermost button can view the data for the intersection that the user searched. The second button gives the user the function to add a bottleneck to the database. Next, the middle button opens the database manual, which serves as a guide for users to maximize the use of the program. After that, the fourth button closes the program. The last button allows users to debug codes and sequences that the program uses for queries.



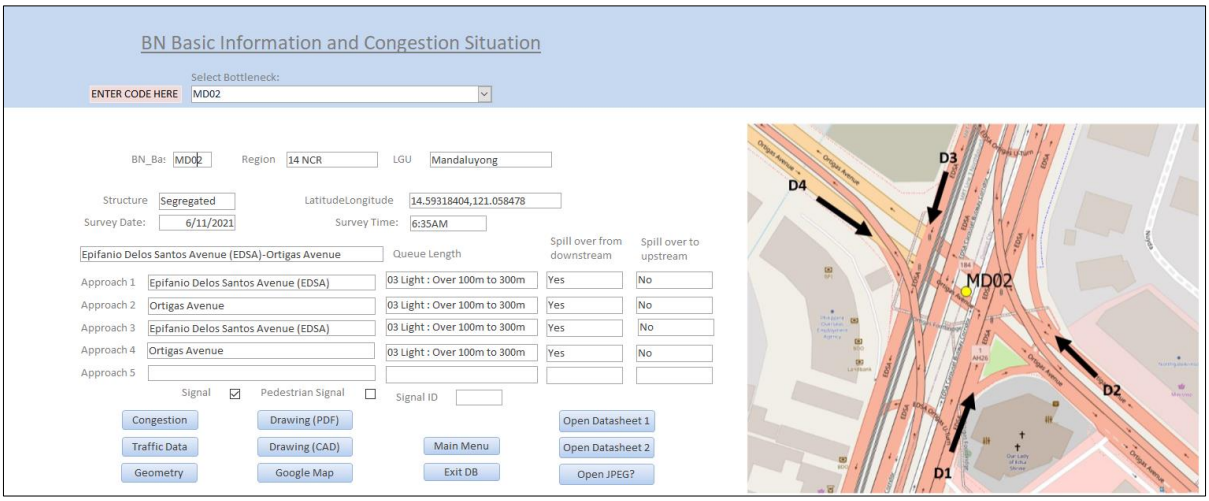
Source: JPT

Figure 4.1: Main Menu Interface of the Database

The View / Edit Data window is shown in Figure 4.2. It serves as the main interface of the database. It shows the basic information on the selected bottleneck such as the intersection structure (at-grade or elevated), LGU to which the intersection belongs, coordinates (latitude, longitude), queue length, spillover from downstream and upstream with date of survey, and the location map to help users visualize the approach from each leg. Moreover, the interface includes checkboxes to determine whether the intersection has traffic signals for vehicles and pedestrians. Last, the signal ID information (from MMDA) is also provided.

Users will type the intersection name in the combo box provided in the interface. A combo box is an object or control that the user places on a form. It displays a list of values that a user can quickly choose from. The combo box in the TBN database is populated by the intersection code, LGU it belongs to, and the intersection name so that the user can locate the bottleneck quickly. The intersections are alphabetically arranged, and the list below the box automatically changes once the user types any character.

