7 OTHER URBAN INFRASTRUCTURE AND SERVICES

7.1 Overall

7.1 This chapter describes the overall service availability for public services such as water supply, wastewater management, and solid waste management. It also intends to elaborate on the results of the Household Interview Survey (HIS), conducted in March 2017, which contains the citizens' perceptions on these basic urban services. The HIS had approximately 2,000 samples which represent approximately 10 households per barangay. Since the rural barangay exceeds to urban as 103 against 78, the samples are biased to rural population. Accordingly, the number of sample households of HIS served by DCWD is merely 43.6% while, 60% of population was served in the City based on DCWD data.

1) Water Supply

7.2 Approximately 40% of the population is not within the water supply service area of Davao City Water District (DCWD), the main provider of potable water in Davao City. Out of the 40%, some areas are serviced by the Barangay Water and Sanitation Authority (BAWASA).

7.3 DCWD connection makes up 50 %, and BAWASA or Association in Barangay makes up 25% and public faucet, own well, rainwater storage and etc. make up 20% and other makes up 10% of all water source in Davao city. Based on the table above most supplied water by DCWD and BAWASA and Association I Barangay is used for the all purposes except for drinking. Bottled water is used for drinking in the houses supplied water by DCWD and BAWASA and Association in Barangay.

7.4 Under HIS study, satisfaction level of water quantity, quality, pressure, service hours, and price are not low, but considerable amount as to 18% of respondents show dissatisfaction or high dissatisfaction of hours of supply. As large as 24% of respondents assessed that water sufficiency is the problem sometimes.

7.5 Rural water supply has been one of the City Mayor’s agenda, including the implementation of the Rural Water Supply and Sanitation Investment Plan to expand water services in the unserved and underserved areas. The Water and Sanitation Council (WSC) mainly oversees the entire water and sanitation situation of the City. The Mayor has appropriated funds for its activities, but council meetings have not been actively held. There is also the absence of a master plan to expand services. Meanwhile, the city promotes new service providers to support areas not yet covered by the water supply services.

7.6 Water quality is being monitored by the Environmental Management Bureau (EMB). Since DCWD and BAWASA are heavily dependent on ground water resources, water contamination, especially by insufficient wastewater treatment, is regarded as a challenge as the population increases. However, the residents as well as the City have taken a slower pace in prioritizing this issue. Rather, focus is placed more on expanding the water supply services. During the Round Table Discussion held in September 27th 2017, the LGU pointed out the weakness of management of BAWASA and capacity to run the qualified water. While DCWD has been serving only urban area, they also have committed to assist some water association in rural area. The LGU’s concern are more to have technical assistance from DCWD in order to improve the laboratory to check water quality and expand water service areas.

2) Wastewater Management

7.7 As in most places in the Philippines, there is no sewerage system in Davao City. The majority of the citizens uses the septic tank for night soil. The grey water from the kitchen and bathing directly goes to the drainage or to the water bodies. This situation has been overlooked for so long even though DCWD has the Feasibility Study for Septage Management Project in 2013[1] but no implementation has been done yet. Septick tanks are installed as large as 93.7% of respondents in HIS. However, properly lined septick tanks are less than half. 62.5% of respondents answered that they never desludged the tanks and approximately 20% respondents "do not know" about frequenceis of desludging. The discharge point of septik tank effluent are ground, sewer pipes nd roadside ditch, so as grey water from kitchen and bathing. Those who experienced water-born diseases in the past year such as diarrhea (377), skin diseases (75) cholera (59), typhoid (49) and amoebiasis (31) are considerable numbers out of 2014 respondents. (inside blacket is number of those experienced). Consequently, it causes the absence from school and work, and expences for cure, which is direclty economic loss of the households. On the other hand, the respondents show limited awareness on the offensive odor, pipe clloging and overflow of wastewater.

3) Solid Waste Management

7.8 Solid waste management (SWM) services also vary by population density as well as barangay's initiatives. In Poblacion district, the daily collection are provided as large as 70% as this is central business district. Other than that, this service are very limited. Segregation of household solid waste has been widely conducted. The awareness of the waste disposal, segregation are also high as shown in the ***Annex 2***. The City Environment and Natural Resources Office (CENRO) does not provide waste collection services in the districts of Paquibato and Marilog. These barangays manage their own wastes, which are mostly agricultural in nature, and people dispose these in their idle land and in water bodies.

7.9 CENRO has street sweepers who start working at 3:00 in the morning so that when residents wake up, their surroundings are already clean. This is also being done to deter people from littering. Barangay captains also implement waste disposal management. They are under strict supervision by CENRO to carry out this responsibility to ensure the cleanliness of their respective jurisdictions. In cases where they fail to carry this out, they can be subject to a reorientation by the Davao City Ecological Solid Waste Management Board. CENRO assigns supervisors by area to manage the sweepers. Residents of those areas usually do not have any particular concern about SWM.

7.10 The City Government is trying to resettle the population at the coastal areas because their continued stay along the sea coasts has worsened the quality of the seawater. This initiative will be jointly conducted by the City Health Office (CHO), Department of Health (DOH), and DENR. The informal settlers along the riverbanks also cause similar problems as the coastal population.

[1] Davao City Septage Management Project Feasibility Study, June 2013, USAID, DCWD.

7.2 Water Supply in Davao City

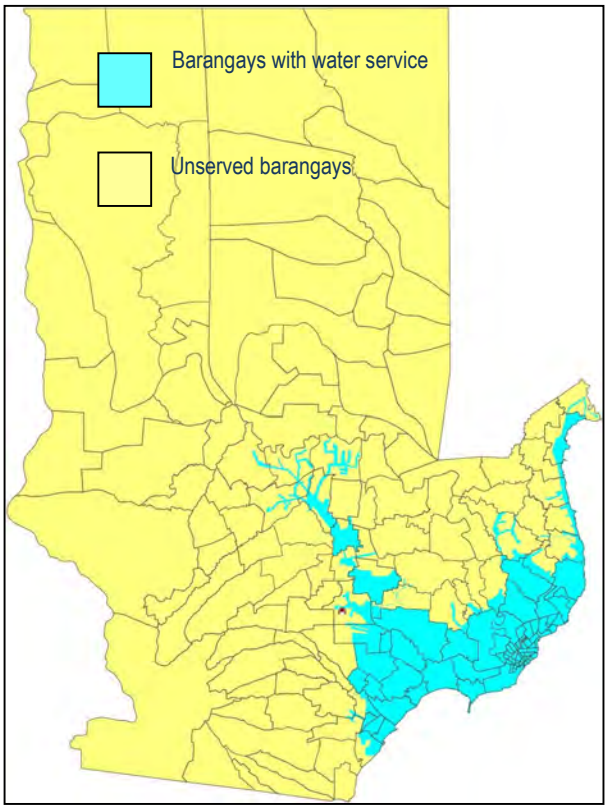
7.11 The main provider of potable water in Davao City is the Davao City Water District (DCWD), serving 60% of the city's barangays. Of the 40% of the barangays outside its water supply service area, some are serviced by the city government through barangay water and sanitation associations (BAWASAs).

7.12 The DCWD supplies water from Level III water systems, while BAWASAs generally supply water from Level I and Level II systems. NEDA Board Resolution No. 12, Series of 1995 describes the levels of water supply service in Davao City and the rest of the Philippines as follows:

(i) **Level I (Point Source):** A protected well or a developed spring with an outlet but without a distribution system, it is generally adaptable for rural areas where houses are thinly scattered. It serves an average of 15 households with people having to fetch water from up to a 250-meter distance.

(ii) **Level II (Communal Faucet System or Stand Post):** A piped system with communal or public faucets usually serving 4–6 households within a 25-meter distance.

(iii) **Level III (Waterworks System):** A fully reticulated system with individual house connections based on a daily water demand of more than 100 liters per person.



Source: DCWD

Figure 7.2.1 DCWD's Water Service Area

7.13 Regarding water sources of HIS respondents, DCWD connections made up 50%; BAWASAs, 25%; public faucets, own wells, rainwater storage, etc. comprised 20%, and other sources, 10%. Water supplied by the DCWD, BAWASAs, and water associations is used for all purposes.

7.14 Because rural barangays exceed urban ones, i.e., 103 against 78, the HIS samples are biased toward rural populations which are not the customer base of the DCWD. Those served by the DCWD account for only 43.6% of the total samples. HIS results also show satisfaction with water quantity, quality, pressure, service hours, and price is not low, but a considerable share of respondents (18%) expressed dissatisfaction or high dissatisfaction with the hours of supply. As large as 24% of the respondents assessed that water sufficiency is sometimes a problem.

1) DCWD Water Supply System

(a) Current Situation of DCWD

7.15 The service profile of the DCWD in the last five years is summarized in Table 7.2.1. Since annual growth of population of the City is as large as around 2.3%, service population of DCWD is still limited as 62.2% of the total population.

Table 7.2.1 Service Profile of DCWD in 2012–2016

Item / Year			2012	2013	2014	2015	2016
City Population			1,542,542	1,579,036	1,616,393	1,648,531	1,686,432
	Served by DCWD	No.	924,775	953,500	981,135	1,013,005	1,048,990
		(%)	60.0	60.4	60.7	61.4	62.2
Barangays in Davao City (no.)							182
	Served by DCWD						110
Service Connections (no.)	Residential		162,334	173,948	178,560	182,698	188,613
	Commercial/Industrial		21,785	15,810	16,977	19,211	20,473
	Others (Government)		569	677	689	691	711
	Total		184,688	190,435	196,226	202,600	209,797
Water Sources (no.)	Deep Wells		54	57	57	60	62
	Springs		1	1	1	1	1
Water Production Volume (000 m^3/day)	Deep Wells		247.9	253.6	262.7	273.5	289.2
	Springs		1.9	2.0	2.1	2.2	2.3
	Total		249.8	255.6	264.8	275.7	291.5
Metered Water Consumption (000 m^3/day)			187.9	188.7	188.3	193.7	201.7
Non-revenue Water (%)			25.0	26.2	28.9	29.8	30.8
Total No. of Staff			1,072	1,083	1,034	1,067	1,083

Source: IM4Davao Team based on DCWD data.

7.16 As shown in Table 7.2.1, the water sources of the DCWD are mostly deep wells. After water is pumped up from the deep well, it is transferred to a reservoir, then distributed to customers by gravity. All reservoirs operated and maintained by the DCWD are located at high elevations. The DCWD water supply system is shown in Figure 7.2.2.

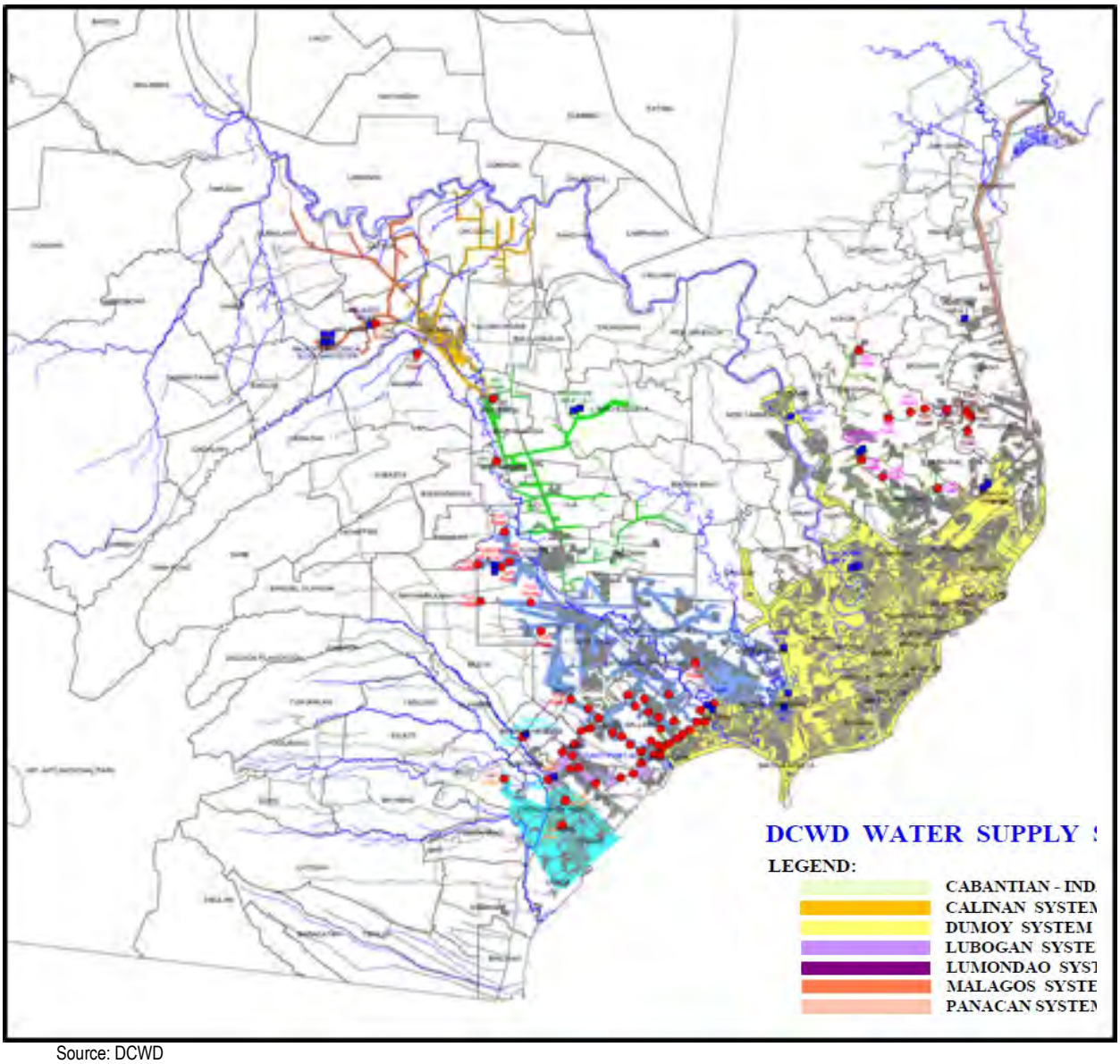
7.17 The DCWD has ten Water Supply System (WSS) in Davao city. Each WSS has water supply facilities shown in Table 7.2.2, where SSF means Slow Sand Filtration.

Table 7.2.2 Water Supply Facility for Each WSS

No.	Name of WSS	Production Well	Booster P/S	Chlorinating Facility	Reservoir	SSF
1	Dumoy WSS	37	6	4	10	
2	Tugbok WSS	9	-	9	3	
3	Panacan WSS	4	-	4	1	
4	Cabantian WSS	5	-	5	2	
5	Lubogan WSS	3	-	3	1	
6	Toril WSS	2	-	2	1	
7	Calinan WSS	1	-	2	1	
8	Riverside WSS	1	-	2	2	
9	Malagos WSS	-	-	1	-	1
10	Tibungco	1	-	1	1	
11	Total	67	6	32	22	1

Source: DCWD

7.18 Photos of reservoirs shown in the table above are shown in Figures 7.2.3 through 7.2.6.



Source: DCWD

Figure 7.2.2 DCWD Water Supply System

Source: IM4Davao Team

Figure 7.2.3 Panorama Reservoir and Pumping Station


Existing Reservoir


Well


Ongoing Construction of Future Reservoirs

Source: IM4Davao Team

Figure 7.2.4 Mandug Reservoirs and Well

Source: IM4Davao Team

Figure 7.2.5 Cabantian Reservoirs and Production Well


Existing Reservoir


Reservoir under Construction

Source: IM4Davao Team

Figure 7.2.6 Tugbok Reservoirs

(b) Current Issues of DCWD

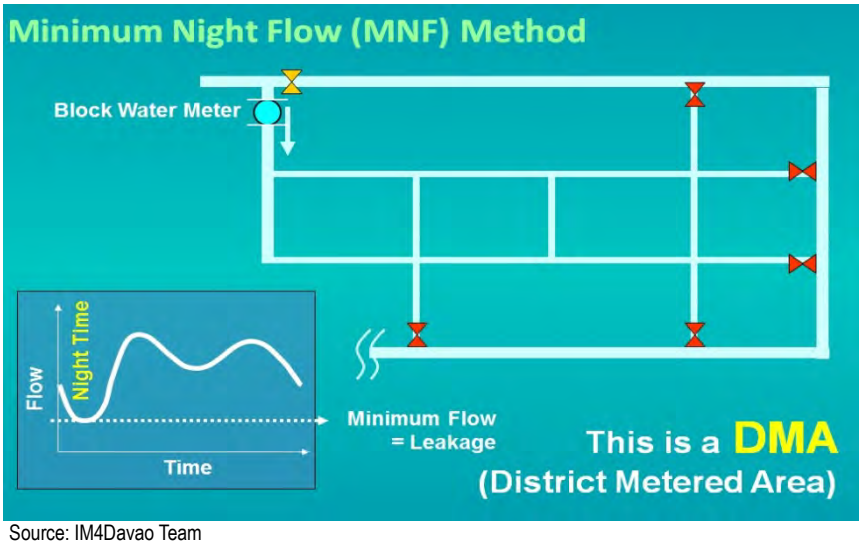
7.19 The DCWD currently faces the following issues:

(i) **Poor Water Quality from Some Deep Wells:** The quality of the water from the Indangan production well No. 3 and Panacan production well No. 6, which are both located in the eastern part of Davao City, does not meet quality standards. The water shows elevated values for color, total dissolved solids (TDS), and sodium.

(ii) **Insufficient Water Quantity:** The volume of production wells is also not enough to supply water to the customers. New water sources should be developed to adequately supply the expected demand in the future.

(iii) **Non-revenue Water (NRW):** NRW is still high at around 31% as of end-2016. To reduce this, the DCWD has established district metering areas (DMAs). A DMA is defined as a discrete area covered by a water distribution network, which is usually created by closing boundary valves so that it remains flexible to changing demands. However, a DMA can also be created by permanently disconnecting pipes to neighboring areas. Water flowing into and out of a DMA is metered, and flows are periodically analyzed in order to monitor the level of leakage.

The Minimum Night Flow (MNF) method is always applied to find leaks in a DMA. Figure 7.2.7 illustrates the MNF method applied in a district metering area.



Source: IM4Davao Team

Figure 7.2.7 Illustration of DMA and MNF

(c) Davao City Bulk Water Supply Project

7.20 In order to meet future water demand, the DCWD had decided to apply the Bulk Water Supply System based on the continuing discussions after "Feasibility Study of Davao City Bulk Water Supply Project" conducted in 2000. And finally Tamugan River was selected as the surface water source for drinking water in order.

7.21 The Davao City Bulk Water Supply System is a joint venture between the DCWD and Apo Agua Infrastructure Inc. (AAII). AAII is a joint venture between Aboitiz Equity (AVE) and JV Angeles Construction Corporation (JVACC). The joint venture agreement (JVA) between the DCWD and AAII was signed on 17 March 2015, and it took effect on 13 July 2015. The project is composed of two parts. Part A components are water intake, raw water transmission line, water treatment plant, and treated water supply facilities funded by AAII at a development cost of PHP10 billion. Part B components are primary pipe mains, storage facilities, and pipeline appurtenances to be funded by the DCWD at a development cost of PHP2 billion.

7.22 AAII can supply the DCWD with a minimum contracted volume of 300,000 m^3/day of treated bulk water from the Tamugan River for a period of 30 years. Water will be treated through a renewable energy-powered water treatment plant and the water will be conveyed by gravity. The distribution of treated water to residential, government, commercial, industrial, and bulk water end-users will be the responsibilty of the DCWD.

7.23 Contract period is 30 years as mentioned above, starting from the first day of operations of the Davao Bulk Water Supply System (DBWSS), which is expected to be by the end of December 2019, according to AAII. Unit price of treated bulk water supply is at PHP12.25 per cubic meter exclusive of tax. The minimum bulk water supply, as indicated in the JVA is at 300,000 m^3/day.

7.24 The provisions/conditions of joint venture agreement are as follows:

(i) **Off-take Point Specifications (OTP):** This refers to the minimum required volume of water from AAII per OTP.

(ii) **Raw Water Specifications:** This refers to the baseline raw water specifications which are the basis for the design of the treated bulk water supply facility, its testing, and

monitoring during the contract period.

(iii) **Treated Bulk Water Specifications:** This refers to the specifications for the treated bulk water consistent with Administrative Order No. 2007-0012, 2007 Philippines National Standards for Drinking Water (PNSDW 2007).