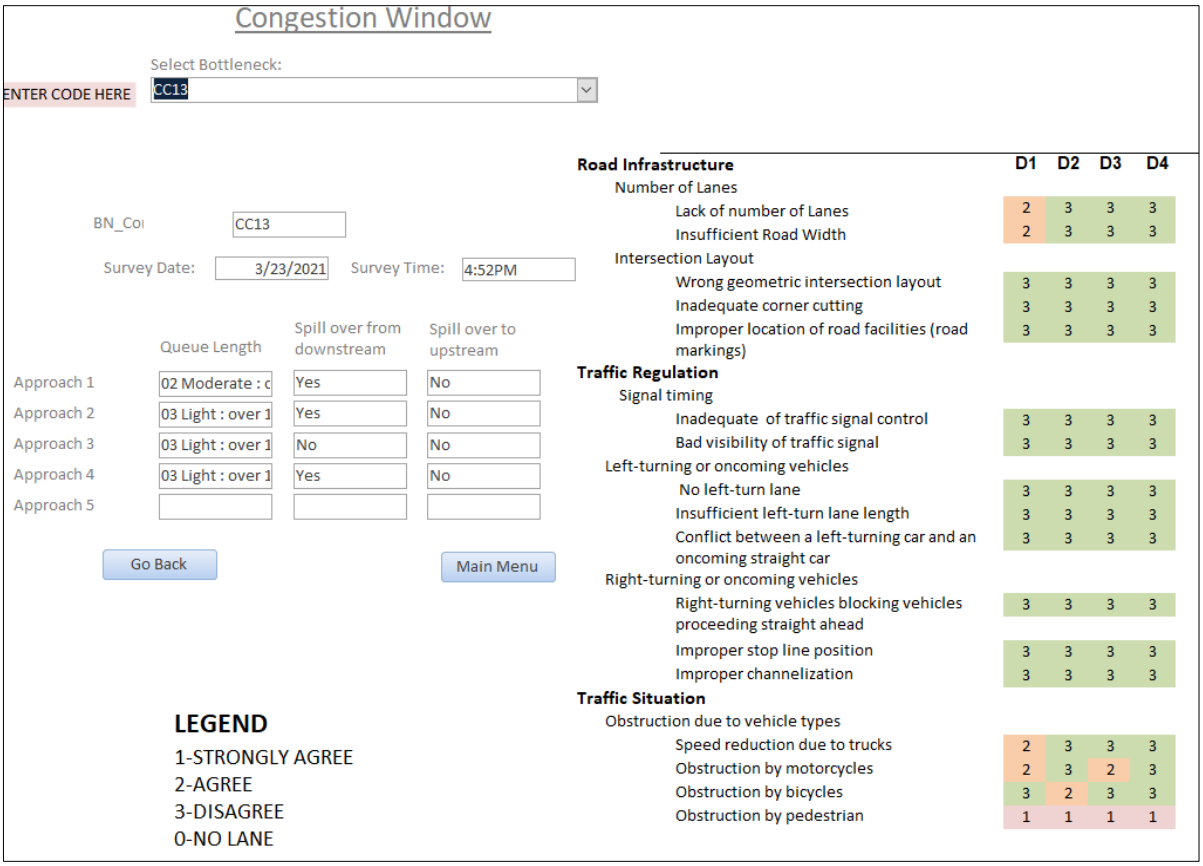
The buttons on the bottom part of the interface connect the data that the database integrated into the cloud server or MS Access file. The following buttons are (i) Congestion, (ii) Traffic Data, (iii) Geometry, (iv) Drawing (PDF), (v) Drawing (CAD), (vi) Google Map, (vii) Open Datasheet 1, (viii) Open Datasheet 2.



Source: JPT

Figure 4.2: View / Edit Data Window of the Database

The Congestion button leads to the Congestion Factor window, which shows the congestion situation in the intersection and the factors of congestion, as shown in Figure 4.3. There is also a combo box in the Congestion Form where the users can search for the bottleneck, and then the database will show the queue length, upstream and downstream spillover, and the factors of congestion based on the results of the site observation for each leg shown.

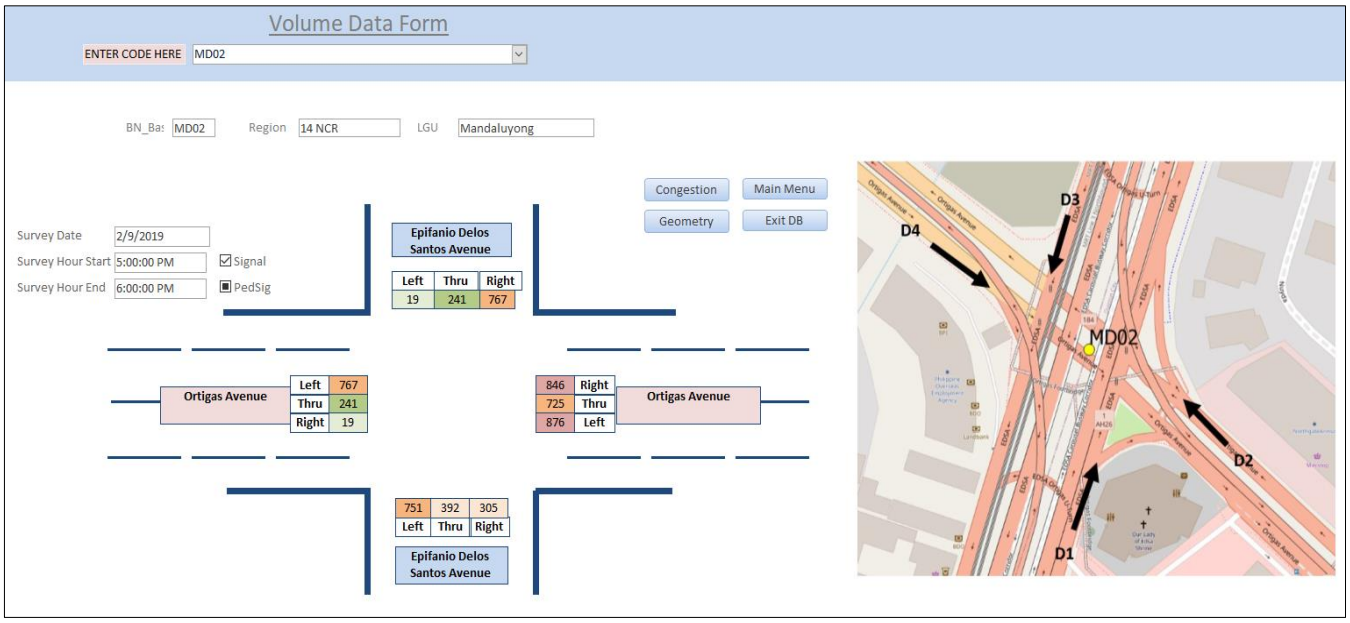


Source: JPT

Figure 4.3: Congestion Factor Window

The Traffic Data button leads to the Traffic Data window, which shows the traffic volume of the intersection. The data were from a traffic count survey by MMDA. There is also a four-

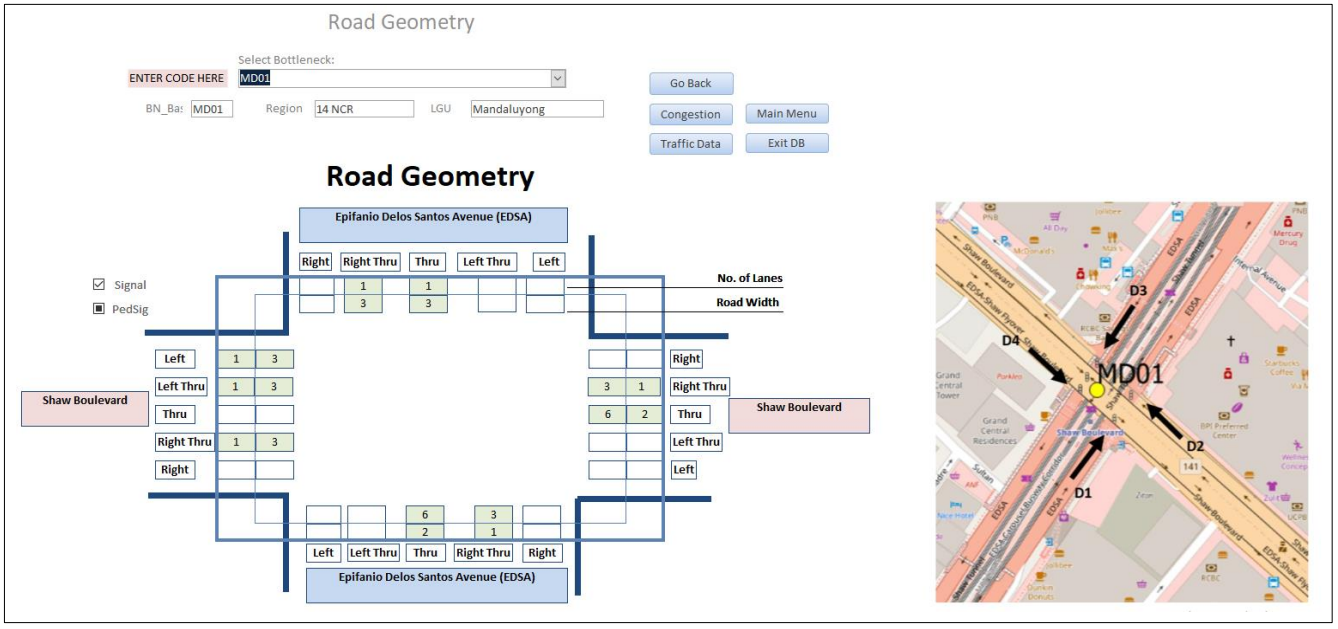
legged intersection map for the user to know the volume on each lane per leg of the intersection. For three-legged intersections, one leg is left blank. Figure 4.4 shows a sample of the window.