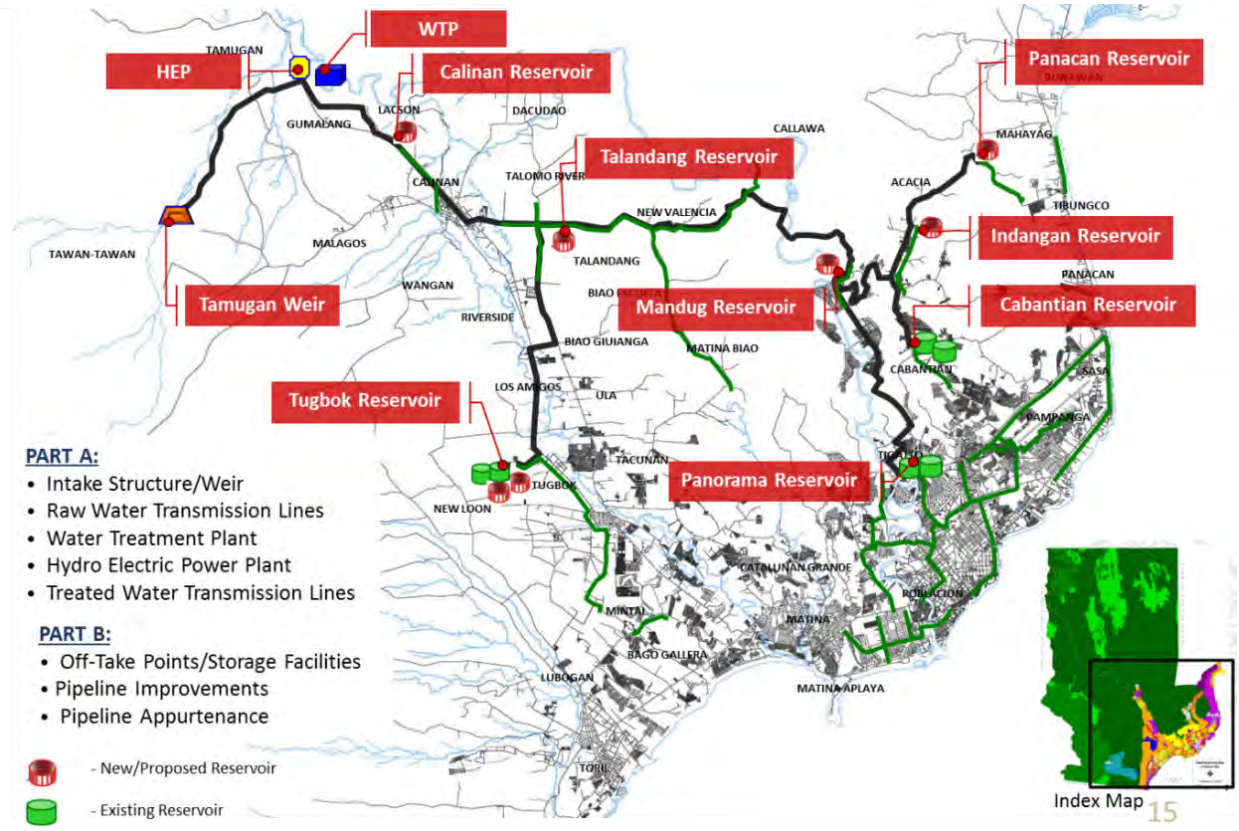
(iv) **Legal and Financial Baseline:** This is in compliance with the 2008 NEDA Joint Venture Guidelines.

7.25 Project benefits are shown below.

- Protects the long-term security of Davao's groundwater source;
- Reduced groundwater use and, thus, savings on power in the end;
- Improved water quality in Panacan and Cabantian WSS;
- Piped water for 114 out of 182 barangays;
- Benefits more than 1,000,000 people; and
- Improved water pressure and volume for existing consumers.

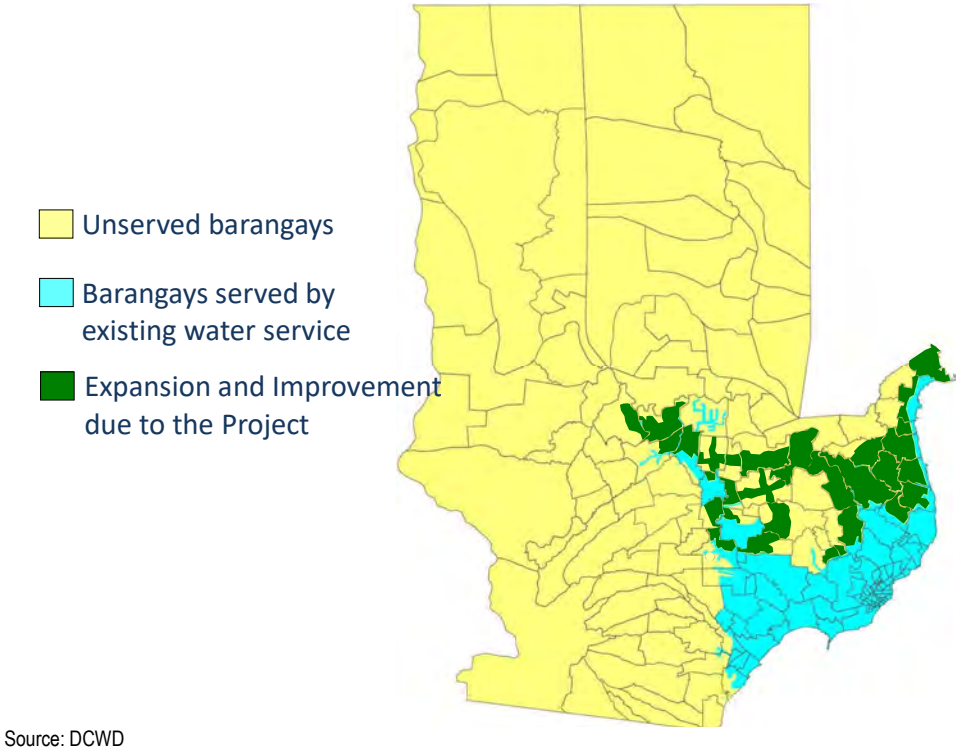
7.26 The outline of the Davao City Bulk Water Supply Project is shown in Figure 7.2.8. The project will expand coverage areas of the DCWD and improve existing ones (Figure 7.2.9).

7.27 Once the Davao City Bulk Water Supply Project is completed, an additional production amount of 300,000 m^3 will be supplied by bulk water. Figure 7.2.10 shows that the total amount of supplied water by 2030 will meet the demand of DCWD service areas in the same year. The DCWD will use 35 of the 62 current deep wells, with the intention of preserving groundwater for use in case of shortage or emergency in the future.



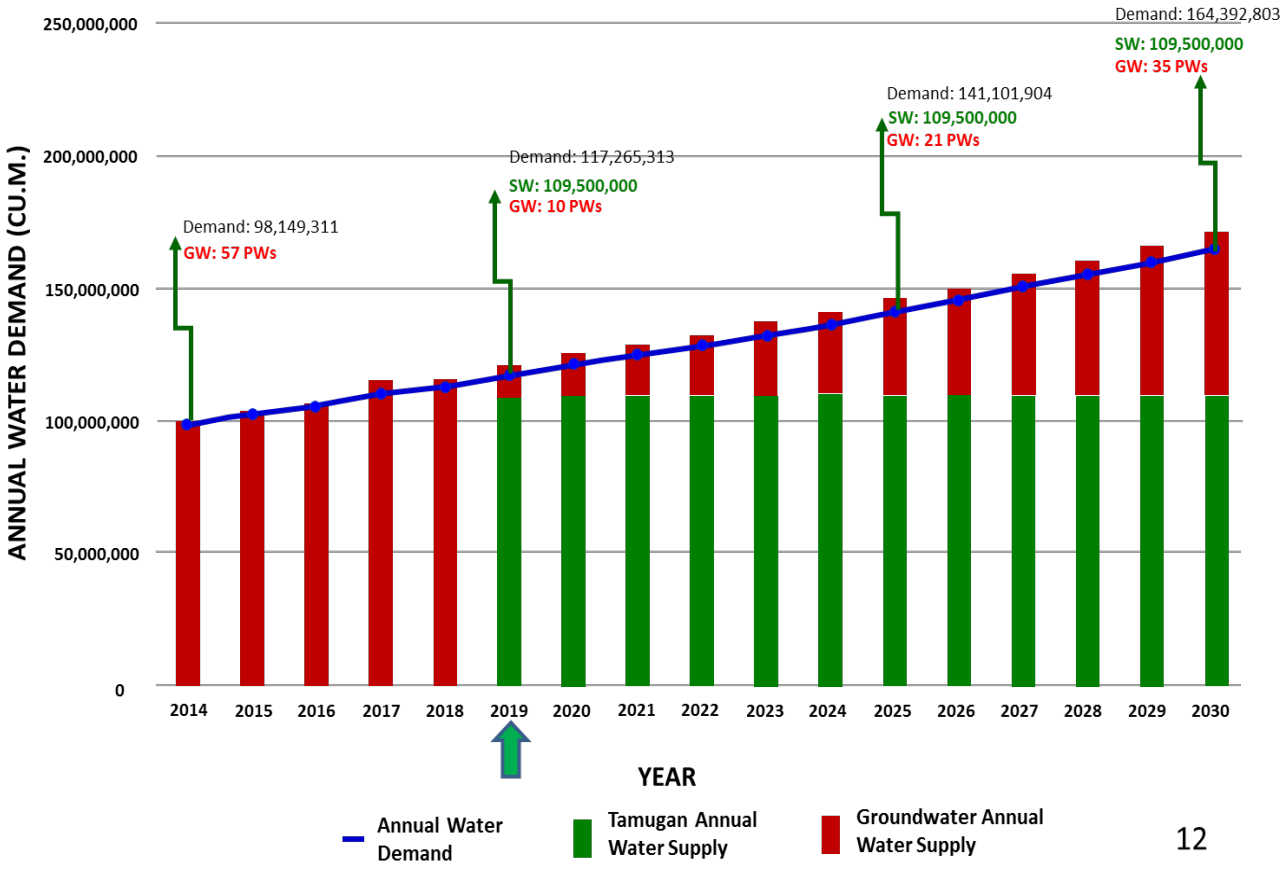
Source: DCWD

Figure 7.2.8 Davao City Bulk Water Supply Project



Source: DCWD

Figure 7.2.9 Expansion of and Improvement in DCWD Service Areas through the Davao City Bulk Water Supply Project



Source: DCWD

Figure 7.2.10 Water Demand and Supply in 2030

2) Rural Water Supply

(a) Current Situation

7.28 Water in rural areas is sourced from spring, groundwater, and rain water. Barangay Tibuloy in Toril District sources its water from a spring located in a mountain in Barangay Baracatan, a neighboring barangay. Figures 7.2.11 through 7.2.14 show the water supply system of Barangay Tibuloy.

7.29 The barangay has two reservoirs. Figure 7.2.12 shows the nearest from the spring and is connected through water pipes (Figure 7.2.11). These facilities are in Barangay Baracatan.

7.30 Figure 7.2.13 shows the main and bigger reservoir which is located in Barangay Tibuloy near the barangay hall. A water pipe is also placed to carry water between the two reservoirs. The occurrence of water theft is high because the pipe passes through several households before it reaches the reservoir in Tibuloy. As a result, water flow to the main reservoir can be limited.

7.31 Figure 7.2.13 shows two faucets and pipes connected to several *purok* (a political subdivision of a barangay), except for Purok 7, where it is difficult to connect water pipes due to the difficult road. For those served with water, the flow is confined to water drums placed beside the main barangay road. Water drums are placed at considerable distances from each other, and residents access water from these points.

Source: IM4Davao Team

Figure 7.2.11 Water Pipes of 6 Barangays Connected to the Spring

Source: IM4Davao Team

Figure 7.2.12 Smaller Reservoir of Barangay Tibuloy

Source: IM4Davao Team

Figure 7.2.13 Main Reservoir of Tibuloy near Barangay Hall

Source: IM4Davao Team

Figure 7.2.14 Water Drum and Smaller Water Pipe

7.32 Groundwater is sourced underground using an electrical water pump, manual pumping, or no pumping at all. Electric water pumps are installed with top stand reservoirs. This is usually seen in several barangays such as Upper Malagamot, Lizada, Sirawan, Subasta, and New Valencia. Manual pumping is done with the use of jetmatic pumps. Shallow wells require no pumping at all. Based on the initial data from the City Engineer's Office, shallow wells are one of the water systems in several districts such as Buhangin, Bunawan, and Calinan.

7.33 Figures 7.2.15 and 7.2.16 show the elevated reservoirs in selected areas of District 3. Figure 7.2.15 is one of the seven reservoirs in Barangay Subasta. Figure 7.2.16 shows a reservoir with a warning device on top to alert residents for a possible occurrence of flood, among others. During heavy rains, the area becomes prone to floods caused by the overflow of a river nearby.

Source: IM4Davao Team

Figure 7.2.15 Elevated Reservoir of Barangay Subasta, Calinan District

Source: IM4Davao Team

Figure 7.2.16 Elevated Reservoir in Samuel Village, Purok 1, Barangay Lizada, Toril District

7.34 Rain water serves as an alternative water source to springs or groundwater. It is the main source for those without any other water source. Springs can dry up especially during droughts. Groundwater extracted using electric water pumps will not be available during power outages. Some households have factored this eventuality and installed rainwater catchment facilities. Those without catchments may request water from their neighbors with rain water tanks. In some areas, households with rain water catchments still fetch drinking water from the nearest source of potable water.

7.35 The construction and establishment of water supply systems are funded either by the national government, i.e., the Department of Public Works and Highways (DPWH) or the local government.

Table 7.2.3 Funding Water Supply Systems

Level	Process	Funding Agency
National	The office of the congressman facilitates the construction of water supply systems with technical assistance from the DPWH.	DPWH
Local	The city LGU initiates the construction and establishment of water supply systems. Barangays through their respective barangay councils propose to the city LGU.	LGU

Source: IM4Davao Team

7.36 After construction, the water supply system is owned, managed, and operated by the barangay, an association, or a cooperative.

(b) Management of Water Supply Systems

(1) By Barangay Run

7.37 A barangay run is under the direct supervision and management of a Barangay Captain who may designate a responsible committee/group on water related concerns. The water is for free or with a fee. For example, water in Barangay Tibuloy, Toril District, is free, while residents of Barangay New Valencia pay for their water. Below are two situations of a barangay-run water supply system.

7.38 **Case of Barangay Tibuloy:** Barangay Tibuloy has been sourcing water from the same spring as barangays Baracatan, Catigan, Eden, Atan-Awe, and Sibulan. There are three challenges in this set-up, as follows: (i) Barangay Eden has the highest elevation among them and gets more water compared to the barangays located at the lower portion, including Barangay Tibuloy; (ii) the main water source can run out of water especially during drought; and, (iii) the cutting of water pipes to insert smaller pipes leading to houses. Barangay officers and/or selected residents work together in conducting repairs and maintenance. The common issues are water leakage and disconnected pipe because of strong water pressure as a resut of heavy rains. The barangay has seven purok, of which only one has no water supply. Since the installation of pipes in the 1990s, water has been free of charge. The barangay has no definite plans to turn over the ownership, management, and operation of the water supply system to an association because of unpredictable water supply.

7.39 **Case of Barangay New Valencia:** Barangay New Valencia has three reservoirs. The barangay owns, manages, and operates two, while the other is managed by an association. The barangay serves 200-300 households and the barangay hall serves as the main office for water-related activities such as meetings, payment of water bills, among others. An assigned person from the barangay receives payments on water dues. A minimum of PHP60.00 plus PHP10.00 charge for repairs and maintenance is being collected. Water sampling is done yearly and, cleaning and chlorinating the tank are conducted twice a year. The barangay has seven purok. Only Purok 7 has no water connection due to the absence of electricity. Residents in this purok rely on rain water and/or spring.

(2) By Barangay Water and Sanitation Associations (BAWASAs), a private association

7.40 An association which manages rural WSSs can be established at either the purok or barangay level. It could be established solely for water matters, or has a subgroup that deals with water, or has several persons assigned to water-related concerns. The water source of such associations is groundwater extracted using electric water pumps. Many of them have no designated offices. Meetings are conducted within the vicinity of the barangay hall, in a purok meeting place (usually a structure with roof, benches, and tables made of light materials), or in the residence of the current association chairperson. Associations run Level III WSSs. This means that their members are individually connected and billed based on individual meter readings. Some of the associations collect PHP10.00 or PHP 70.00 per cubic meter at the minimum with incentives for early payment. For two consecutive months of non-payment, water connection is cut off. Non-revenue

water, specifically water leakage, can be addressed depending on the availability of funds to buy water connectors. Otherwise, they use rubber to temporarily stop water leaks. For water sampling, the associations send to DOH, yearly, every other year or, once, since the installation of water supply system.

7.41 **Case of MAWASA:** Of the several associations visited by the IM4Davao Team, the City Engineer's Office identified the Manambulan Waterworks and Sanitation Association (MAWASA) in Barangay Manambulan, Tugbok District, as one of the better-performing associations. Figures 7.2.17 through 7.2.19 show the office, record book, and water supply system, respectively, of MAWASA.

7.42 Figure 7.2.17 shows the office of MAWASA located a few meters away from the barangay hall. The office is open from Monday to Friday, 9 am-4 pm. The office has no basic office equipment yet such as laptops or computers and printers. MAWASA was established in 1994. It is guided by its constitution and by-laws, stipulating among others the election of officers every three years and a general assembly of members once a year. The association went through various challenges in terms of its management and operation, yet remaining steadfast through the years.

Source: IM4Davao Team

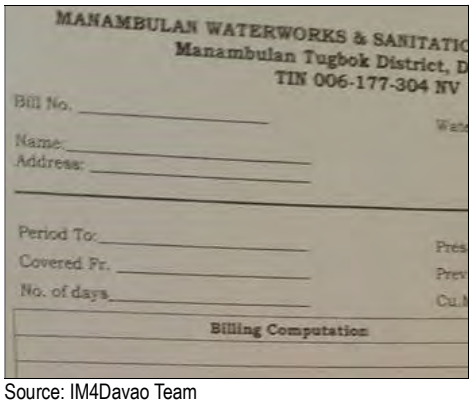
Figure 7.2.17 MAWASA Office

7.43 Of the 900 households in Barangay Manambulan, MAWASA has been servicing 546, which mean 354 households are not yet connected to them. These unconnected households get water from the river or the rain for their needs. For drinking water, they buy from connected households at PHP1.00 per gallon or PHP25.00 per gallon for purified drinking water.

7.44 The barangay has three reservoirs. Because of political dispute, the barangay, through its MAWASA, manages only two reservoirs. The current administration has ongoing requests to the city LGU for the installation of additional reservoirs.

Source: IM4Davao Team

Figure 7.2.18 Record Book of MAWASA



Source: IM4Davao Team

Figure 7.2.19 Billing Form of MAWASA

7.45 MAWASA uses a columnar notebook as record book and gives its members a billing statement, as shown in Figure 7.2.19. A grace period of at least 15 days is provided from the date of receipt. Non-payment on the due date results in disconnection on the

next day.

7.46 **Case of a Cooperative:** In Barangay Callawa, a cooperative named Barangay Callawa Women Consumers Cooperative (BCWCC) used to run the water system. It was initially run by the barangay before it was turned over to BCWCC last October 2014. There are several cooperatives in Barangay Callawa with whom the barangay captain consulted for possible ownership, management, and operation of the water suply system. It was only the BCWCC who accepted the offer. However, in September 2016, the BCWCC gave back the ownership, management, and operation to the barangay due to issues which were left for the barangay to resolve.

(c) Regulatory Agencies

7.47 In Davao City, the Technical Working Committee on Water and Sanitation was created through Executive Order 05, Series of 2013. The chairperson is the city mayor, the co-chairperson is the acting city administrator, and the members are the City Planning and Development Office, City Accountant's Office, City Engineer's Office, City Health Office, City Social Services and Development Office, and the DCWD. Its duties and responsibilities are as follows:

- To monitor the operation and maintenance of the water system as well as the management of BAWASAs;
- To monitor and check the record of operations submitted by BAWASAs;
- To regularly conduct site and system inspections for the early detection of failure of the system of BAWASA management;
- To assist barangay councils in seeking financial sources for the necessary repair of water supply systems, the cost of which is more than the fund accumulated by the respective associations and the funds allocated by the barangay council; and,
- To conduct information, education, communication (IEC) campaigns in the community on health and sanitation to protect water sources and maintain good water quality.

(d) Issues on Rural Water Supply

(1) Among Barangay Run and Private Run Water Supply System

7.48 Several issues face BAWASAs and private associations regarding rural water supply, as follows:

(i) **Limited Water Supply in Some Areas:** Water supply is already limited in some areas such as Upper Malagamot, Panacan due to the growing population in the served area. The City Engineer's Office has already advised them to drill for another water source.

(ii) **Unpredictable Water Supply:** This situation normally happens when the source is a spring. Water runs out when there is a drought or during a sustained hot weather. Meanwhile, during heavy rains, water overflows from pipes.

(iii) **Insufficient Funds:** Some BAWASAs lack immediate funds to immediately buy materials to stop water leak, the common problem of water suppliers. They use rubber as a temporary solution, while some just do not address this issue.

(iv) **Non-payment of Water Bills by Some Members:** Water connection is cut off for non-payment of water bills for two consecutive months. According to the City Health Office, there were BAWASAs who were not able to sustain their operations because their members did not pay their dues.

(v) **Non-potable Water in Some Areas:** Barangay Waan has a deep well but its residents rely on water refilling stations for their drinking water.

(vi) **Non-compliance with Regular Water Testing:** According to the City Health Office , bacteriological exam is needed every three months and physical/chemical exams every six months. However, the associations take water sample for testing either once a year, once every two years, or only during the installation of the water supply system. Associations do not subject themselves to regular tests probably because there are no incidents of water-borne diseases in their areas.

(vii) **Lack of Regular Training and Mentoring:** The associations have not undergone regular training and mentoring to update and enhance the capacities of their officers in, among others, institutional strengthening.

(2) Regulatory Agencies

7.49 Some of issues facing government agencies overseeing barangay run and private run water supply system are as follows:

(i) **Lack of City Government Personnel to Monitor and Regulate the Associations:** It is the mandate of the city to monitor, regulate, and strengthen the water supply system especially in rural areas. The City Health Office has few sanitation inspectors, who are also busy with other aspects of environmental sanitation. Meanwhile, the City Engineer's Office only has 19 staffers attend to water and sanitation concerns.

(ii) **Lack of Updated and Comprehensive Data and Information on Water Supply:** This data is needed to for better planning. CEO has provided data and information on the water supply system. However, there are yet missing information and some data for validation.

(iii) **Lack of Rural Water Supply Master Plan:** Rural water supply has been one of the city mayor's agenda, including the implementation of the Rural Water Supply and Sanitation Investment Plan to expand water services to unserved areas and to improve it in underserved ones. Meanwhile, the Technical Committee on Water and Sanitation mainly oversees the entire water and sanitation situation of the City. The mayor has appropriated funds for its activities. The Committee meets every quarter. In the committee, there is a need to draft a master plan to expand services even as the city encourages new service providers to support areas not yet covered by water supply services.

(iv) **Need to Treat Wastewater:** Water quality is being monitored by the Environmental Management Bureau (EMB). Since the DCWD and BAWASAs are heavily dependent on groundwater resources, water contamination, especially from untreated wastewater, is regarded as a challenge as the population continues to increase. However, residents and the city government have taken a slower pace in prioritizing this issue. Rather, focus is placed on expanding water supply services.

(v) **Lack of Technical Capacity in BAWASAs:** During the roundtable discussion held on 27 September 2017, the LGU pointed out the lack of technical capacity in BAWASAs. In particular, it asked the DCWD for technical assistance to help improve the laboratories in BAWASAs so they can check the quality of their water sources and expand their service areas. Although the DCWD serves urban areas only, they have committed to assist some rural water associations in this regard.

7.3 Flood Control (Drainage and Rivers)

1) Storm Water Control

7.50 To address the issues and challenges in providing infrastructure and social services to improve the quality of life in Davao City, the LGU has invested in different projects. In 1998, CPDO released the Urban Storm Drainage Masterplan, which discusses the state of the drainage system in the city at that time supported by historical accounts of previous investments made for storm water control.

7.51 The masterplan described the condition of the city's drainage system in 1981 as satisfactory. The drainage system only covered the urbanized area. As early as 1998, Davao City had been experiencing flash floods, as a result of urban sprawl, causing property damages and health related problems that dampen urban growth. Hence, the city embarked on an Urban Drainage and Flood Control Project. The primary objective of the project was to upgrade and rehabilitate the drainage system and implement measures to eradicate flooding particularly in the urban area and lowland areas to allow development opportunities.

7.52 The Urban Storm Drainage Masterplan mentioned the sewerage system masterplan of 1993 (updated in 1996) which stated the investment of Davao City on sewerage systems to increase environmental protection and as mandated by the NEDA Board requiring all LGUs to invest in an urban sanitation system as well as to meet the quality standards of DENR on wastewater effluent prior to discharge (CPDO, 1998).

7.53 The city's systems to accommodate storm water have been insufficient and inadequate for the volume of precipitation, tidal flows and sea level rise as discussed in its CLUP for 2013 to 2022. The goals and strategies established by the City Government in the CLUP focused on the maintenance of existing drainage systems and constructing a climate resilient system that can endure the impacts of climate change (City Government of Davao, 2014).

2) Storm Water Control Master Plan

(a) History of Storm Water Control Master Plan

7.54 The first storm water control master plan in Davao City was formulated in 1982. After that, an update was done in 1998, which master plan remains as the latest edition to date.

7.55 The 1982 master plan selected a priority area for construction and operation of the storm water drainage system as well as established the planning and design criteria for such system.

7.56 The 1998 master plan, on the other hand, selected six barangays as priority areas for the installation of the storm water drainage system and for the preparation of a basic plan, preliminary design, cost estimate, and maintenance plan. The installation project period is planned to be completed six years from commencement, or in 2004.

(b) Outline of Storm Water Control Master Plan in 1998

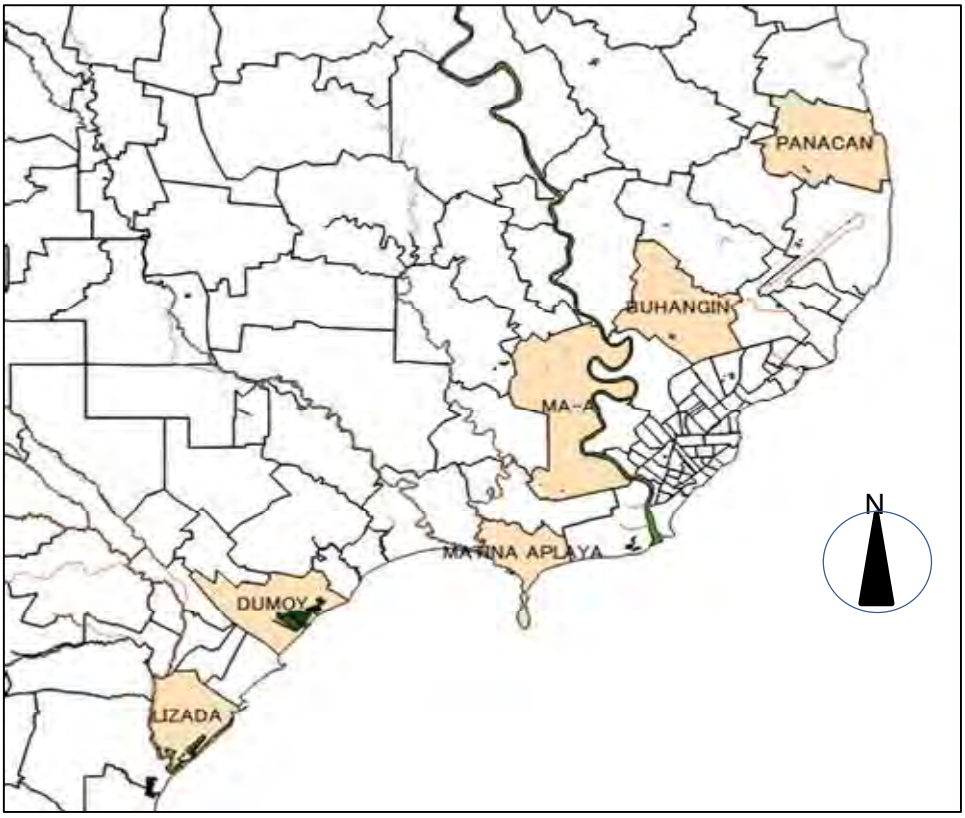
(1) Priority Areas

7.57 The selected priority areas for the control of storm water are shown in Table 7.3.1 and Figure 7.3.1.

Table 7.3.1 Outline of the Priority Areas

Name of Barangay	District	Population in 2015	Area (ha)	Population Density (persons/hectare)
1. Lizada	Toril	20,112	443.7	45.33
2. Dumoy	Talomo	18,622	530.8	35.08
3. Matina Aplaya	Talomo	33,384	315.6	105.78
4. Ma-a	Talomo	59,803	999.4	59.84
5. Buhangin	Buhangin	65,461	672.5	97.34
6. Panacan	Bunawan	35,806	703.3	50.91

Source: Davao City Urban Drainage and Flood Control Project, Storm Drainage Master Plan Final Report, 1998.



Source: IM4Davao Team

Figure 7.3.1 Location Map of the Priority Areas

(2) Planning Conditions

(i) **Run-off Coefficient:** Run-off coefficients by land use type are given in Table 7.3.2.

(ii) **Return Period:** The return period for waterway design is given in Table 7.3.3

(iii) **Tidal Level:** The invert elevations of outlet creeks and main drains to the Davao Gulf are below sea level. Therefore, the discharge capacities of the creeks and drains depend on the tide levels (i.e., high capacity at low tide and low capacity at high tide). The tide level record at the Sta. Ana port is shown in Table 7.3.4.

Table 7.3.2 Run-off Coefficient by Land Use Type

Land Use Type		Run-off Coefficient
1. Residential zone	Low density	0.50
	Medium density	0.60
	High density	0.75
2. Protected residential zone	Low density	0.30
	Medium density	0.40
	High density	065
Socialized housing		0.60
3. Commercial zone	Minor	0.70
	Major	0.95
4. Protected commercial zone	Minor	0.75
	Major	0.95
5. Open space zone		0.10
6. Transportation/Utility zone		0.30
7. Industrial zone	Light	0.70
	Medium	0.80
	Heavy	0.90
8. Protected industrial zone	Light	0.70
	Medium	0.75
9. International zone	General	0.65
	Special	0.25
10. Protected international zone		0.60
11. Conservation zone		0.10
12. Tourism development zone		0.25

Source: Davao City Urban Drainage and Flood Control Project, Storm Drainage Master Plan Final Report, 1998.

Table 7.3.3 Return Period

Type of Waterway	Return Period
Main drain channel	25 years
Lateral drains	2 years

Source: Davao City Urban Drainage and Flood Control Project, Storm Drainage Master Plan Final Report, 1998.

Table 7.3.4 Tide Level Record at the Sta. Ana Port

Tide Condition	Elevation above MLLW (m)
Mean Higher High Water (MHHW)	1.536
Mean High Water (MHW)	1.407
Mean Sea Level (MSL)	0.755
Mean Low Water (MLW)	0.102
Mean Lower Low Water (MLLW)	0.000

Source: Davao City Urban Drainage and Flood Control Project, Storm Drainage Master Plan Final Report, 1998.

(3) Project Cost

7.58 The grand total of the capital cost for the six main drain systems at 1998 prices was estimated at about PHP380 million (see Table 7.3.5).

Table 7.3.5 Project Cost

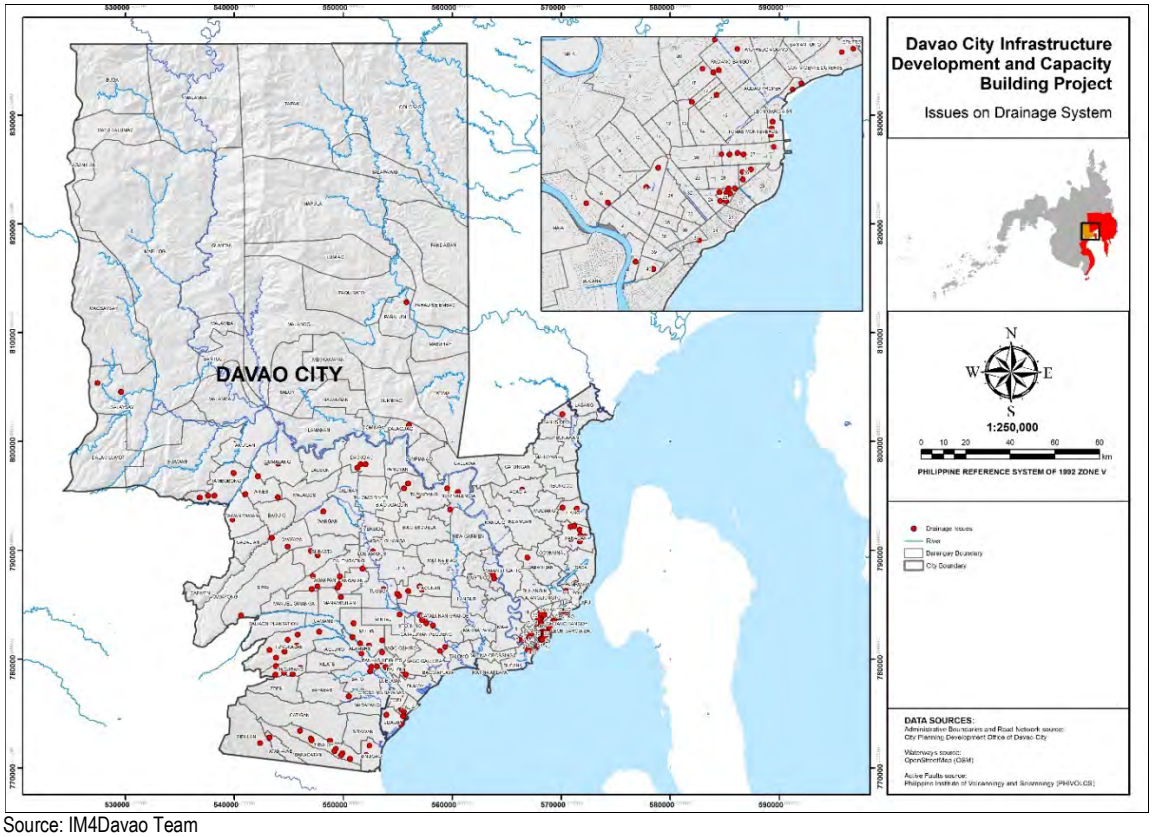
Storm Drainage System	Total Length (m)	Construction Cost (PHP million)	Right-of-way Cost/ Land Cost (PHP million)	Total cost (PHP million)	Benefited area, 1998 (ha)
1. Lizada	6,304	68.446	2.824	71.271	314.7
2. Dumoy	12,911	65.495	7.286	72.781	566.1
3. Matina Aplaya	8,202	80.946	4.561	85.507	497.0
4. Ma-a	7,499	123.947	1.942	125.889	833.8
5. Buhangin	2,010	14.795	1.177	15.972	1,005.4
6. Panacan	3,010	9.715	1.362	11.007	94.9
Total	**39,936**	**363.344**	**19.153**	**382.497**	**3,312.0**

Source: Davao City Urban Drainage and Flood Control Project, Storm Drainage Master Plan Final Report, 1998.

3) Issues on Storm Water Control in Davao City

7.59 Inadequacy of the existing drainage system to withstand the changes in volume of precipitation was the main problem identified in the CLUP. Impacts include flooding particularly in the lowland areas and overflowing of rivers affecting the communities residing along or near the water bodies.

7.60 The IM4Davao Team conducted several outreach meetings at the onset of this project with the purpose of disseminating project information to leaders and officers of all barangays of the city. Among others, the meetings engaged the participants in activities that revealed priority issues and current problems in their respective areas. Figure 7.3.2 shows the locations of identified issues related to drainage. A total of 158 drainage problems were identified, which tend to be more distributed in the urban and lowland areas near the coastline.



Source: IM4Davao Team

Figure 7.3.2 Identified Areas with Drainage Issues

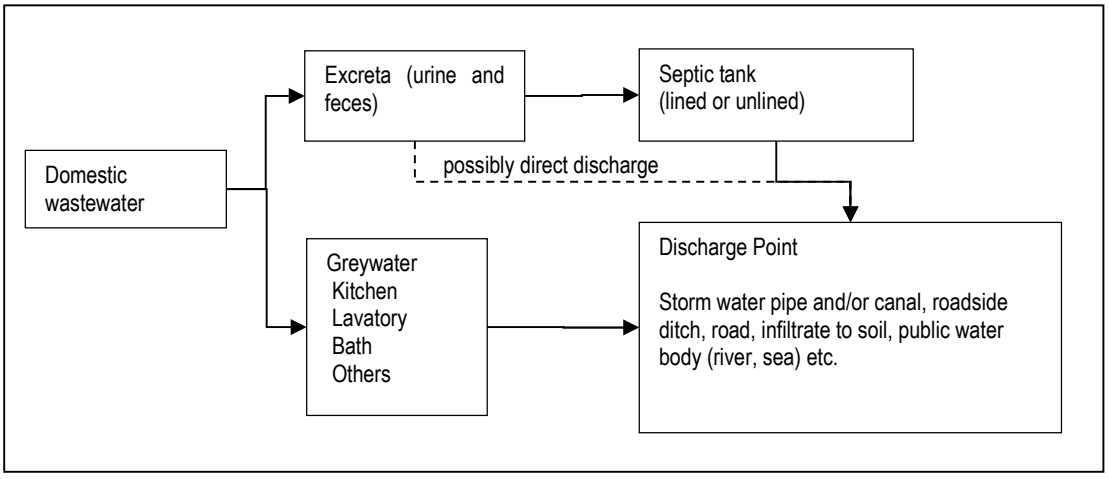
7.4 Wastewater Management

1) Current Domestic Wastewater Stream

7.61 As in most places in the Philippines, there is no sewerage system in Davao City. Majority of the citizens use septic tanks for night soil. Grey water from kitchens and bathing directly goes to the drainage or to water bodies. This situation has been overlooked for so long. Even though the DCWD has produced the Feasibility Study for Septage Management Project in 2013,[2] no implementation has been done yet.

7.62 Septick tanks are installed in houses of about 93.7% of the HIS respondents. However, properly lined septick tanks are less than half. About 62.5% of respondents answered that they never desludged the tanks and approximately 20% respondents “do not know” about frequenceis of desludging. The discharge point of septik tank effluent are ground, sewer pipes nd roadside ditch, so as grey water from kitchen and bathing. Those who experienced water-borne diseases in the past year such as diarrhea (377), skin diseases (75) cholera (59), typhoid (49) and amoebiasis (31) are considerable numbers out of 2014 respondents. (inside blacket is number of those experienced). Consequently, it causes the absence from school and work, and expences for cure, which is direclty economic loss of the households. On the other hand, the respondents show limited awareness on the offensive odor, pipe clloging and overflow of wastewater.

7.63 Currently, there is no sewage system installed for domestic wastewater in Davao City. Hence, excreta from toilets is discharged into septic tanks in many cases. Untreated water from septic tanks is discharged into roadside ditches and/or rainwater drainage where it mixes with greywater (see figures 7.4.1 and 7.4.2).



Source: IM4Davao Team based on internet information and site reconnaissance.

Figure 7.4.1 Current Domestic Wastewater Stream

[2] Davao City Septage Management Project Feasibility Study, June 2013, USAID, DCWD.

Roadside ditch

Roadside ditch

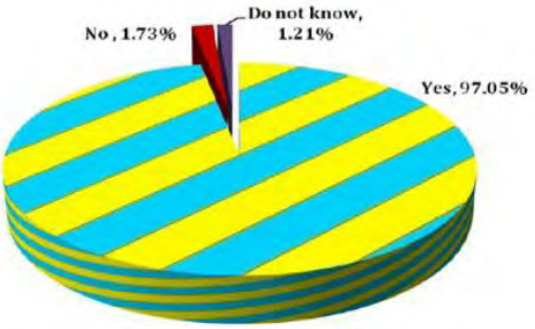
Roadside ditch

Roadside ditch to storm water pipe

Source: IM4Davao Team

Figure 7.4.2 Present Situation of Roadside Ditch (San Pedro Street, Davao City)

7.64 The DCWD reports that about 82% of households in Davao City have sanitary toilets (108 barangays within 182 barangays) in 2013. In a customer satisfaction survey (CSS) conducted in 2012, about 97% of DCWD customers revealed that septic tanks are available for their use (Figure 7.4.3).