Source: JPT

Figure 4.4: Traffic Data Window

The Road Geometry button leads to the Road Geometry window, which shows the road inventory of the intersection. The data were studied from the DPWH Atlas and other websites. Figure 4.5 shows a sample of the window.



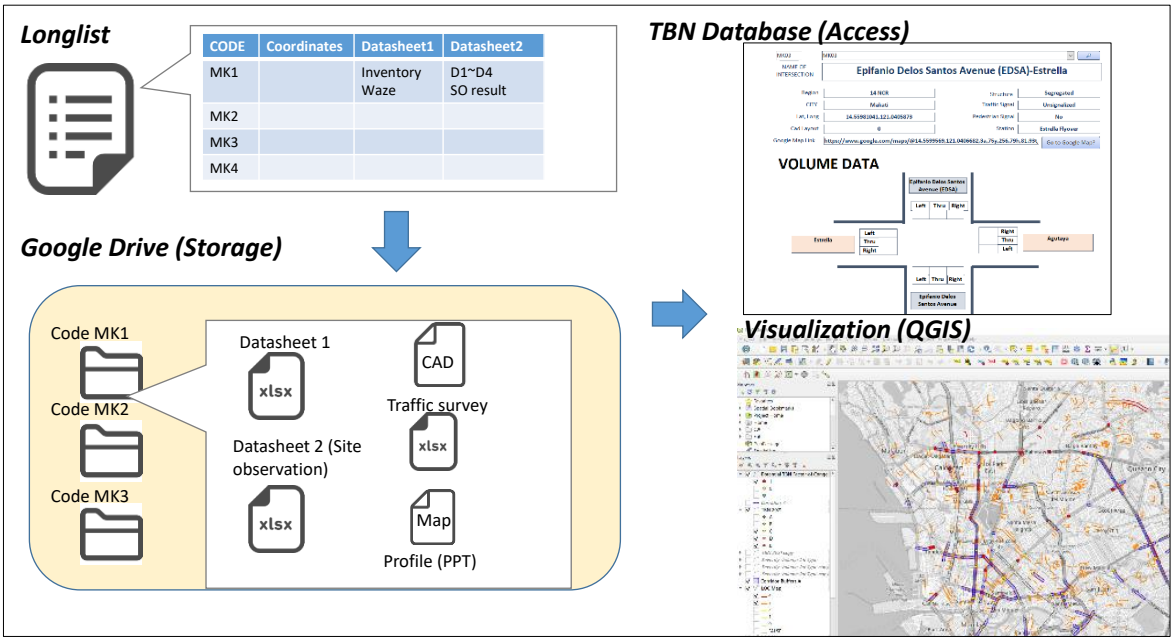
Source: JPT

Figure 4.5: Road Geometry Window

5 Data Management and Operations

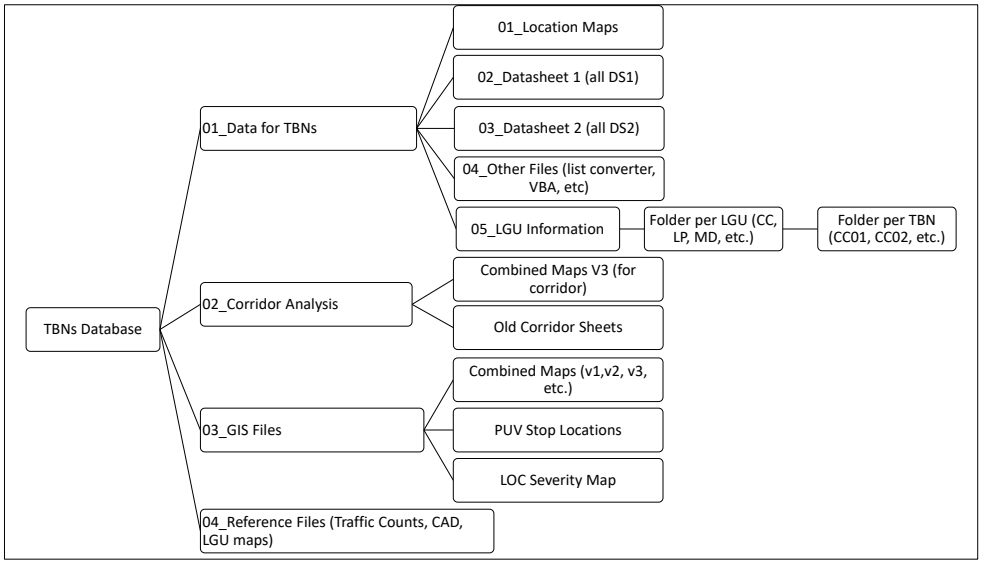
5.1 Data Management

Individual data, such as Excel files (Datasheet 1 and 2), traffic count data, CAD drawing data, etc., for each bottleneck are stored in the cloud server (Google Drive) and are linked by TBN database file. The cloud server serves as an online warehouse and allows users to create, edit, store, and share documents and other relevant data. If MMDA wants to update survey data, they can upload the latest data in the cloud server, and the table in MS Access is automatically revised. Figure 5.1 shows the conceptual diagram of the intersection bottlenecks database, and Figure 5.2 shows the warehouse structure of the cloud server.



Source: JPT

Figure 5.1: Conceptual Diagram of the Database on Intersection Bottlenecks



Source: JPT

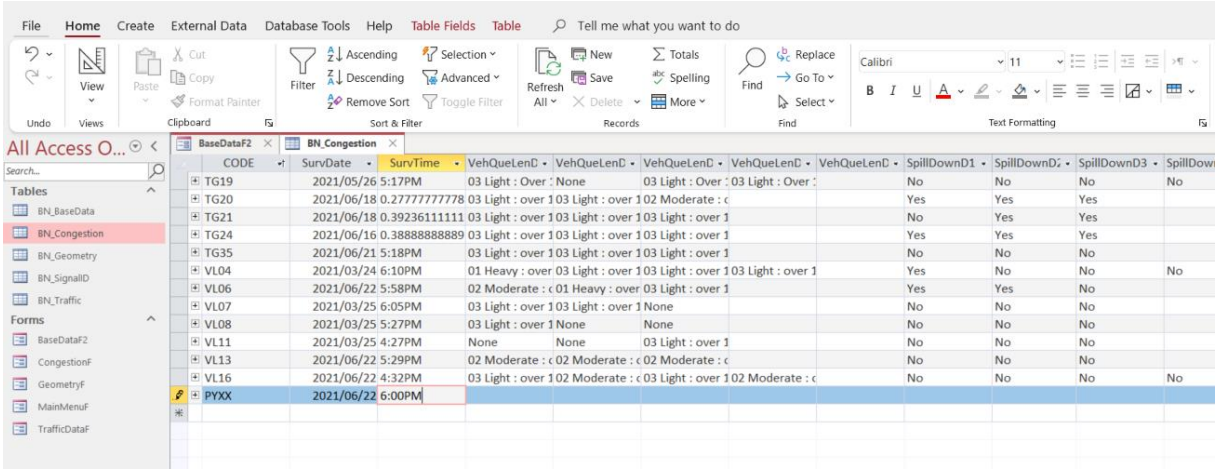
Figure 5.2: Structure of Cloud Server Data Storage