Source: IM4Davao Team

Figure 7.4.3 Households with Septic Tanks[3]

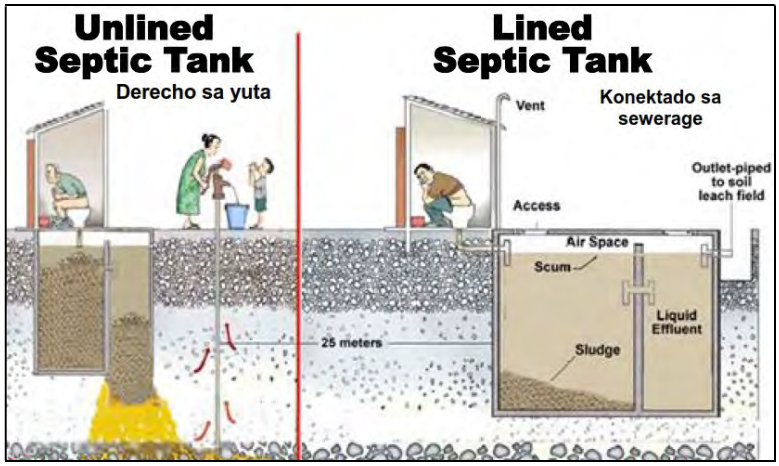
7.65 Under these circumstances, DCWD, which is in charge of water supply and domestic wastewater treatment, regards septage treatment as the first priority for domestic wastewater treatment.

[3] Davao City Septage Management Project Feasibility Study, USAID, 2013

2) Septage Management

(a) Outline

7.66 Many households installed their own septic tanks for excreta treatment/disposal in Davao City. Two types of septic tanks exist; the unlined and the lined (Figure 7.4.4). The use of an unlined septic tank can easily contaminate the ground water because the liquid part of the excreta infiltrates down to the ground. In the lined septic tank, on the other hand, treated water flows out from the septic tank and is discharged to the roadside ditch and/or rainwater drainage.



Source: IM4Davao Team

Figure 7.4.4 Unlined and Lined Septic Tank

7.67 In addition, in order to make septic tank function properly, it is necessary to extract the sludge (septage) accumulated in the tank at an appropriate cycle.

7.68 The Davao city enacted and enforced an ordinance concerning septage and sewage in 2010 (“Ordinance No. 0363-10 Series Of 2010/ Ordinance Establishing A Septage and Sewerage Management Program In Davao City) before NSSMP implemented. Currently, Davao city is implementing the septage management program based on this ordinance.

7.69 In the ordinance, management of the septic tanks was set forth with the following conditions:

- Structure criteria of septic tank;
- Treatment and disposal method of the extracted septage (treatment facility, sanitary landfill or land application site);
- Septage extraction cycle (every five years or when the sludge volume is already one-half of the total capacity of the septic tank, or when the septic tank becomes ineffective whichever comes first);
- Desludging fee (service provider shall pay to the city, 75PHP for residential building, 250PHP for commercial establishment entity);
- Necessary qualification of the desludging service provider;
- Penal provision; and
- Others.

7.70 The actual situation of septage management is as follows according to HIS

results:

- Many households have not desludging of their septic tanks at appropriate frequencies. ("Never" and "Not sure" for frequency of desludging septic tank is over 80%).

Table 7.4.1 Frequency of Desludging Septic Tank

	No.	%
Annually	36	2.0
Once per 2 years	91	5.1
Once per 3-5 years	109	6.2
Once per more than 5 years	86	4.9
Never	1105	62.5
Not sure	341	19.3

Source: HIS conducted by IM4Davao Team

- 85% do not pay for septic tank desludging, but from those who paid, cost per service average value is 2779.375 PHP, and middle value of cost is 2550 PHP. The septage should be treated in plants before it is disposed, but 91% of respondents do not know if they are treated properly.

Table 7.4.2 Payment for Desludging Service of Septic Tanks

	No.	%
Yes	269	15.5
No	1466	84.5

Source: HIS conducted by IM4Davao Team

7.71 There are now seven registered septage desludging service providers in the city, as listed in Table 7.4.3.

Table 7.4.3 List of Registered Septage Desludging Companies

Name	Business name	Address/Tel. No.	Barangay
1. Guillen, Leo Ladica	LL. Guillen Excavation Septic Tank Service	New Society Village, Matina	Matina Crossing
2. Alegria, Paulion Jr. Laquina	Surop Septic Tank Excavator & Plumbing Service	Purok 12 St. John/ 2255178	Bucana
3. Añover, Nelsa Mugat	Hardcore Septic Tank Cleaning & Plumbing Service	Purok 12B Palsil/ 2216312	Bucana
4. Debil, Rolando Requiso	Landor Septic Tank Excavator & Plumbing Service	Purok 5 Boulevard (near brgy. hall)	37-D
5. Galindo, Eric Mariano	Septic Tank Excavation & Plumbing service (Booking Office)	Purok 12-A St. John/ 2126312	Bucana
6. Guillen, Mareta Gerali	Service Contractor Engaged in Septic Tank Cleaning	Blk.13, New Society Village	Matina Crossing
7. Aquino, Jemson	Romil Sludge and Allied Service	#45 Purok 10, Nacilla Village, Bugac, Maa	Maa

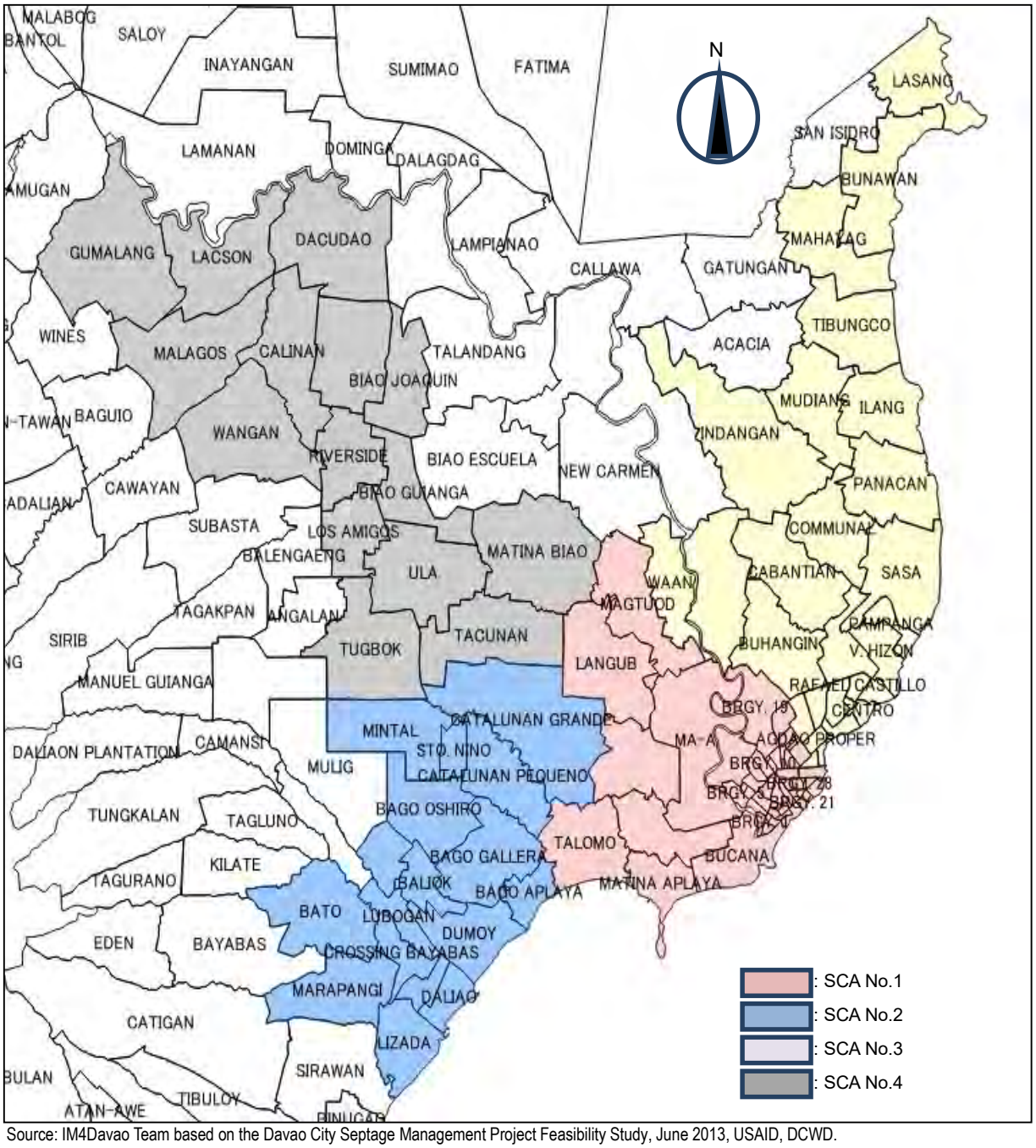
Source: Davao City Government.

(b) Previous Study

7.72 A previous study on septage management, the Septage Management Project Feasibility Study, was implemented in 2013 by DCWD and USAID. The study is outlined below.

(i) **Septage Collection Area:** The septage collection area (SCA) of Davao City is proposed to be subdivided into four (4). The four SCAs shall cover 108 of its total 182 barangays. The 108 barangays are the same barangays covered by the present water supply service area of DCWD. (Refer to Figure 7.4.5)

(ii) **Study Results:** A summary of the study results is shown in Table 7.4.4.



Source: IM4Davao Team based on the Davao City Septage Management Project Feasibility Study, June 2013, USAID, DCWD.

Figure 7.4.5 Location Map of Septage Management Project

Table 7.4.4 Results of the Septage Management Project Feasibility Study

Factor		2020	2025
City Population	Population	1,889,899	2,158,139
	No. of Households	395,376	451,494
Water Service Connections	Residential Customers	202,269	235,209
	Non-Residential Customers	28,496	33,783
	Total Connections	230,765	268,993
	Share to Total Households Served (%)	51	52
Septage Management Service	WD Customers	230,765	268,993
	Non-WD Customers	4,927	12,491
	Total Households Served	207,196	247,700

Factor		2020	2025
	Share to Total Households Served (%)	52	55
		Phase 1 (2016-2020)	**Phase 2 (2021-2025)**
Treatment Plant Capacity (m^3/day)		410	+130
No. of Desludging Trucks	10 m^3 Vacuum Truck	5	+2
	5 m^3 Vacuum Truck	9	+2
	2.5 m^3 Vacuum Truck	6	+2
No. of Dump Trucks		2	--
Capital Cost (PHP million)	Land	21	--
	Treatment Plant	204.5	+61.3
	Desludging Trucks	88.3	+33
	Total	313.8	+94.3
Annual O&M Costs (PHP million)	Treatment	15.1	16.6
	Desludging	17.4	22.4
	Total	32.5	39
Septage Tariff	PHP/m^3 of water consumed (at 2013 price level)	1.23	
	Equivalent % of Water Bill (%)	6.63	
Financial Indicators	Weighted Ave. Cost of Capital (WACC) (%)	10.52	
	Net Present Value (NPV) at WACC (PHP million)	206.6	
	Financial Internal Rate of Return (FIRR) (%)	19.94	
Economic Indicators	Economic Internal Rate of Return (EIRR) (%)	76	
	Benefit-Cost Ratio (BCR)	3.77	

Source: Davao City Septage Management Project Feasibility Study, June 2013, USAID, DCWD

(c) Septage Management Program

7.73 Introduction of the sewer system requires a considerable investment and a long time; the proper Septage management is less effective in preventing water pollution than sewage system. However, it can be realized in less investment than sewer system and can be establishing short time compared with the introduction of the sewerage system.

7.74 DCWD formulated septage management program in December 2016 based on Septage management F/S in 2013. Currently, DCWD is making efforts to conclude MOA with Davao City which is necessary to implement this program.

7.75 This program will be implemented in two phases, Phase1a and Phase1b. Phase1a began construction of a septage treatment facility in 2018 and started operation of the facility in 2019, Phase1b started construction of a septage treatment facility in 2019 and started service in 2021. The number of buildings subject to Desludge assumed by DCWD is shown below.

Table 7.4.5 No. of Desludged Buildings

SCA	Nos. of Desludged Residential Buildings	Nos. of Desludged Commercial Buildings
Phase 1a		
SCA 1	36,288	7,168
SCA 2	21,495	1,865
Sub-Total	57,783	9,033
Phase 1b		
SCA 3	40,738	4,527
SCA 4	4,814	380
Sub-Total	45,552	4,907
Total	103,335	13,940

Source DCWD

3) Sewerage System

7.76 Currently, there is no sewerage system in Davao City to treat domestic wastewater. Several sewerage system plans were formulated in the 1980s to 1990s (Table 7.4.6). However, they have not been realized. Because a considerable period of time had passed since their formulation, it is necessary to update such plans.

Table 7.4.6 Outline of Existing Studies

Name of Study	Outline	Formulated Year	Remarks
1982 Sewerage Plan	The sewerage scheme formulated with the 1982 drainage master plan. – Two sewage treatment plants each located at Dumalag Point and Lanang. – Combined main drains each at Talomo, Matina, Poblacion, Agdao, Lanang and Insular – Intercepting sewer main to the combined main drains.	1982	Source: Davao City Drainage Master Plan 1998
1993 Sanitation and Sewerage Master Plan	Project components: – Communal sanitation facilities (140 communal toilets for 35,000 residents in the Poblacion area) – Sewerage systems (Poblacion and Toril) • Target population of Poblacion sewerage system stage 1: 147,000 in the year 2015 • Target population of Toril sewerage system stage 1: 19,700 in the year 2015 • Cost of stage1 sewerage: PHP231 million • Cost of stage1 sanitation: PHP263 million – Maintenance equipment and spare parts – Institutional support	1993	Source: Davao City Drainage Master Plan 1998
1997 Sewerage and Sanitation Project Water District Development Project World Bank Davao City	Project components: – Communal sanitation facilities (140 communal toilets for 35,000 residents in the Poblacion area) – Poblacion Sewerage systems • Coverage population: 147,300 in the year 2015 • Coverage area 486ha • Two pump stations (25,725 and 10,558 m^3/day) • WWTP capacity: 17,540 m^3/day • Total project cost: P 881.78 million (price level 1997) – Toril Sewerage systems • Coverage population: 19,700 in the year 2015 • Coverage area 215ha • WWTP capacity: 3,642 m^3/day • Total project cost: PHP206.37 million (price level 1997) – Total project cost: PHP1,088.15 million (price level 1997)	1997	Source: 1997 Sewerage and Sanitation Project Water District Development Project Environmental Assessment Report World Bank Davao City
Davao City Wastewater Collection and Treatment System Feasibility Study, The S.M. Group International	Project components: – Target areas • Sub-basin 1: Poblacion district and part of Agdao • Sub-basin 2: part of Bucana on the east bank of the Davao river • Sub-basin 3: part of Bucana on the west bank of the Davao river and part of Matina crossing – Communal sanitation facilities (131 communal toilets in the Sub-basin 1) – Sub-basin 1 sewer system • Coverage population: 258,300 in the year 2015 • Coverage area: 956ha • Number of pump stations: 4 • Average flow: 50,315 m^3/day – Sub-basin 2 sewer system • Coverage population: 7,090 in the year 2015 • Coverage area: 75ha • Number of pump stations: 1 • Average flow: 1,513 m^3/day – Sub-basin 3 sewer system • Coverage population: 27,570 in the year 2015 • Coverage area: 270ha • Number of pump stations: 1 • Average flow: 5,885 m^3/day		Sources: Davao City Wastewater Collection and Treatment System Feasibility Study,(Final Report) The S.M. Group International

Name of Study	Outline	Formulated Year	Remarks
	– Sewerage treatment facility • Capacity 63,230 m³/day (daily average flow) • Treatment method: Sequencing Batch Reactor – Total project cost: USD39.9 million (USD1=PHP38.3) PHP1,528.17 million (price level 1999)) (collection and pumping system: USD30.0 million, Treatment system: USD9.9 million)		

Source: IM4Davao Team based on various documents received by DCWD and Davao City Government.

7.77 In January 2017, more than one private company proposed to conduct, free of charge, a feasibility study on sewage systems for DCWD. However, the DCWD Board decided to go ahead and install a sewerage system with septage treatment incorporated into the system. The name of the private company is Apo Agua Infra, Inc.[4] That company proposed to conduct a feasibility study on sewage systems, however just proposed, no progress in September 2017.

[4] Apo Agua Infra is contractor of the Davao city balk water supply project.

7.5 Solid Waste Management

1) Current state of Solid Waste Management in Davao City

(a) CENRO: Competent Authority for Solid Waste Management

7.78 Solid waste management (SWM) services also vary by population density and barangay initiatives. For example, because the City Environment and Natural Resources Office (CENRO) does not provide waste collection services in the districts of Paquibato and Marilog, these barangays manage their own wastes which are mostly agricultural in nature, and people dispose these in their idle land and at water bodies. Within the whole city area, the collection operation currently serves about 112 barangays and 65% of the total population of the city. Other than here, this service is very limited. Segregation of household solid waste has been widely conducted. The awareness of waste disposal and segregation is high, as shown in ***Annex 2***.

7.79 CENRO has street sweepers who start working at 3 in the morning so that when residents wake up, their surroundings are already clean. This is also being done to deter people from littering. Barangay captains also manage waste discharge. They are under strict supervision by CENRO to carry out this responsibility to ensure the cleanliness of their respective jurisdictions. In cases where they fail to carry this out, they can be subject to a reorientation by the Davao City Ecological Solid Waste Management Board. CENRO assigns supervisors by area to manage the sweepers. Residents of those areas usually do not have any particular concern over SWM.

7.80 Improper solid waste disposal in coastal communities has has worsened the quality of the seawater. The city government tried resettling coastal populations to prevent the situation from worsening. This initiative will be jointly conducted by the City Health Office (CHO), the Department of Health (DOH), and the DENR. Informal settlers along the riverbanks also cause similar problems as coastal settlers.

(b) Related legislations in solid waste management

7.81 The law RA9003, named Ecological Solid Waste Management Act of 2000, is the most important law for solid waste management. In this act, all the LGUs shall have responsibilities for solid waste management. After this law is enacted, Davao City has enacted ordinances based on the act as shown below.

Table 7.5.1 Ordinances related to Solid Waste Management

Ordinance Number	Title	Notes
EO 19 series of 2002 June 28, 2002	An order creating and constituting the City of Davao Ad Hoc Solid Waste Management Board and for other purposes	
044-02 series of 2002 August 13, 2002	An Ordinance creating the Davao City Ecological Solid Waste Management Board	
EO 41, series of 2004, January 23, 2004	An order requiring barangays in the City of Davao to implement a Comprehensive Barangay Solid Waste Management Program which highlights waste reduction and recovery schemes	An Order directing all Barangays in Davao City to fully implement and enforce the provisions of R.A 9003 particularly the establishment of Material Recovery Facility (MRF) in every barangay or clusters of barangays and the mandatory segregation of waste.
158-05, series of 2005, November 16, 2005	An Ordinance approving the 2005 Revenue Code of the City of Davao, as amended	Article 3 Service Charge for Garbage Collection • Areas of collection and disposal • Fees for large and unusual quantities of rubbish and special collections • Time to place receptacles on sidewalks • Prohibitions on disposal

Ordinance Number	Title	Notes
		• Imposition of garbage fees • Time of payment • Garbage service charges for multiple businesses • When a building is used for both residential and commercial purposes, the rate for commercial purposes shall be applied. • Business establishments shall provide separate containers for each type of waste: compostable, non-recyclable, recyclable, special wastes, any other classification determined by CENRO. • The Sanitary Inspector shall inspect once every month the said establishment to find out whether garbage is properly disposed of within the premises. • Violation of provisions of Section 278 of this Article (fees) will pay a fine
EO 01 series of 2006 January 7, 2006	An Order prescribing the Guidelines, Rules and Procedures in the Enforcement of the Ecological Solid Waste Management policies, ordinances and programs of Davao City for the preservation and enhancement of the environment	
Ordinance No. 0171-09, Series of 2009	The Davao City Anti-littering Ordinance of 2009	
Ordinance No. 0361-10, Series of 2009	An Ordinance providing for an Ecological Solid Waste Management, prohibiting certain acts, providing penalties for violations, and for other purposes	

Source: 10-year integrated Solid Waste Management Plan of Davao City (2018–2027)

(c) Davao City 10-year Integrated Solid Waste Management Plan

7.82 In the Philippines, all the LGUs are mandeted to formulate solid waste management plan every 10 years, and the plan shall be approved by National Solid Waste Management Commission under the law RA9003. For Davao City, the current 10-year plan has a duration from 2008 – 2017, then the City is revising the plan for the next 10 years 2018 - 2027. Main items in the plan are listed below.

i) Current solid waste management conditions

ii) Waste characteristics

iii) Legal and institutional framework

iv) Solid waste management system in the 10 years

v) Plan implementation

7.83 The plan includes institutional, financial and social / environmental aspects for each components for the next 10 years. Among these components, it would be noteworthy that they will challenge new trials in the field of solid waste management.

i) Rehabilitation of the existing SLF at New Carmen (2018)

ii) SLF construction (2019)

iii) MRF construction (2022)

iv) Provision of WTE (2022)

And collection vehicles will be purchased for the complete waste collection.