Much is still needed to be done for the Access to be user-friendly and convenient for a beginning user to function. However, the basics and fundamental functions of the database management system is present, and the prototype can fully integrate multiple data sources, and visualize information for the users to analyze, and appreciate.

5.2 Data update

Adding TBN points require adding a data item in each of the tables (Congestion, Geometry, Signal, etc.) Every table should have the new TBN except the BaseData Table. The BaseData Table would be the last Table where users would add the new TBN. After finally adding it to the BaseData Table, a TBN would be encoded to the database. Then, the user can add the necessary information in each of the forms where the TBN was added.

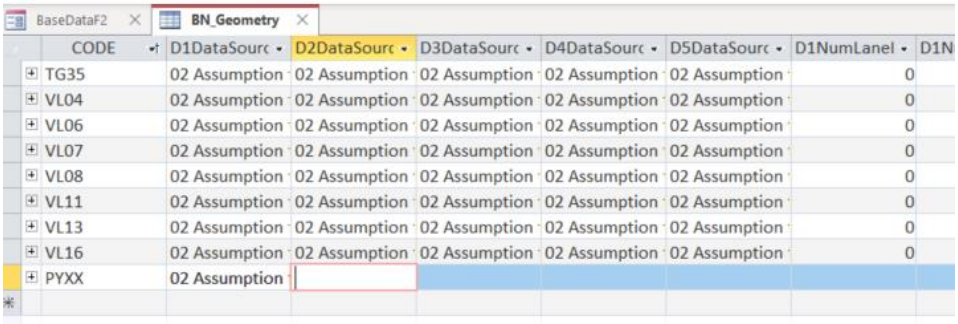
Figure 5.3 shows the process on adding a data in the database. First, add a data item on the Congestion Table. A new TBN labeled PYXX was added in the Congestion Table. Add a record to a table or form. Open the table in Datasheet View or the form in Form View. On the Home tab, in the Records group, click New, or click New (blank) record, or press Ctrl+Plus Sign (+). Find the record with an asterisk in the record selector, and enter your new information.



Source: JPT

Figure 5.3: New TBN Data Input in BN_Congestion Sheet

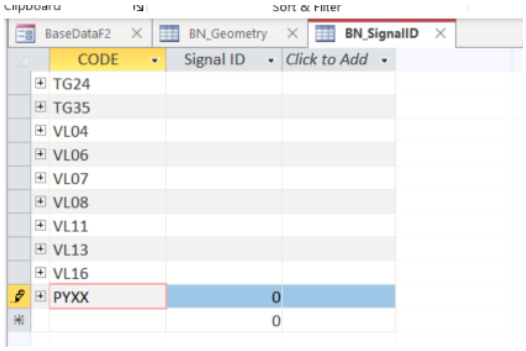
After adding the necessary and available information on the new bottleneck, add the corresponding code on other Tables such as Geometry, Signal ID, and Traffic. User can now see that inserting a new data and updating the existing data is very simple in Datasheet View as working in spreadsheet. But if the user wants to delete any data, it is necessary to need to select the entire row first as shown in Figure 5.4.