(d) Municipal Solid Waste Generation

7.84 The 10-year Integrated Solid Waste Management Plan of Davao City (2018–2027) estimated the amount of municipal solid waste (MSW) generated in Davao City, as shown in Table 7.5.2.

Table 7.5.2 Estimates of Municipal Solid Waste in Davao City in 2011-2021

Unit: kg per day

Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Total amount	834,767	853,121	892,162	931,018	987,948	1,023,310	1,085,074	1,106,152	1,164,976	1,186,760	1,208,544
Biodegradable	389,557	402,441	408,031	413,370	415,005	550,581	561,489	572,396	456,005	456,943	465,646
Non-Biodegradable											
Recyclable	144,299	149,072	151,143	153,120	153,725	202,441	206,451	210,462	168,913	169,260	172,484
Residual	227,304	234,821	238,083	241,198	242,151	324,939	331,376	337,813	266,075	266,622	271,700
Special Waste	14,756	15,244	15,455	15,658	15,719	21,663	22,092	22,521	17,273	17,308	17,638

Source: 10-year integrated Solid Waste Management Plan of Davao City (2018–2027)

7.85 In fact, measured data in MSW weight are collected only at the weighbridge in the New Carmen Sanitary Landfill Site. Solid Waste Dumped at Davao City Landfill for the year 2011-2016 is shown in Table 7.5.3. Received waste has been increasing gradually although the remaining capacity is really limited.

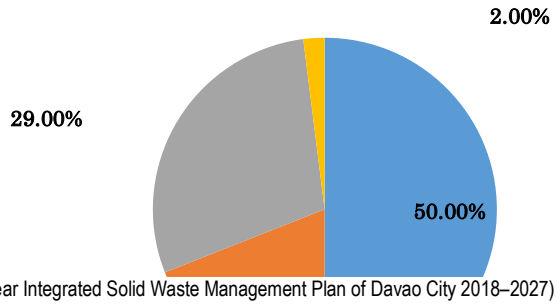
Table 7.5.3 Estimated Municipal Solid Waste Generated Daily

Year	Daily Generated Waste (tons)
2011	418.42
2012	413.04
2013	442.50
2014	427.50
2015	604.30
2016	638.95

Source: Davao City CENRO

(e) MSW Characterization

7.86 MSW characterization was conducted in 2017 by the city's CENRO. The result of the solid waste characterization study is shown in Figure 7.5.1. Average per capita waste generation from all sources within the LGU is 0.58 kg per day. The total waste generation in the LGU is 991 tons/day. The biodegradable and recyclable com-ponents are 50% and 19% of total waste generation respectively. Residual waste account for 29% while special waste, 2%.



Source: 10- year Integrated Solid Waste Management Plan of Davao City 2018–2027)

Figure 7.5.1 Composition of Wastes in Davao City in 2017

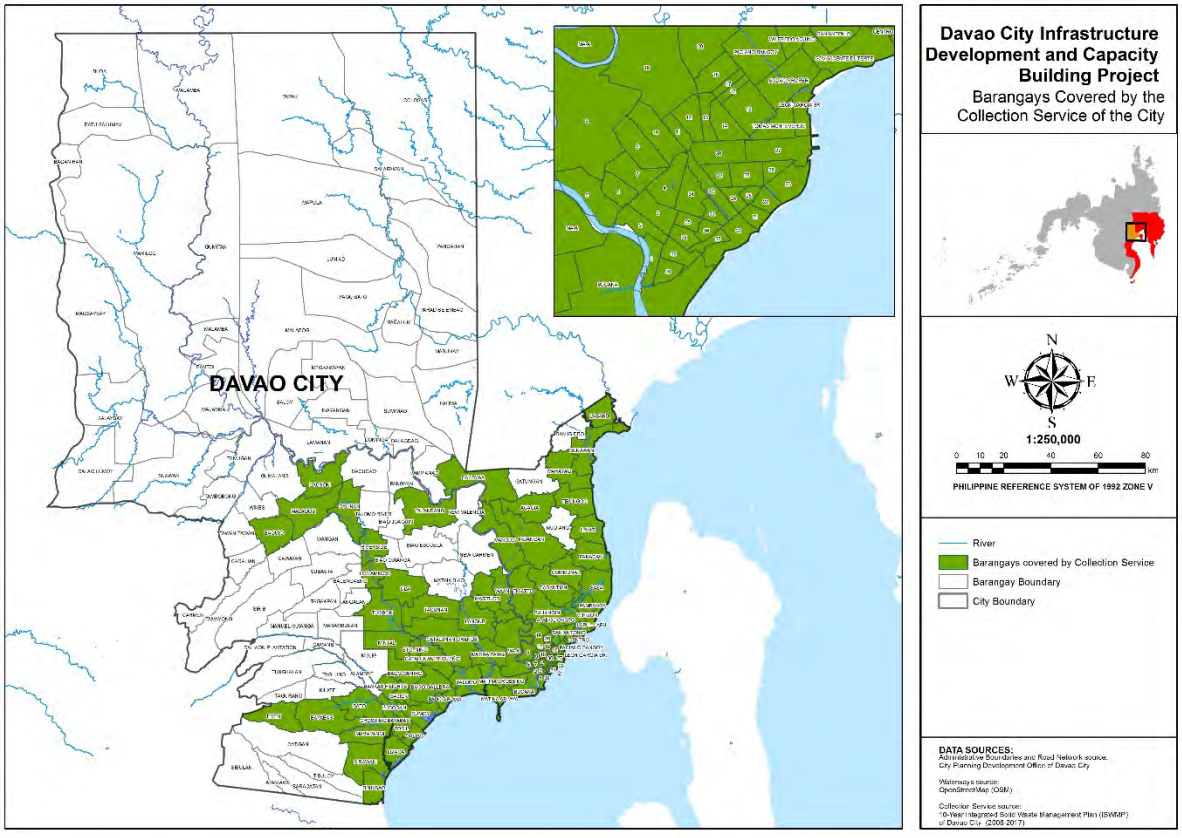
Source: IM4Davao Team

[1] 23-25 March 2017

Figure 7.5.2 Waste Amount and Characterization Study in Barangay Paciano Bangoy

(f) MSW Collection and Transportation

7.87 Collection area is expanding year by year. Now there are 112 barangays which are provided waste collection service by CENRO. Collection area is shown in Figure 7.5.3.



Source: IM4Davao Team

Figure 7.5.3 Collection Area (Barangay basis)

7.88 Every barangay designates MSW collection points. The collection points have waste bins. Residents discharge garbage in the bins, and MSW is collected by compactors and dump trucks. Frequency of waste collection is once or twice a week.

Source: IM4Davao Team

Figure 7.5.4 Collection Points in Barangay Paciano Bangoy

7.89 The latest standard waste amount collected is estimated at 611 tons per day by CENRO. The breakdown of collection is shown below.

Table 7.5.4 Municipal Solid Waste Collected in Davao City

Amount (tons / day)	Source	Vehicle trips	Average amount per trip (tons / trip)
596	Residual at collection points	95	6.3
13	Market bio waste	3	4.3
1	Trimming waste	1	1
1	Establishments and coconut venders	1	1

Source: Davao City Environment and Natural Resources Office (CENRO)

(g) MSW Recycling

7.90 General recycling in daily life basis is implemented by junkshops and other relevant dealers. In a sense, recycling system has been established by informal sectors.

7.91 As part of the Information, Education and Communication activity by CENRO, MSW recycling is recommended and some Material Recovery Facilities (MRFs) are operational in actual basis.

7.92 The representative composting facility is located at New Carmen SLF vicinity, which can process up to 25t/d. That 25 tons of biodegradable wastes produce about 75 sacks (875 kilograms at 35 kg per sack) of compost using the windrows heap method. The average monthly production is 2,000 to 2,250 sacks. The compost is used in the greening and beautification programs of the city (i.e., greening of parks and center islands of streets).

7.93 8 MRFs are operated by barangays. In Davao City, composting and valuables temporary storage are common activity done by barangays. For example, Barangay Vicente Hizon has an MRF which has mechanical composters, vermi-culture composting cells and recyclables stockyard with cartons. In order to make compost in good quality, they segregate banana peels from other market waste and take care of the composting cells. They also recommend home composting to the residents. All MRFs in Davao City is

listed below. Currently, some of them are still in the installation stage due to the delay of the preparation.

Table 7.5.5 List of Barangay with Functional Materials Recovery Facility (MRF)

Barangay	Capacity (Vol./Day) (kgs.)	Type of Waste Accpeted	Remarks
Calinan Proper	1,130	biodegrables and recyclable materials	
Centro	2,540		
Mahayag	1,765		Vermi-culture composting
Catalunan Grande	20,000		Operated from 2018
Vicente Hizon Sr.	15,234		Vermi-culture composting
Cabantian	780		
28-C	970		
Matina Pangi	1,534		

Source: Davao City Environment and Natural Resources Office (CENRO)

7.94 MRFs in Davao City generally have introduced vermi-culture composting system, and all the composts through the system are in good quality in appearance.

Source: IM4Davao Team

Figure 7.5.1 Vermi-culture Composting Product

7.95 Feeding program has a close relationship with supply of the composts to school. Thus, composting system should be implemented continuously although its capacity is small.

Source: IM4Davao Team

Figure 7.5.2 Products in Elementary School under Feeding Program

Source: IM4Davao Team

Figure 7.5.3 Materials Recovery Facility in Barangay Vicente Hizon

7.96 Used tires would be threat to MRF operation. There supposes to be no exit. And we can only see used tires to be used as pods or other displays, which are not involved in the sound cycle society.

7.97 This year, Davao City started BDF plant operation cooperating with JICA and a Japanese private company named “Biomass Japan,” under the program “projects for small and middle-sized enterprises assistance” funded by JICA. The plant is under commissioning, and it will be handed over to the city this November to start commercial operation. This project is for now having a good start with good balance between demand and supply of biodiesel fuel, and with continuous operation in a good shape. Table 7.5.6 shows the state of the operation of the biodiesel fuel plant.

Table 7.5.6 Outline of Biodiesel Fuel Plant

Item	Description	Remarks
Aims	Air pollution control	Replacement of diesel oil
Plant capacity	1,000 liters / day	
Raw material	Cooking oil from shopping malls, restaurants and households	
Additives	Caustic soda	
Use application	Waste vehicle	Jeepneys in commercial phase

Source: Davao City Environment and Natural Resources Office (CENRO)

(h) MSW Final Disposal

7.98 There is only one operational landfill site for Davao City. The New Carmen Sanitary Landfill is located in Barangay New Carmen, Tugbok District. This facility is located 15 km away from the city center. The outline of the facility is shown in Table 7.5.7.

7.99 Since months ago, one landfill cell was operational while another cell was closed a few years ago.

7.100 Since the end of 2017, rehabilitation of the landfill has been implemented. In the first 3 months, urgent rehabilitation made landfilling a bit more effective than before.

7.101 The dumping area has been well developed, then the site has broad area for dumping. All the waste dumped in the area has been well compacted by dozers.

7.102 Davao City is also planning to implement a safe closure of the New Carmen sanitary landfill site after a new landfill operation starts. Therefore, the service life of the current landfill might be several years. It is not worthy that the landfill closure shall comply with the Implementing Rules and regulations under RA9003.

Table 7.5.7 Municipal Solid Waste Generation (estimated)

Item	Description
Total area	3.8ha
Capacity	2.85 million m^3
Operation	2010 to present
Estimated available service life	6years from now
Main equipment	2 landfilling cells (one closed) Weighbridge HDPE liner structure Leachate treatment devices Gas ventilation pipes Storm water drainage system Monitoring system Perimeter fences Internal road network

Source: Davao City Environment and Natural Resources Office (CENRO)

From top left clockwise: weighbridge office, weighbridge body, overall 3D model of the facility, MRF
Source: IM4Davao Team

Figure 7.5.4 New Carmen Sanitary Landfill

(i) Waste-to Energy (WTE) Facility

7.103 As for the introduction of WTE technology, on March 20th, 2018, the Exchange Notes between the Government of the Philippines and the Government of Japan relative

to PhP 2.5 billion grant was signed by both governments. With this grant aid, Davao City will operate the first WTE facility in the Philippines in 4-5 years.

2) Issues on Solid Waste Management

(a) Potential Land Acquisition for MSW Management

7.104 At least in the coming 6 years, Davao City will need new land for new MSW management facilities. Even though a latest technology such as Waste-to-Energy (WTE) is introduced, all the kinds of solid waste cannot be treated by this technology. In addition, the residues discharged from the processes of the WTE facility need to be disposed properly. Therefore, new land acquisition is the most crucial matter for MSW management.

7.105 Potential sites are being selected by CENRO. There are a couple of the potential landfill sites in the northern part of Davao City, which need to be assessed carefully considering hauling cost and surroundings situation. In the selection of the potential sites, the City has criteria to comply with RA9003, namely Ecological Solid Waste Management Act, for suitable land acquisitions.

(b) Progress of Recycling Activities

7.106 As per RA9003, every barangay has to install and operate a MRF. However, even the best barangay cannot operate composting machines due to the shortage of budget for power supply.

7.107 Recycling costs and 3R (Reduce, Reuse and Recycle) initiatives cannot be realized in the short term (i.e., short term like 5 years / 10 years). Despite the city's efforts to promote and encourage these activities, the service life of the current landfill site is shrinking.

(c) Urgent Improvement for Landfill Practice

7.108 Around the entrance of the current SLF, there were many collection vehicles waiting for weighing. It triggered a traffic jam in front of the entrance. This situation was also evident inside the property as many vehicles are waiting for unloading the waste. Actually, the road occupied by the vehicles should be open to the public but the ordinary passages of vehicles were affected by the traffic jam.

7.109 After the entry to the compound, there was a steep slope to the unloading point. Moreover, the access road to the unloading place was relatively narrow for the 10 ton-class collection vehicles. The unloading place was the space that could accept one vehicle. This was the critical point for internal passage. One backhoe was helping the vehicle to unload the waste, and it took long time due to the limited working space.

7.110 All the trucks had to turn around for dumping, but it took a long time and entailed considerable effort due to the limited space.

7.111 There were some wastes littered around the internal road. But considering their working time and condition for landfilling, the heavy equipment had little chance to remove the littered waste.

Source: IM4Davao Team

Figure 7.5.5 Situation of Internal Roads at New Carmen Sanitary Landfill

Source: IM4Davao Team

Figure 7.5.6 Unloading Process at New Carmen Sanitary Landfill

Source: IM4Davao Team

Figure 7.5.7 Littered Wastes at New Carmen Sanitary Landfill

7.112 Big heaps of dumped waste laid on the past waste accumulation. The height was

approximately 10m. The dumped waste had spilt and laid outside the landfill cell with liner structure. It might affect the quality of the groundwater nearby. Moreover, waste accumulation spread out even to the closed cell. Some dumped waste even lays on the canal, which disturbs the leachate flow.

Source: IM4Davao Team

Figure 7.5.8 Leachate Collection at New Carmen Sanitary Landfill

7.113 Beyond the unloading place, there was an internal road for the collection vehicles. However, the road along the existing cell was not passable due to poor pavement.

7.114 As mentioned above, the New Carmen landfill site is the only landfill site of Davao City. Thus “prolonging the service life” of the landfill is the priority. Considering its current state, critical issues to be solved in the landfill site are as follows:

(i) Traffic Jam at the entrance of the facility and along the internal road;
(ii) Unfavorable waiting place for unloading due to a steep slope;
(iii) Narrow unloading place surrounded by the accumulation of waste;
(iv) Absence of a turn-around place for the trucks;
(v) Waste heaps that are about to fill-up the dumping space; and
(vi) Littered waste all around the landfill cell that might affect the surroundings

7.115 In August, Hon. City Mayor decided to input another heavy equipment to enhance a temporary rehabilitation of the landfill in order to accept all the current incoming waste smoothly. One grader, one refuse compactor, two dozers and one back-hoe can work for earth-working. The main works are i) cut the closed cell to open a dumping area, ii) install the foundation of a new access road to the current landfilling cell and iii) control the dumping area. Due to the input of heavy equipment, the landfill has gained enough volume to receive incoming waste for now.

7.116 The rehabilitation of the landfill will last next year to install the leachate circulation system and secure enough volume for another 5 years incoming waste.

Heave equipment

Dumping area

Earth works

New access road to cell

Source: IM4Davao Team

Figure 7.5.9 Situation of Leachate Collection: New Carmen Sanitary Landfill

(d) Budget for MSW management

7.117 Generally speaking, for every LGU, it is hard to prepare budget for a new SWM facility by themselves. However, Davao City has already prepared the budget for the acquisition of 2 new lands for 2 new sanitary landfill sites. The city also prepared for operation of the biodiesel fuel plant and installation of new material recovery facilities. In proposal basis, the city will allocate the budget for sanitary landfill rehabilitation. This is supposed to be based on the policy of the current top management of the city. Table 7.5.8 shows the main investment by the city budget in 2017-2018.

Table 7.5.8 Budget in 2017–2018 for Solid Waste Management (extracted)

Project description	Budget (PHP)
2017 - approved	
Acquisition of 2 sanitary landfill sites (south and north bounds)	100,000,000
Solid waste recycling program thru handicraft	155,000
Used cooking oil to bio-diesel program	1,050,000
Material recovery facility	12,000,000
2018 - proposed	

Project description	Budget (PHP)
Procurement of equipment for sanitary landfill	64,000,000
Procurement of garbage trucks	50,000,000
Establishment of bio-diesel facility	5,000,000
Enhancement of sanitary landfill waste water facility	100,000,000

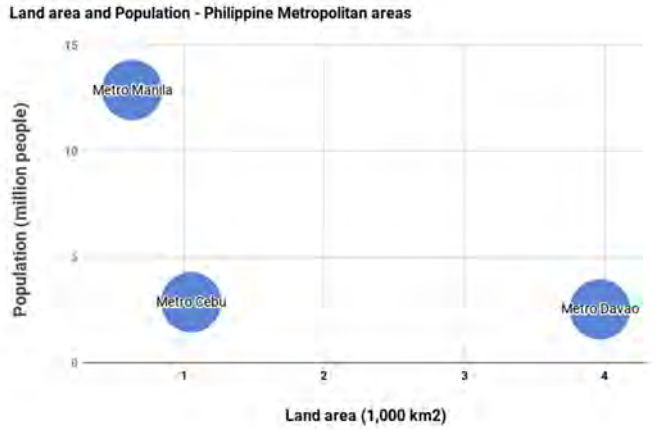
Source: CENRO

7.118 As shown in its growth trend, the city's population will continue to increase at over 2% annually. With this future perspective, the volume of generated waste will grow hand-in-hand with the population increase and rise in incomes.

7.119 It is recommended that the future budget should include not only the new MSW management facilities but also the expansion of the collection services.

3) Comparison of representative cities in the Philippines

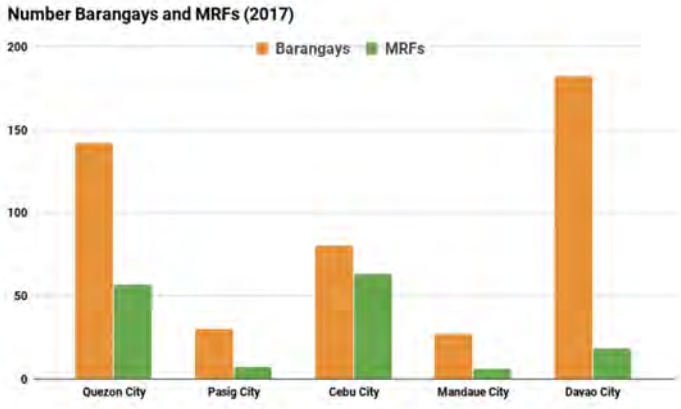
7.120 In order to understand the current situation of Davao City in the solid waste management field, Metro Manila including Quezon City and Metro Cebu including Cebu City are compared to Davao City in terms of solid waste management.