CODE	D1DataSourc	D2DataSourc	D3DataSourc	D4DataSourc	D5DataSourc	D1NumLanel	D1N
TG35	02 Assumption	02 Assumption	02 Assumption	02 Assumption	02 Assumption	0	
VL04	02 Assumption	02 Assumption	02 Assumption	02 Assumption	02 Assumption	0	
VL06	02 Assumption	02 Assumption	02 Assumption	02 Assumption	02 Assumption	0	
VL07	02 Assumption	02 Assumption	02 Assumption	02 Assumption	02 Assumption	0	
VL08	02 Assumption	02 Assumption	02 Assumption	02 Assumption	02 Assumption	0	
VL11	02 Assumption	02 Assumption	02 Assumption	02 Assumption	02 Assumption	0	
VL13	02 Assumption	02 Assumption	02 Assumption	02 Assumption	02 Assumption	0	
VL16	02 Assumption	02 Assumption	02 Assumption	02 Assumption	02 Assumption	0	
PYXX	02 Assumption						

Source: JPT

Figure 5.4: Adding bottleneck in Geometry Table

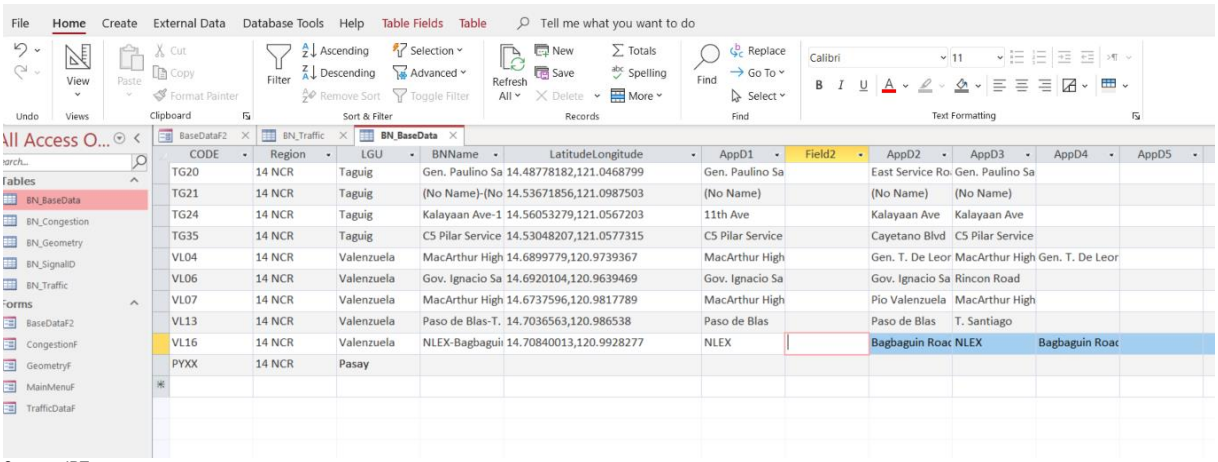


CODE	Signal ID	Click to Add
TG24		
TG35		
VL04		
VL06		
VL07		
VL08		
VL11		
VL13		
VL16		
PYXX	0	
	0	

Source: JPT

Figure 5.5: Adding bottleneck in Signal Table

After these steps, add the potential traffic bottleneck PYXX to the BaseData Table