Source: IM4Davao Team

Figure 7.5.10 Land Area and Population

7.121 Figure 7.5.14 shows the land area and population of each city. Aside from other 2 cities, Davao has so huge land with low density as a whole.



Source: IM4Davao Team

Figure 7.5.11 No. of Barangays and MRFs (2017)

7.122 Figure 7.5.15 shows the number of barabgays and MRFs in each city. Although the number of MRFs in Davao City is not that small, the number of MRFs is too small compared to the number of the barangays.

7.123 On the other hand, Metro Manila and Metro Cebu are still struggling with securement of new sanitary landfills. They all suffer from the lack of landfill remaining volume, and in actual basis, both cities are now transfer the collected waste in the city to other city in order to dispose at private disposal sites.

7.124 For Waste-to-Energy projects, they both have a lot of proposals for WTE projects from various private entities. Still they don't proceed to the realization phase.

4) Suggestions

7.125 As the ways to think of countermeasures against the issues above, there are some suggestions shown below.

7.126 Final disposal is the final step of the entire solid waste management system, no measures exist other than final disposal.

7.127 Whatever happens in the previous steps, final disposal shall cover all kind of the waste.

7.128 Capacity of sanitary landfill site should be the maximum the city can explain.

7.129 No landfills, no solid waste management. There are so many technologies related to solid waste management. However, sophisticated and complete interconnected management system shall necessarily prepare ways out of the system. Once accidents or problems happen in the system, final disposal will be way to continue the system.

ANNEX

ANNEX 1: INDIGENOUS PEOPLES OF DAVAO CITY

1 Ethnolinguistic Groups of Davao City

1.1 Davao City prides itself of being a melting pot of various local and foreign cultures and the interesting progeny resulting from the intermarriages between and among the Filipino settlers, foreign immigrants, and the native inhabitants. The Dabawenyos of today can be generally grouped into Christians, Moros, and indigenous peoples (IPs). The latter two represent the city's 11 major ethnolinguistic groups. The Moro ethnic groups in Davao City, of which there are six, are descendants of Islamized IPs from other provinces such as the Lanao provinces, Jolo, and Maguindanao. Meanwhile, the IPs or the *lumad*, which is Cebuano for "native," are the ethnic groups who originally inhabited the city, most of whom were forced to move to the area's hinterlands as waves of settlers arrived centuries and decades past. The Lumad comprises five IP groups who were neither converted to Christianity or Islam and have largely remained animist. The Lumad and Moro ethnolinguistic groups are briefly described below.

Mount Apo, the highest peak in the Philippines, is the traditional landmark of the Obu-Manuvu tribe.

(1) Indigenous Peoples or Lumad

1.2 One of the widely used definition of the concept of indigenous peoples was outlined by the chairperson of the United Nations' Working Group on Indigenous Populations, Mme. Erica-Irene Daes, who said that certain peoples are considered indigenous:

- "because they are descendants of groups which were in the territory of the country at the time when other groups of different cultures or ethnic origins arrived there;
- because of their isolation from other segments of the country's population, they have preserved almost intact the customs and traditions of their ancestors which are similar to those characterized as indigenous; and
- because they are, even if only formally, placed under a State structure which incorporates national, social and cultural characteristics alien to theirs."[1]

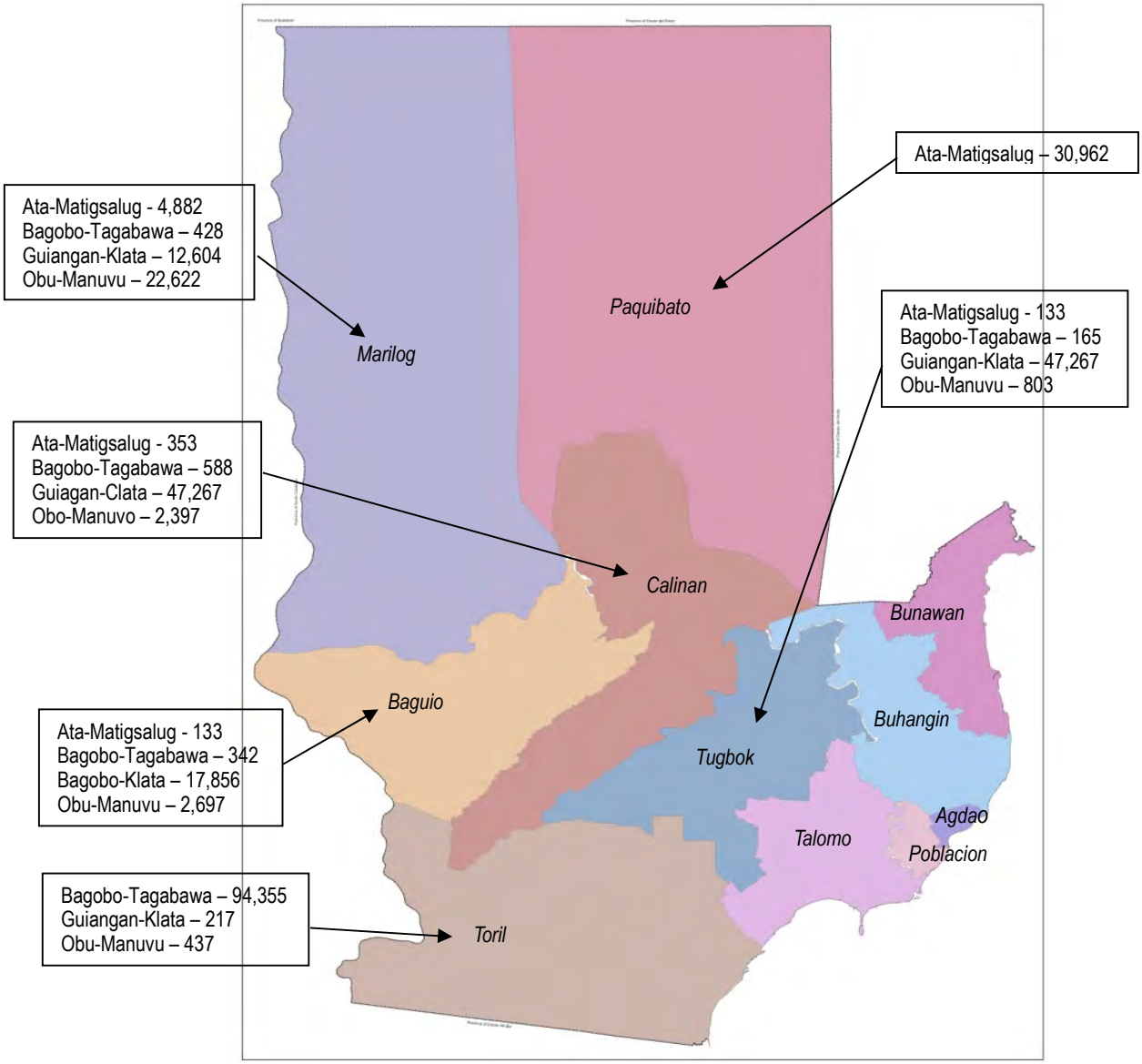
1.3 **Distribution:** Figure 1.1 shows the 2007 IP population in Davao City by administrative district. While the Davao City Planning and Development Office (CPDO) undertook a census among IP communities in 2014, the Research and Statistics Division informed the IM4Davao Project Team that they have to validate the figures first before publishing them.

(a) Ata

1.4 The Ata group lives in the mountain ranges of Davao City and are distributed in four of the city's 11 administrative districts and covering 21 out of 182 barangays. These are the barangays of Colosas, Fatima, Lumiad, Malabog, Mapula, Panalum, Pandaitan, Paquibato Proper, Paradise Embac, Salapawan, Sumimao, and Tapak (Paquibato

[1] http://www.iwgia.org/culture-and-identity/identification-of-indigenous-peoples.

district); Dalagdag, Dominga, Lamanan, Megkawayan, and Saloy (Calinan district); Bantol, Malamba, and Tamugan (Marilog district); and Callawa (Buhangin district). The Ata comprise one of the two major IP groups in Davao City.



Source: NCIP, 2007

Figure 1.1 IP Population in Davao City by Administrative District, 2007

(b) Klata/Guiangan

1.5 The other major IP group among the Lumad is the Bagobo, but they are divided into three subgroups. While they differ in their language, all three have similarities in their culture, clothes, and locations. The Bagobo Klata are forest dwellers and live in a very small territory stretching from Barangay Catalunan in Talomo district to Barangay Calinan in Calinan district,[2] and in Barangay Manuel Guinga, Tugbok District.[3] The Klata people possess remarkable artistry as shown in their beautiful and colorful clothes.

[2] City Tourism Office (CTO) brochure.
[3] http://ovcre.uplb.edu.ph/press/features/item/122-threatened-land-threatened-lives-the-bagobo-klata-of-the-south.

(c) Obu-Manuvu

1.6 Another Bagobo subgroup, the Obu-Manuvu, can be found in the provinces of Bukidnon (southeastern portion) and Cotabato (northeastern portion), and in Davao City. In Davao City, they are located in the highlands north of the Tamugan River and the western part of the city, specifically in the barangays of Bantol, Dalag Lumot, Magsaysay, Malamba, Marilog Proper, Salaysay, Suawan, and Tamugan in Marilog district; and in barangays Baguio Proper, Carmen, Gumalang, Malagos, Tambobong, and Tawantawan in Baguio district.[4]

1.7 Celebrated for their artistry, they produce intricate casting, fine weaponry, and jewelry and wear colorful dresses and ornaments for different occasions. Being lovers of music, they have several musical instruments such as the *agong*, *kulintang*, *paundag*, *koglong*, *lantoy*, and *kombeng*. The have their own traditional sports and games as well, i.e., *siklot*, *sibaw*, *kasing paatukoy*, and horse fighting.

Source: Obu-Manuvu ADSDPP

(d) Tagabawa

1.8 The third Bagobo subgroup is the Tagabawa which means people from the south. Its members live in the districts of Baguio, Calinan, Marilog, Toril, and Tugbok.

(e) Matigsalug

1.9 This name comes from “matig” which means place of origin and “salog” which means river, specifically the Davao River which the Matigsalug simply call “Salog.” They can be found mostly in the hinterlands of Marilog and Paquibato districts.

(2) The Moros

1.10 Another major ethnic grouping in Davao City are the Moros who belong to ethnic groups who converted to Islam. There are six such groups in Davao City.

(a) Iranun

1.11 Iranun comes from the word “ira” meaning residue, remains, or silt, referring to a place area or culture, and “nun” meaning the people therein with distinct culture, laws, and beliefs.[5]

[4] Obu-Manuvu ADSDPP.
[5] CTO brochure.

(b) Kalagan/Kagan

1.12 The name Kalagan/Kagan came from the word “kaag” meaning whisper. The Kagan people are known to be farmers, cultivating rice, corn, abaca, and coconut. Those who live near the sea naturally became fisherfolks.

(c) Maguindanaon

1.13 Maguindanaoan refers to people of the flood plain because they mainly inhabit the broad Pulangi River valley and delta. They are divided into two subgroups, namely Tau-sa Ilud or people of the lower valley and Tau-sa Laya or people of the upper valley. Each has its own dialect and territory.

(d) Maranao

1.14 Their name came from “ma” which is an adjective prefix and “ranao” or lake, which makes them lake dwellers. The Maranao have historically been known to be brave and proud of their rich literature called Darangen. They are also acknowledged for their craftsmanship in wood and metal products.

(e) Sama

1.15 The name Sama is a derivative of the word “sama-sama” meaning together. Described as peace-loving, majority of the Sama people live in the coastal barangays of Bunawan to Toril districts.

(f) Tausug

1.16 Renowned for their unquestionable courage, the word Tausug refers to “people of the current.”

1.17 **Literacy:** According to the local government document entitled “Lumad and Moro Literacy in the 21st Century,”[6] the Davao City government defines literacy as more than just reading, writing, and counting skills; it encompasses the “ability to understand laws and make informed choices, and the capacity to improve their situation.” As a result of its various programs to improve the literacy among the IPs and the Moros, both groups had achieved rates of 92.89% and 96.63%, respectively, in 2011, while Davao City had a literacy rate of 98.53%.

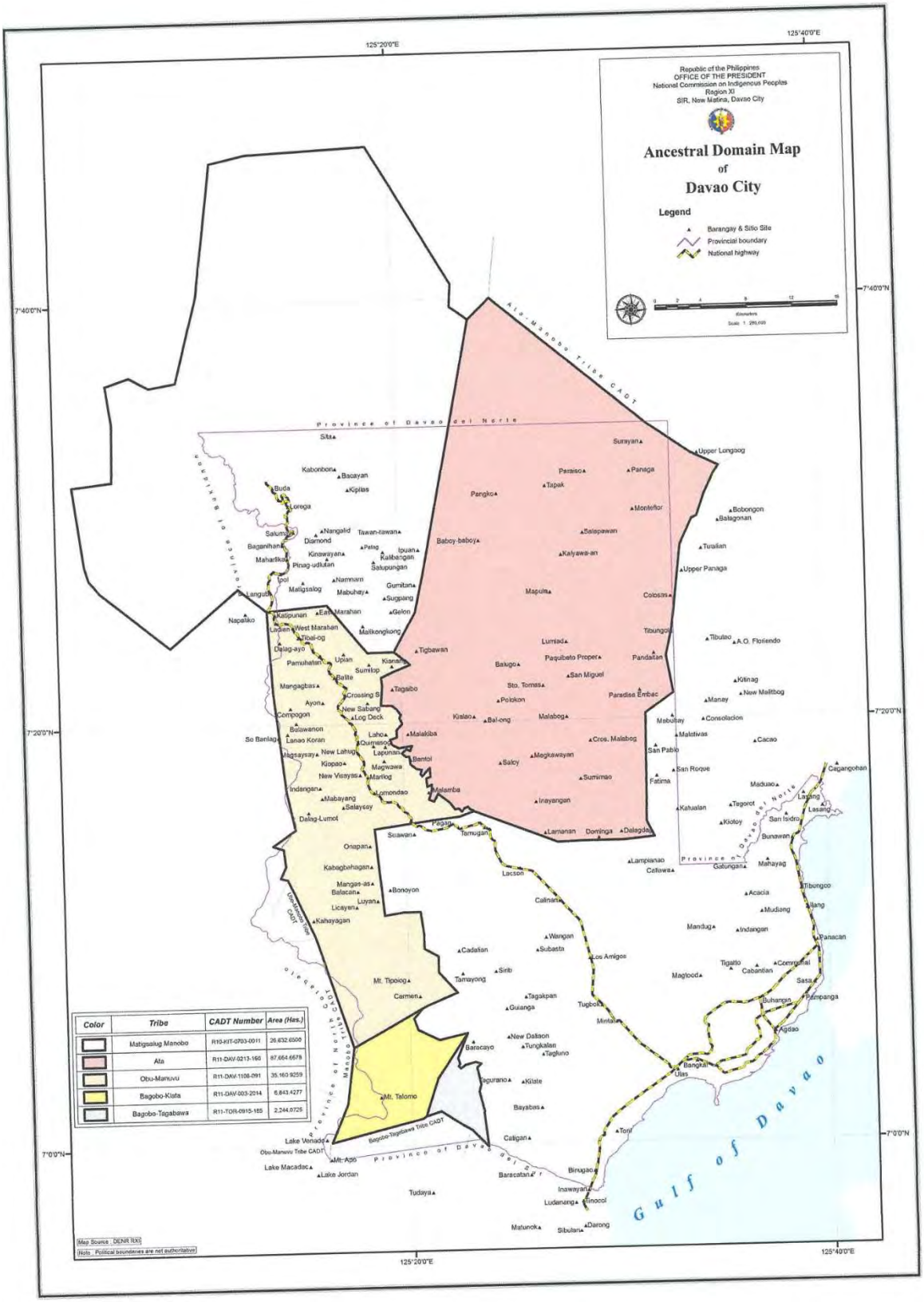
[6] “Lumad and Moro Literacy in the 21st Century: An Entry to the United Nations Educational, Scientific and Cultural Organization International Literacy Prizes.”

Table 1.1 Brief Profile of the IPs in Davao City

IP	Population	District (Barangay)	AD Area (ha)	Livelihood	ADSDPP Content
1. Ata	14,146[1]	21 barangays • Buhangin • Calinan • Marilog • Paquibato		• Farming (root crops e.g., cassava and sweet potatoes, corn, etc.) • Hunting • Fishing • Carpentry • Driving • Labor • Small businesses	• Target period: 2015-2019 • Contents: – Ancestral domain (geological features and geohazards) – Community situation (history, demography, livelihood sources and incomes) – Health and sanitation – Socioeconomic development – Environmental development program – Indigenous knowledge system and practices (IKSP) – Development targets and needs in: o environmental protection and management o basic services and social infrastructure o economic development o preservation of cultural heritage o organizational/institutional development o peace and order o migration – Community rules and implementing mechanisms – Indigenous political structure – Investment plan – Others
2. Klata/Giangan		• Talomo (Catalunan) to Calinan (Calinan) • Tugbok (Manuel Guinga)		• Subsistence farming (abaca is their major source of income, followed by root crops, cereals, banana, coconut, coffee)[2] • Plantation workers	• Still being prepared.
3. Matigsalug		• Marilog (Baganihan, Buda, Gumitan, several sitios in Marilog, and Salumay) • Paquibato (Sitio Al-on, Malabog)			• Target period: 2008-2012; for updating in 2017 • Contents: – Locations – Ancestral domain – Community situation (history and lineage, livelihoods: agriculture, fishery, forestry, blacksmithing) – IKSP – Land use and development – ADSDPP development framework

IP	Population	District (Barangay)	AD Area (ha)	Livelihood	ADSDPP Content
					– Indigenous political structure – Transfer and improvement of land or property – Ecological balance and development of lands and natural resources – Investment plan – Project concepts – Others
4. Obu-Manuvu	22,386	• Baguio (portions of Carmen and Tambobong) • Marilog (portions of Bantol, Dalag Lumot, Malamba, Marilog Proper, Salaysay, Suawan, Tamugan, and entire Magsaysay)	Approx. 36,713.52[3]	• Farmers (corn, cacao, coffee, abaca, rubber trees, tiger grass) • Plantation workers • Fishing • Hunting • Mat/basket weaving using romblon leaves • Employees (domestic helpers, sales staff) • Laborers	• Target period: 2016-2021 • Contents: – Ancestral domain (location, environmentally critical areas, geohazards, features, land classification) – Community situationer (population, livelihood, agricultural practices) – Justice system and social processes – Mutual help and defense systems – Development needs, plans, and programs o Spatial and physical development o Social services and human development o Cultural promotion, protection and development o Environmental protection, preservation and sustainability o Infrastructure development – Rules and regulations regarding implementing the ADSDPP – Indigenous political structure, leaders and their roles – Investment plan – Others
5. Tagabawa		• Baguio, Calinan, Marilog, Toril, Tugbok			• Still being prepared.

1 ADIPH for Ata. Data gathered during the ADSDPP formulation in 2014. Including the Ata in Santo Tomas municipality of Davao del Norte province.
2 http://ovcre.uplb.edu.ph/press/features/item/122-threatened-land-threatened-lives-the-bagobo-klata-of-the-south
3 Includes 1,714.24 ha in North Cotabato, based on their ADSDPP.



Source: DENR Region XI

Figure 1.2 Ancestral Domain Map from the DENR

2 Development Issues

1.18 Some of the major development issues being faced by IPs are described below, as culled from various documents, deduced from interviews, and arrived at from observations.

(i) **Lack of a Reliable and Updated Database:** A famous management thinker, Peter Drucker, became immortalized with one of his best quotes: "What gets measured gets improved." Following this, if government and the IPs themselves want their current situation to become better, the first thing to do is to develop a reliable master database that will show information on IP populations, locations and distribution, livelihoods, and other development indicators to support planning and implementation.

- At the moment, the National Commission on Indigenous Peoples (NCIP) provincial office has no updated data on population. The IM4Davao team was referred to CPDO which did a census among the IPs in 2014 by barangay. However, according to the office's Research and Statistics Division, they still have to validate the figures. The difficulty of coming up with accurate figures is understandable because of the decades-long conflict between the New People's Army who have been particularly active in IP territories.
- There is also a need to identify IPs based on accepted international parameters to avoid confusion among the IP and Moro communities.
- Information about IPs--and Moro--cultural communities should be harmonized. To illustrate, while the Kadayawan Festival has a rallying cry of "10 Tribes, One Voice," the CTO brochure lists 11 ethnolinguistic tribes.

(ii) **Decrease in Agricultural Areas:** Corn is the second most important food next to rice among economically marginalized and the IPs living in the uplands. The city's CLUP 2013-2022 reported a decrease in the area planted to corn and vegetables, and in the production of the same especially in districts 2 and 3 due to the conversion of land from agricultural to residential and/or commercial, as well as to a diversion to high-value crops such as fruits. Meanwhile, the CLUP ascribes the lower production volume to "high cost of inputs, limited capital, lack of machineries, lack of appropriate technology, extreme weather conditions, occurrence of pests and diseases (sic) and limited supply of seeds and planting materials.

(iii) **Lack of Access to Basic Services:** The Davao City government has acknowledged that the IPs lack access to health services, education, and a stable source of income.

(iv) **Uncertainty over Ancestral Domain:** The fight to uphold and reclaim their ancestral rights over their land continues. Common problems encountered by IPs related to their lands are encroachment, selling of lands to non-IPs or private groups, environmental hazards, and land use.

- For the Bagobo-Klata in Tugbok district, for example, they face two big foes who have encroached upon their ancestral domain. One is the religious sect known as the Kingdom of Jesus Christ, The Name Above Every Name, Inc., a Philippine-based Restorationist church founded and led by Apollo C. Quiboloy, and the other is Sumifru (Sumitomo Fruits) Corporation, a large-scale banana plantation and an affiliate of Sumitomo Corporation. University of the Philippines Los Banos' (UPLB) researchers for a DA-BAR funded project, entitled "Documentation of Indigenous

Knowledge for Climate Change Adaptation,"[7] wrote that Quiboloy's group started encroaching on the Klata/Guiangan's ancestral domain in 2000 by building a mansion with a landscaped garden for tourists. Quibuloy was a most important figure when Rodrigo Duterte, the current Philippine president, ran for office. According to the UPLB researchers, "The encroachment left most of the Bagobo-Klata farmers landless; they had no choice but to work as farm laborers in the plantation."

- The ancestral domain of the Obu-Manuvu in Marilog district is traversed by fault lines, while other areas are susceptible to landslides and erosion or show degradation as a result of unsustainable farming practices, urban expansion, and lack of protection.
- Some portions of their ancestral domain have been designated as "tourism potential areas."

(v) **Negative Effects of Climate Change:** The Klata/Guiangan have experienced the effects of climate change. According to the UPLB research project, landslides in 2008 during which they lost a big portion of their abaca stands, the unpredictable weather, and unusual heat have all affected their farming practices. Nevertheless, they have tried to adapt to the changing climate by planting other crops.

(vi) **Lack of Development Plans:** Republic Act (RA) 8371 of 1997 or the Indigenous Peoples' Right Act (IPRA) mandates all IP groups to formulate an ancestral domain sustainable development and protection plan (ADSDPP). Up to this writing, however, only three IPs have been able to prepare such a plan. The Matigsalug prepared one for the period 2008 to 2012 and is expected to update it this year. The Ata prepared their plan for the period 2015-2019, while the Obu Manuvu's plan is for the period 2016-2021. The Klata and Tagabawa are expected to start formulating their respective plans by April 2017. ADSDPPs include descriptions of their ancestral domain (geological features and geohazards), community situationer (history, demography, livelihood sources and incomes, health and sanitation, IP locations, populations, livelihoods, proposed projects, and investment plans. They undergo a technical review to ensure that they interface with local development plans. After the review, they are adopted by the City Council.

(vii) **Concerns about Self-determination under the Bangsamoro Basic Law:** While Mohagher Iqbal, chair of the Bangsamoro Transition Commission, said in a May 2014 speech at a Solidarity Event[8] that the future Bangsamoro government will recognize the rights of the IPs (referring to the Lumad) to their native titles, customs and traditions, justice systems and political structures and to an equitable share in revenues from their ancestral lands, among other rights, the Lumad have to involve themselves in the crafting of the law to protect their right to self-determination even as they support the Bangsamoro people's decades-long struggle for territorial autonomy.

(viii) **Insurgency:** The "Lumad and Moro Literacy in the 21st Century" report cites armed conflict between the government and the New People's Army (NPA) as a constraint to efforts of the government and other providers of services and support to improve the

[7] DA-BAR funded project "Documentation of Indigenous Knowledge for Climate Change Adaptation,"
[8] "IPs have a Bright Future in the Bangsamoro," speech of BTC Chair Mohagher Iqbal, 23 May 2014, Shangri-la Edsa Hotel.

socioeconomic conditions in far-flung communities, where most of the IPs live. The report said that settlers in villages where the NPAs operate are "hesitant to participate in program activities," often refusing to fill out registration forms or participate in census and surveys "for fear that their identities will be divulged to government security forces." In addition, clashes have resulted in evacuations, disrupting the people's lives. Killing of IPs by both the NPA and government forces and the recruitment of members by both groups from the ranks of the IPs have hurt the IP communities.

2. PRELIMINARY LISTING OF SHORT-TERM PRIORITY PROJECTS FOR DAVAO CITY

Urban Services

1.19 Some of the IPs have also formulated their respective Ancestral Domain Investment Plans for Health (ADIPH), wherein they presented their specific requests for support from NCIP, the local government, and national agencies. Again, only the Ata, Matigsalug, and Obu-Manuvu groups have prepared this plan.

Health

(i) Create a regional database system on IP in the DRHIS;

(ii) Conduct Training on IP Women / Men as barangay health workers (BHWs);

(iii) Extend financial assistance in the review classes for board exam to qualified IP midwifery graduates;

(iv) Establish and sustain a mechanism for IEC on health in the identification and reporting of notifiable infectious diseases in the ICCs;

(v) Conduct culture sensitivity training for hospital health service providers;

(vi) M&E visits and assessments of the deployed human health resources (HHR) in the ICCs/GIDAs;

(vii) Establish/conduct activities and projects for Adolescent Health and Youth Program (AHYDP);

(viii) Capacity building on the identification, development and production of herbal medicines and soaps of indigenous plants;

(ix) Conduct pilot IP community immersions; and

(x) Engage on an Oplan Tutok Lumad Research Project: Creating a Culture Sensitive Maternal Health Program.

ICC/IP	Health	Water and Sanitation	Power	Livelihood
1. Ata	• Need for 4x4 emergency vehicles due to the location and distance from the nearest health facility. • Need for health centers manned by a licensed midwife and with medicines for barangay Colosas, Pandaitan, and Tapak. • Enrolment in PhilHealth for 94% (3,024 HHs) of HHs. • IEC on health practices	• Installation of Level II system for potable water to service 14 barangays • Sanitary toilets	• Few HHs have access to electricity • Solar light facilities for 2,821 HHs at the barangay and sitio level.	• Need for funds for animal/ poultry raising to include feeds, vegetable production, farm implements

ANNEX 2: HOUSEHOLD INTERVIEW SURVEY

1 Background and Objectives

1. The Japan International Cooperation Agency (JICA) Project Team (hereinafter referred to as the "IM4Davao Team") implemented the "Davao City Infrastructure Development Plan and Capacity Building Project" in cooperation with the National Economic and Development Authority (NEDA) Central Office, NEDA Regional Office XI, and the Davao City LGU.

2. As the third-largest metropolis of the Philippines, and premier city and center of development in Southern Philippines, Davao City had a population of 1.6 million in 2015. It has a land area of 244,000 ha, only 7.2% of which is built-up urban land and the rest comprises brushland/shrubs/grassland (50.0%), agricultural land (30.6%), and forest use land (11.0%). Economic activities and the population are concentrated on the limited urban area, so the urban center faces serious traffic congestion, a situation aggravated by rapid urbanization and disorderly development. Davao City is also vulnerable to natural disasters such as floods. It is, thus, necessary to have a long-term vision for the city's urban infrastructure development. In this context, Davao City formulated its Comprehensive Land Use Plan (CLUP) 2013–2022, which states its role in the Association of Southeast Asian Nations (ASEAN), the Philippines, and Southern Philippines or Mindanao, but it has yet to prepare a concrete development plan for urban infrastructures. An appropriate urban infrastructure development plan from the economic, social, and environmental viewpoints, based on a plausible future scenario, needs to be formulated before urban issues worsen.

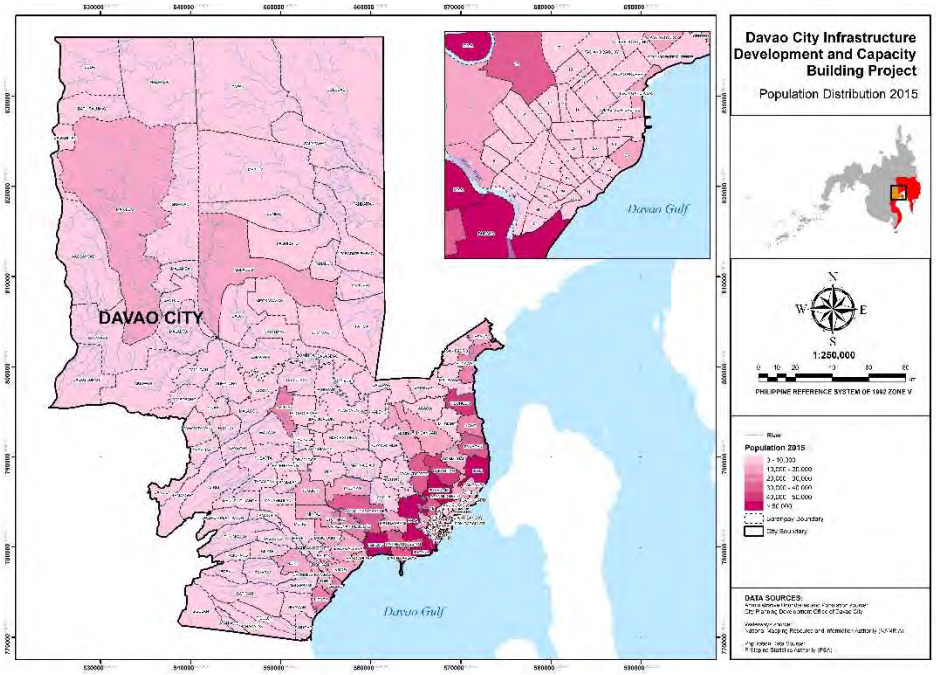
3. During the course of the study, huge databases from surveys were generated and compiled. One such database is the output of a large-scale Household Interview Survey (HIS) conducted in Davao City from March 24 to April 8, 2017.

4. HIS aims to obtain basic data in aid of formulating comprehensive urban development plans. HIS results can be utilized not only as an important resource for understanding public opinion about existing infrastructures, services, and living environment and for making evaluation indicators for future policies, but also as an essential database from which to cull existing travel behaviors of people and to forecast traffic demand. Public opinion regarding development issues affecting the growth of a metropolis can be a useful indicator and guide for urban planners and decision makers.

5. Results of the HIS done in Davao City indeed provide important primary data which, together with other data gathered during the study, were analyzed to provide the platform from which plans to attain the vision of Davao City will be developed.

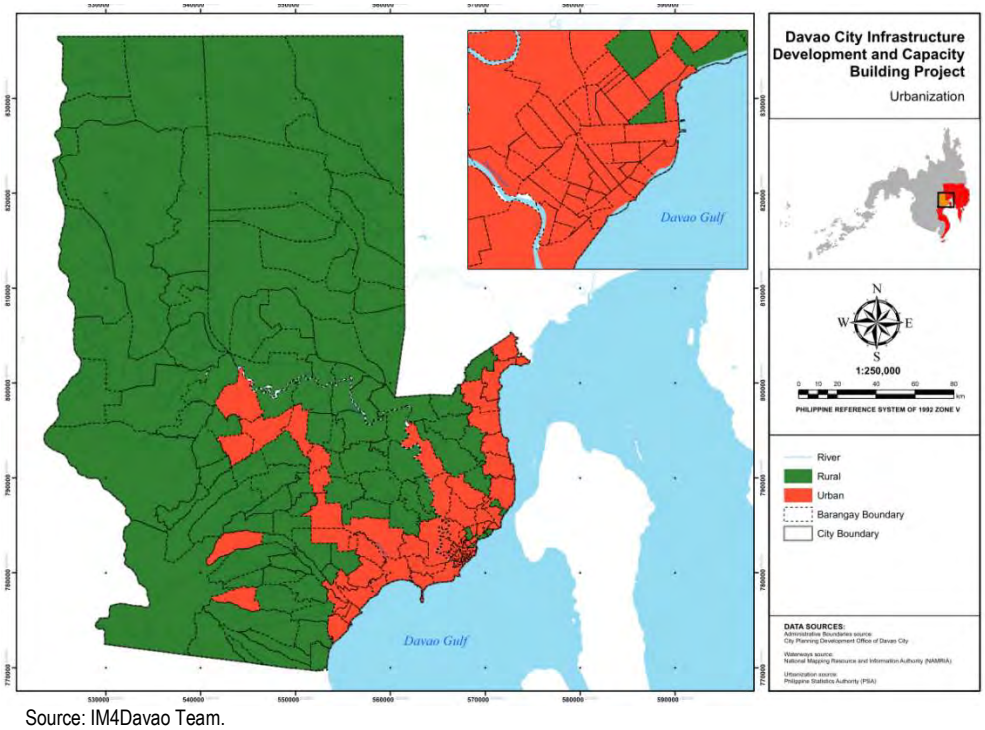
2 Survey Area

6. The survey area covered the entire Davao City (see Figure 2.1), all 182 barangays identified into urban and rural areas based on the list of Philippine Standard Geographic Code (see Figure 2.2). Survey tasks encompassed information collection, situation analysis, and coordination.



Source: IM4Davao Team.

Figure 2.1 Survey Area



Source: IM4Davao Team.

Figure 2.2 Urban and Rural Barangays of Davao City

3 Survey Methodology

1) Survey Process

(1) Preparation

7. For the survey, the Survey Subcontractor established a temporary office in Davao City to serve as headquarters for the HIS activities, trained supervisors and interviewers, and conducted two dry runs to ensure the interviewers had a good understanding of the survey method and questionnaire. Results of the dry run and revisions to the methodology and survey forms were considered in finalizing the latter, after which the forms were translated into Cebuano, the prevailing language in the city, for a smooth conduct of the interview.

8. The IM4Davao Team provided survey manuals, barangay code tables, data entry and error checking systems, as well as the finalized survey forms prior to the commencement of the actual field survey.

9. Coordination with barangays was arranged as well, with supervisors and interviewers maintaining close coordination and pleasant working relationship with barangay personnel up to the completion of the field interviews.

(2) Field Survey

10. Field interviewers were assigned to interview randomly selected households in their assigned areas. Regarding the selection of target households, samples from each barangay were taken from at least three different streets except in mountain barangays where only one or two streets were accessible. When target households could not be surveyed due to their inaccessible locations (i.e., interviewers had to cross rivers or hike up the mountains) or security concerns, replacement households were chosen from those living in nearby barangays with similar characteristics as the original barangays.

11. Household heads and every household member were interviewed according to the prepared survey forms. For members who are under 11 years old, the parent or guardian were allowed to answer for them. Pictures of interviewees were taken with their consent.

12. To understand the accessibility and living environment of interviewed households, photos were also taken of the routes to the households, especially in rural areas, coastal areas, and informal settlements.

(3) Data Encoding and Error Checking

13. Even as field interviews were underway, answers in accomplished survey forms were also being coded and encoded. Guided by barangay code tables, coders assigned a code to each barangay representing a respondent's residence, workplace, and trip origin and destination. Encoders entered answers into a database, carefully checking that the data being entered matched the source. Once errors and/or inconsistencies were observed, the same were referred to survey supervisors and/or reported back to the IM4Davao Team.

(4) Data Compilation (Data Transfer and Checking)

14. Survey answers were presented in Excel file and transferred to csv format, after which data cross-checking was done to ensure all answers are logical.

2) Survey Forms

15. The survey forms used in the HIS are listed below.

(a) **Form 1 Household Information:** This questionnaire covers the socio-economic characteristics of households, their structures, income levels, location of residence, number of years in said residence, etc. Only the household head answered this form.

(b) **Form 2 Household Member Information:** This questionnaire covers the socio-economic characteristics of each household member. These include age, gender, education level, occupation, work or school address, income, and car ownership. All household members answered this form.

(c) **Form 3 Information on and People's Satisfaction/Perception of Existing Living Conditions and Urban Services:** This questionnaire covers public opinion on natural disaster preparedness, water supply, sewerage and drainage system, fuel, solid waste collection, traffic congestion and public transport, and governance. Only the household head answered this form.

16. The HIS for this study did not anymore ask the interviewees about the trips they made because the IM4Davao Team would be utilizing the survey data gathered under the ADB-funded "Davao Sustainable Urban Transport Project." The latter survey showed the characteristics of weekday trips made by Davao residents, in particular their trip origins and destinations, trip purposes, travel modes, transfer points, as well as departure and arrival times.

3) Survey Organization and Work Flow

17. An organization and management team were formed to ensure efficient survey activities and good outputs. The HIS Team consisted of a survey chief, a deputy survey chief, an Interview Group, and a Data Processing Group (Figure 3.1).

18. The Interview Group consisted of two area coordinators, 11 supervisors, and 157 interviewers and are Davao-based, while the data processing supervisors, coders, editors, and encoders are under the Data Processing Group which is Manila-based.

19. Below are the tasks of each survey team member.

(a) **Survey Chief:** Provided overall supervision of the HIS, monitored survey activities, trained interviewers and conducted the dry run, coordinated with barangay officials/local police.

(b) **Survey Deputy Chief:** Assisted the survey chief in the overall supervision and coordination of the survey.

(c) **Area Coordinator:** Planned and managed the entire survey schedule and coordinated survey permissions with every barangay captain in Davao City; directly supervised survey teams under them, which included performance monitoring and reporting; did 20% random checking of all completed sheets.

(d) **Field Supervisors:** Prepared comprehensive survey plans and day-to-day work assignment schedules for the survey teams; did coaching/mentoring for interviewers for quality assurance; each supervisor was assigned at least one municipality to handle; did 50% random checking of all completed sheets; reviewed all interviews conducted by interviewers under them.

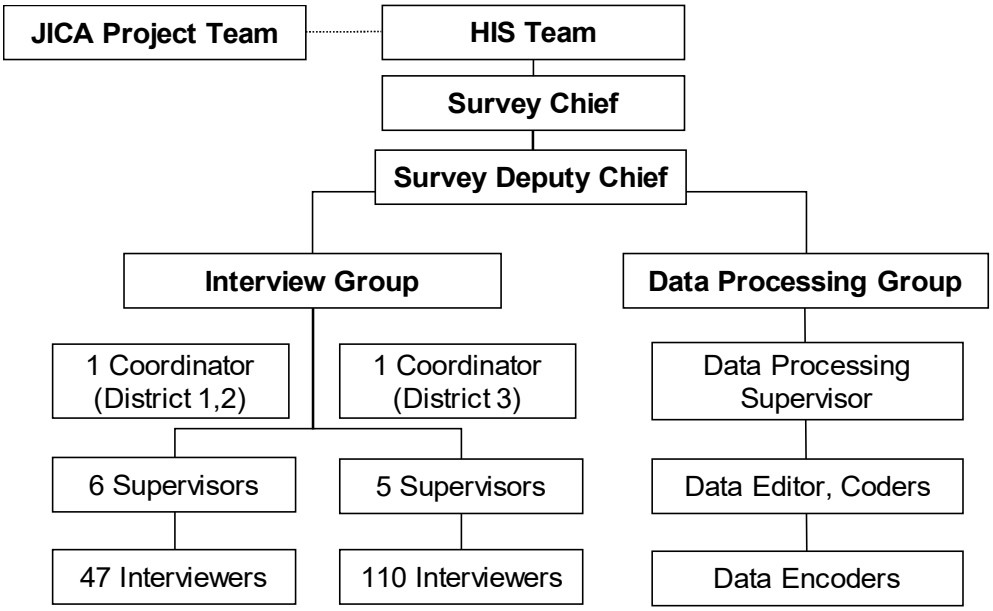
(e) **Interviewers:** Visited households in their assigned areas; conducted interviews with household respondents as indicated in the survey to ensure completeness and accuracy of every answer given by respondents; could speak Visaya; had clear understanding of the questionnaire (being college students); are neither members of the barangay councils nor barangay staff to avoid influencing the respondents; and were not allowed to do the survey in their residential barangays.

(f) **Data Processing (DP) Supervisors:** Provided technical consulting and responded to error reports, problems, or queries raised by encoders; monitored the performance of controllers/ editors and encoders to guarantee and adhere to the agreed schedule; and checked the accuracy and correctness of data before passing them on to the Project Team.