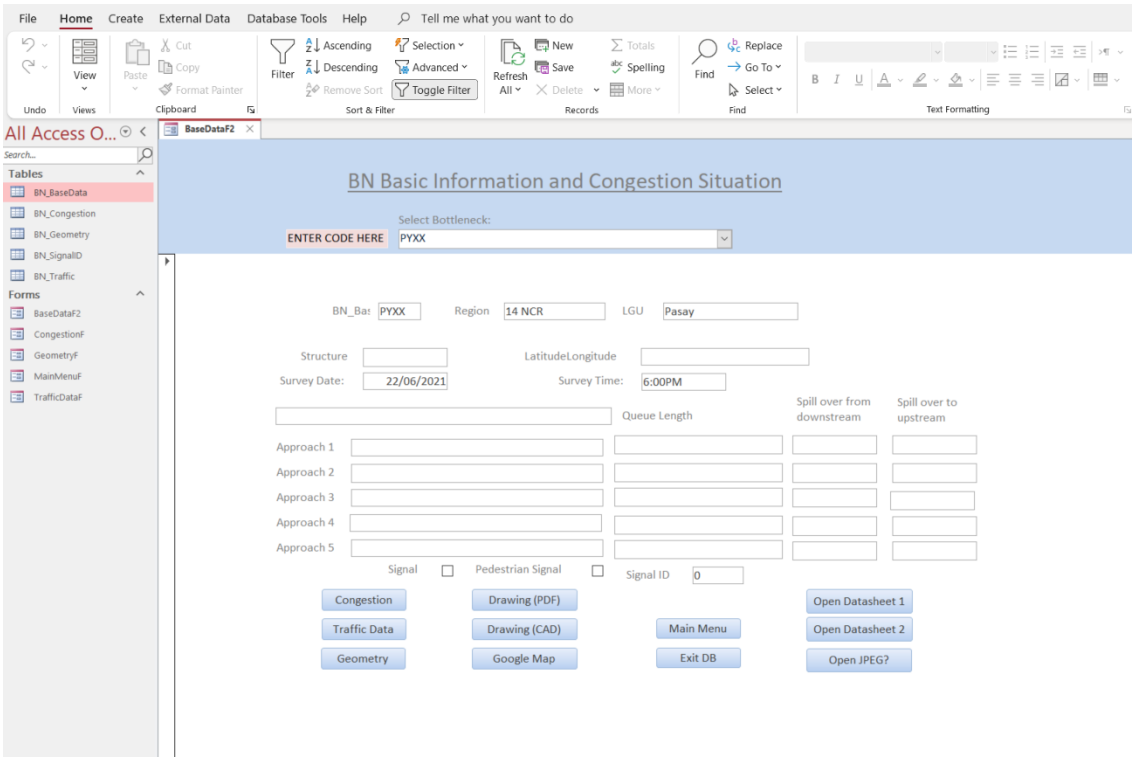


CODE	Region	LGU	BNName	LatitudeLongitude	AppD1	Field2	AppD2	AppD3	AppD4	AppD5
TG20	14 NCR	Taguig	Gen. Paulino Sa	14.48778182,121.0468799	Gen. Paulino Sa		East Service Ro	Gen. Paulino Sa		
TG21	14 NCR	Taguig	(No Name)-(No	14.53671856,121.0987503	(No Name)		(No Name)	(No Name)		
TG24	14 NCR	Taguig	Kalayaan Ave-1	14.56053279,121.0567203	11th Ave		Kalayaan Ave	Kalayaan Ave		
TG35	14 NCR	Taguig	C5 Pilar Service	14.53048207,121.0577315	C5 Pilar Service		Cayetano Blvd	C5 Pilar Service		
VL04	14 NCR	Valenzuela	MacArthur High	14.6899779,120.9739367	MacArthur High		Gen. T. De Leor	MacArthur High	Gen. T. De Leor	
VL06	14 NCR	Valenzuela	Gov. Ignacio Sa	14.6920104,120.9639469	Gov. Ignacio Sa		Gov. Ignacio Sa	Rincon Road		
VL07	14 NCR	Valenzuela	MacArthur High	14.6737596,120.9817789	MacArthur High		Pio Valenzuela	MacArthur High		
VL13	14 NCR	Valenzuela	Paso de Blas-T.	14.7036563,120.986538	Paso de Blas		Paso de Blas	T. Santiago		
VL16	14 NCR	Valenzuela	NLEX-Bagbaguii	14.70840013,120.9928277	NLEX		Bagbaguin Roac	NLEX	Bagbaguin Roac	
PYXX	14 NCR	Pasay								

Source: JPT

Figure 5.6: Adding bottleneck in BaseData Table

After adding to the code PYXX to all the tables, with the Base Data Table last, users can now access/view the bottleneck in the View Data Form. The information can now be shown By design, you cannot edit data from some types of queries. For example, you cannot edit the data returned by a crosstab query, and you cannot edit or remove calculated fields — values that a formula calculates as you use your database, but that do not reside in a table.



Source: JPT

Figure 5.7: Viewing new bottleneck in ViewData Form