(g) **Coders:** Assigned all codes to barangays where the respondents reside, work, started, transferred, and ended their trips (trip origins / trip destinations / transfer points) based on a zone code list.

(h) **Editor:** Conducted quality check on the completeness of the transmitted sheets; edited and checked for accuracy of information provided; coordinated the transmittal of erroneous questionnaires to supervisors for appropriate corrections, re-asking, or re-fielding; and interfaced with the survey chief to organize responsibilities and deliverables.

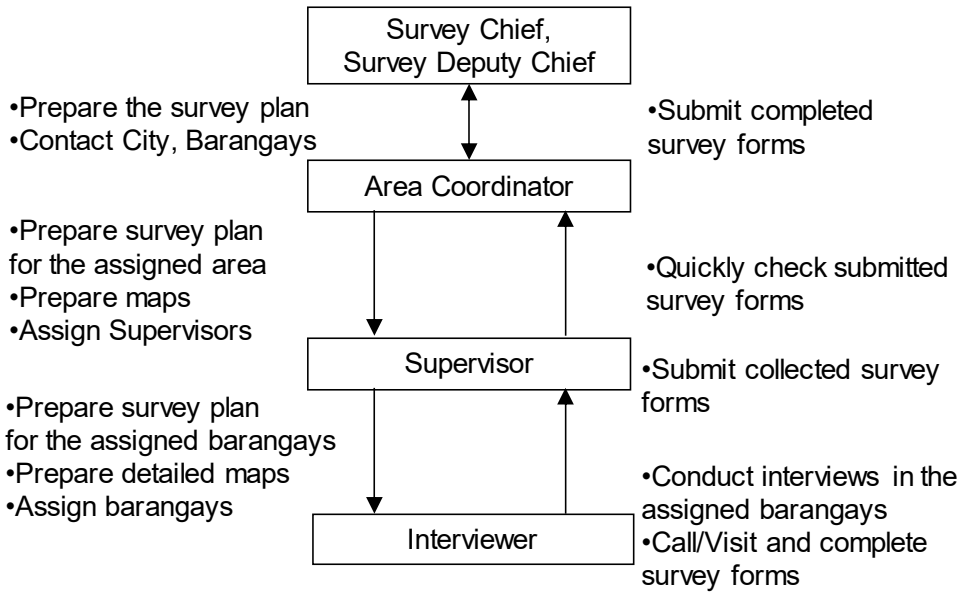
(i) **Encoders:** Inputted all completed questionnaires into an electronic database system following specific encoding process and daily quota.



Source: IM4Davao Team.

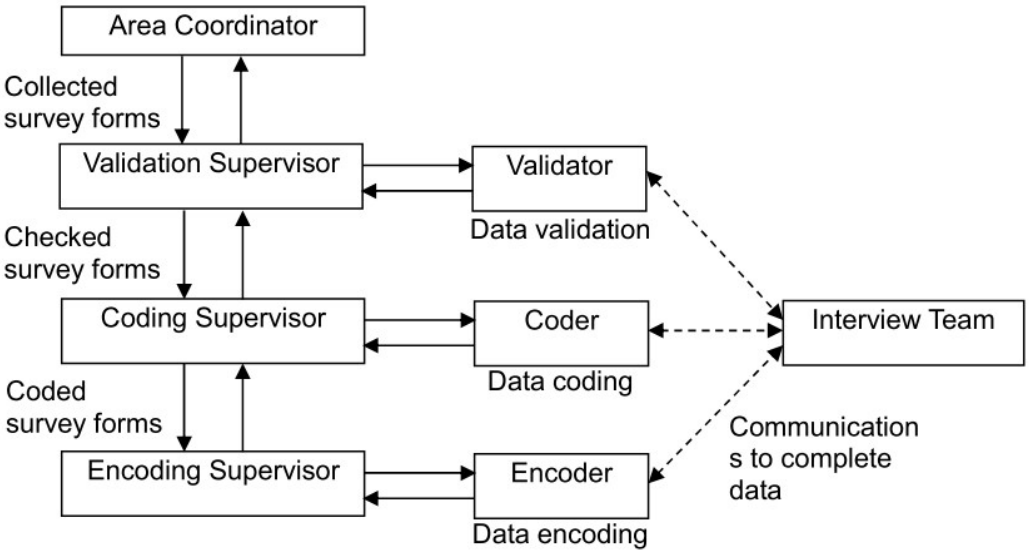
Figure 3.1 HIS Organization and Staffing

20. The Interview Group and the Data Processing Group worked together to ensure that the data gathered were correct, validated, and corrected (if need be). Figure 3.2 and Figure 3.3 show the work flows for the groups.



Source: IM4Davao Team.

Figure 3.2 Fieldwork Flow



Source: IM4Davao Team.

Figure 3.3 Data Processing Flow

4) Implementation of HIS

21. The survey method adopted the conventional direct interviews on field with target household respondents who were randomly selected, i.e., 10 households in each of the 182 barangays in the survey area to meet the minimum requirement of 1,820 household respondents.

22. The sampling size was not set at 1% of households, the acceptable size, owing to the survey's purpose of getting public perception on a wide range of issues. Therefore, all barangays in the 11 administrative districts were covered, as shown in Table 3.1.

Table 3.1 Population and Target Sampling by District

Congressional/ Administrative District		Number of Barangays	Population			Number of Households		Target Sample Households	Population Density in 2015 (/ha)
			Actual, 2010	Actual, 2015	Projected[1], 2017	Actual, 2010	Projected[1], 2017		
District 1	Poblacion	40	156,450	174,121	183,475	38,795	45,865	400	150.8
	Talomo	14	382,652	418,615	449,945	88,903	105,105	140	47.3
District 2	Agdao	11	99,406	102,267	117,265	23,134	27,350	110	192.6
	Buhangin	13	256,959	293,118	303,227	58,848	69,573	130	31.0
	Bunawan	9	131,704	152,102	155,482	29,871	35,315	90	23.7
	Paquibato	13	19,260	21,372	46,873	4,386	10,068	130	0.7
District 3	Baguio	8	30,384	33,873	35,888	6,760	7,992	80	4.2
	Calinan	19	81,844	92,075	96,192	18,416	21,772	190	4.1
	Marilog	12	34,986	39,564	53,299	7,589	11,490	120	0.8
	Toril	25	133,452	148,522	157,571	30,623	36,204	250	7.8
	Tugbok	18	91,622	121,334	107,817	20,888	24,694	180	8.3
Davao City		**182**	**1,418,719**	**1,596,963**	**1,707,034**	**328,213**	**395,428**	**1,820**	**7.5**

Source: Population Census of 2010 and 2015 from National Statistics Office of the Philippines.
[1] The projected population is intended solely for estimating target samples and is not recommended for planning purposes.

Source: IM4Davao Team.

Figure 3.4 Implementation of HIS

5) Survey Schedule

23. Training was conducted for the Interview Group for two days, which was followed by one day for the dry run to ensure better understanding of the survey forms and conditions in the survey areas (Table 3.2). The dry run was done in the field with selected households: one from the surveyors' neighbors and the other in the urban area. Results of the dry run and the discussions during the two-day training were used to finalize the survey questionnaires.

Table 3.2 Fieldwork Schedule

Activity	March 2017			April 2017
	Week 2	Week 3	Week 4	Week 1
Review of HIS Forms	9-16 March			
Recruitment of Supervisors	9-16 March			
Briefing of Supervisors		18 March		
Training of Supervisors			19 March	
Recruitment of Interviewers	9-17 March			
Training of Interviewers (at NEDA-XI)			21-22 March	
Dry Run/Pilot Interviews (in Talomo Proper and Matina Crossing)			21 March	
Consolidation of Supervisors/Interviewers' Comments on HIS Forms & Survey Approach			22 March	
Coordination with City Hall and Barangays		15-20 March		
Preparation of Survey Deployment Plan			23 March	
Finalization of HIS Forms			23 March	
Actual Fieldwork			24-31 March	
Re-fielding and Editing				1-8 April

Source: IM4Davao Team.

24. Encoding and data processing of completed questionnaires were performed from 8 April to 31 July, 2017. Under the supervision of the demand forecast specialist of the IM4Davao Team, three levels of logical checking were carried out to ensure data quality and adequacy, i.e., level 1 to check for illegal characters and remove them, level 2 to check if inputted data are within the acceptable range of answers, and level 3 for cross-checking answers to related questions (e.g., income and occupation, age and ownership of driver's license).

4 HIS Results

1) Surveyed Households

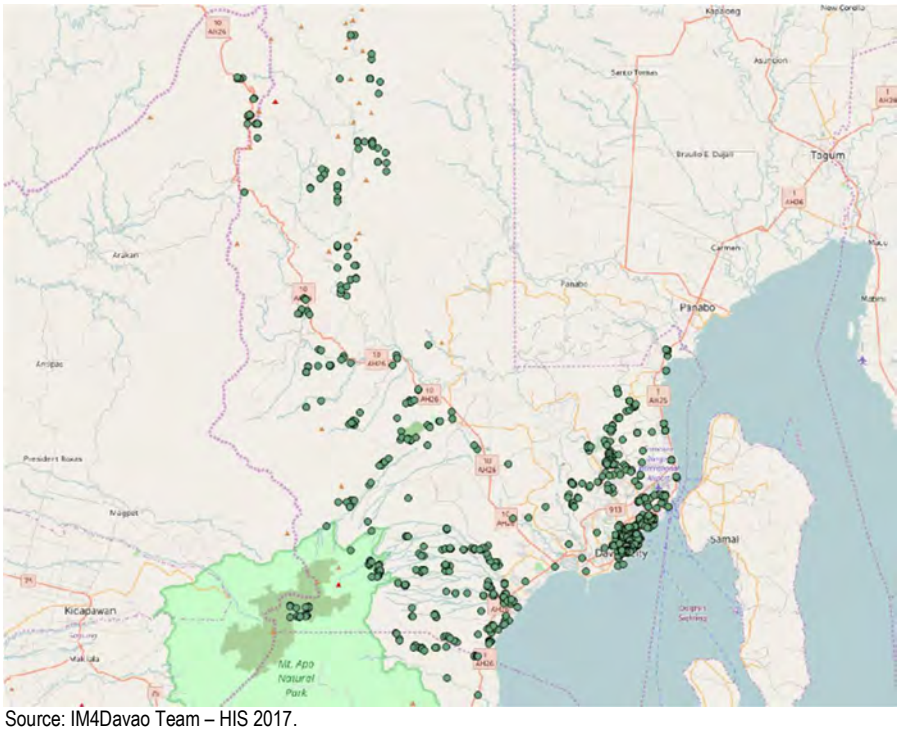
25. The survey was conducted through direct interviews. Interviewers were given extensive training in capturing good responses for Forms 1 to 3. In addition, the layers of quality checks of the accomplished forms ensured that field results are reliable. Outputs from the three forms, provided grassroots information which could be useful in development planning, are presented hereafter. Tabular outputs are presented in succeeding sections of this annex.

26. A total of 2,336 households were surveyed on 24–31 March and 3 April, 2017. After logical checking, only 2,014 valid samples were encoded (Table 4.1). Because around 10 samples were collected in each barangay, and considering that the barangays have different populations, this means that their shares to the respective administrative district population will differ as well. In forecasting, this means different expansion rates.

Table 4.1 Distribution of HIS Respondents by Administrative District

Congressional District	Administrative District	Number of Barangays			Target No. of HH Samples	No. of Interviewed HHs	No. of Valid Samples Encoded
		Urban	Rural	Total			
District 1	Poblacion District	35	5	40	400	560	467
	Talomo District	12	2	14	140	196	140
District 2	Agdao District	11	0	11	110	161	153
	Buhangin District	12	1	13	130	182	179
	Bunawan District	5	4	9	90	126	114
	Paquibato District	1	12	13	130	61	61
District 3	Baguio District	4	4	8	80	114	112
	Calinan District	6	13	19	190	266	259
	Marilog District	2	10	12	120	81	81
	Toril District	10	15	25	250	337	250
	Tugbok District	6	12	18	180	252	198
Davao City		**78**	**104**	**182**	**182**	**2,336**	**2,014**

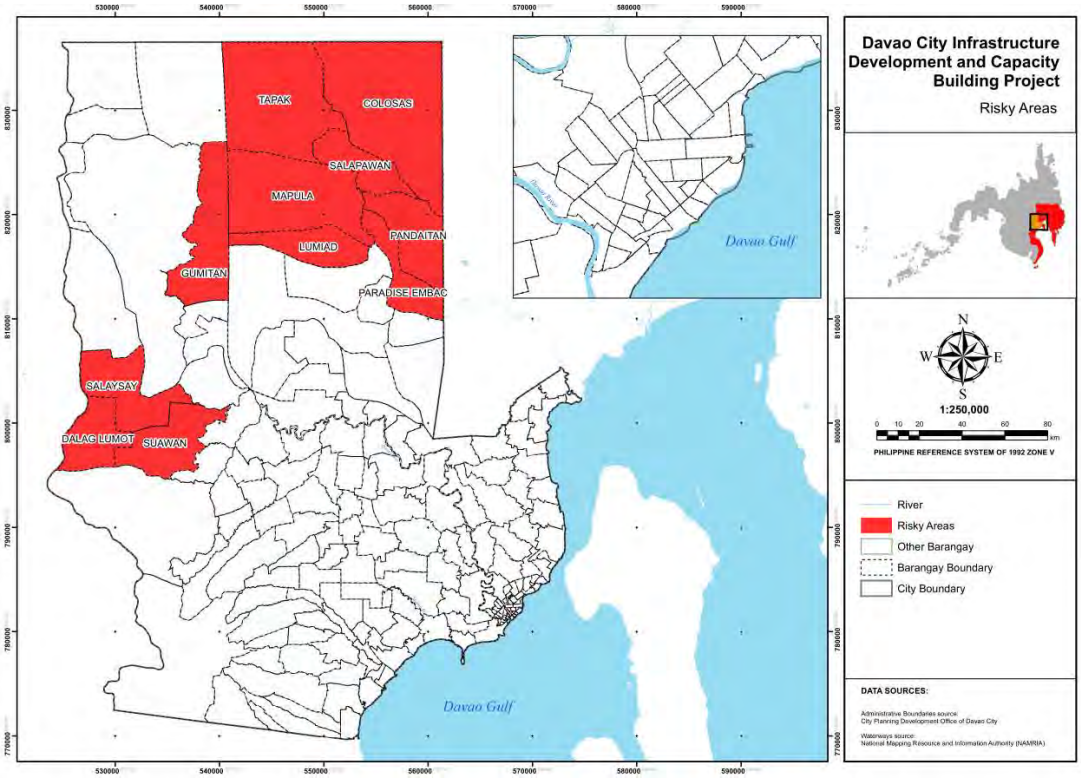
Source: IM4Davao Team.



Source: IM4Davao Team – HIS 2017.

Figure 4.1 Distribution of HIS Respondents

27. No household samples were collected in four barangays of Marilog District (i.e., Dalag, Gumitan, Salaysay, and Suawan (Tuli)) and seven barangays of Paquibato District (i.e., Colosas, Lumiad, Mapula, Pandaitan, Paradise Embak, Salapawan, and Tapak), because of high security risk, as advised by their barangay captains. These areas are known lairs of anti-government forces, and during the scheduled time of the survey, there were armed encounters between the rebels and government forces. With the permission of the IM4Davao Team, replacement households were interviewed from barangays which share similar characteristics with the 11 unsurveyed barangays.



Source: IM4Davao Team – HIS 2017.

Figure 4.2 Barangays in Davao City with High Security Risk

2) Form 1: Household Information

28. This section shows the compiled answers of household heads to Form 1 of the HIS which is about the characteristics of the sampled households only. This deals with housing, income, real and personal property, religious affiliation, and ethnicity.

29. The houses of most of the surveyed households sit on lots 51 to 100 m^2 in size, with floor areas of 26 to 50 m^2, and with 1 to 2 rooms. Structures are made from wood/bamboo or concrete. Only a few households stay in reinforced-concrete structures. The types of houses include nipa huts, rowhouses, concrete bungalows, and wooden bungalows. Around half of the households have stayed in the same place for 30 to 60 years.

Table 4.2 Housing Lot and Floor Areas in Davao City by Administrative District

Congressional/ Administrative District		Lot Area (m^2)					Floor Area (m^2)					Number of Rooms				
		0-50	51-100	101-150	151-200	More than 200	0-25	26-50	51-75	76-100	More than 100	1	2	3	4	More than 4
District 1	Poblacion	100	245	70	27	22	33	185	87	134	25	175	167	79	37	6
	Talomo	11	87	25	7	10	6	62	36	32	4	51	61	20	7	1
District 2	Agdao	59	76	4	7	9	16	78	27	25	9	76	47	17	6	9
	Buhangin	11	81	47	23	17	2	59	42	63	13	53	80	27	17	2
	Bunawan	10	32	40	11	8	8	25	33	25	10	30	53	13	5	0
	Paquibato	10	25	15	2	9	2	21	10	23	5	14	38	6	3	0
District 3	Baguio	6	34	18	25	43	5	42	35	31	13	27	63	28	7	1
	Calinan	7	82	39	32	98	22	89	46	67	34	107	106	33	8	4
	Marilog	1	39	19	11	11	2	18	11	40	10	23	43	11	3	1
	Toril	9	96	46	40	60	10	82	55	78	26	88	114	33	14	2
	Tugbok	14	72	29	37	46	9	57	21	81	30	58	89	34	15	2
Davao City		**238**	**869**	**352**	**222**	**333**	**115**	**718**	**403**	**599**	**179**	**702**	**861**	**301**	**122**	**28**

Source: IM4Davao Team – HIS 2017.

Table 4.3 Housing Structures in Davao City by Administrative District

Congressional District	Administrative District	House Structure				
		Wooden/Bamboo	Brick/Stone	Concrete	Reinforced concrete	Steel-framed
District 1	Poblacion	191	9	227	37	0
	Talomo	63	0	75	2	0
District 2	Agdao	71	0	79	5	0
	Buhangin	80	11	64	24	0
	Bunawan	57	2	39	3	0
	Paquibato	42	0	14	5	0
District 3	Baguio	58	7	49	12	0
	Calinan	141	2	98	16	1
	Marilog	54	1	22	4	0
	Toril	137	4	99	11	0
	Tugbok	106	1	84	7	0
Davao City		**1,000**	**37**	**850**	**126**	**1**

Source: IM4Davao Team – HIS 2017.

Table 4.4 Types of Houses in Davao City by Administrative District

Congressional District	Administrative District	Nipa Hut	Row-house	Concrete Bungalow	Wooden Bungalow	Townhouse/ Apartment	Condominium	Other
District 1	Poblacion	23	103	219	108	11	0	0
	Talomo	12	5	76	46	0	1	0
District 2	Agdao	15	63	44	26	7	0	0
	Buhangin	10	37	69	62	1	0	0
	Bunawan	28	5	39	27	2	0	0
	Paquibato	19	22	9	11	0	0	0
District 3	Baguio	12	4	60	50	0	0	0
	Calinan	41	13	108	94	2	0	0
	Marilog	23	35	15	8	0	0	0
	Toril	38	23	88	98	3	0	1
	Tugbok	12	39	68	76	2	1	0
Davao City		**233**	**349**	**795**	**606**	**28**	**2**	**1**

Source: IM4Davao Team – HIS 2017.

Table 4.5 Years in Current Residence by Administrative District

Congressional District	Administrative District	Current Residence Years							
		0~10	11~20	21~30	31~40	41~50	51~60	61~70	70~
District 1	Poblacion	27	23	53	83	86	107	59	26
	Talomo	16	18	12	32	29	16	15	2
District 2	Agdao	10	9	22	25	29	31	19	10
	Buhangin	30	17	22	33	21	31	18	7
	Bunawan	5	10	14	19	18	19	13	3
	Paquibato	6	7	8	10	11	10	5	4
District 3	Baguio	17	19	9	28	25	12	11	5
	Calinan	66	24	27	33	51	35	13	9
	Marilog	4	7	13	16	20	13	6	2
	Toril	28	23	14	43	56	49	23	15
	Tugbok	26	9	12	39	39	35	24	14
Davao City		**235**	**166**	**206**	**361**	**385**	**358**	**206**	**97**

Source: IM4Davao Team – HIS 2017.

30. About 402 of the 2,014 surveyed households lived elsewhere before staying in their current residential addresses. Of this number, 35% came from the same administrative district and 38% from different districts. About 20% used to live somewhere in Region XI and Mindanao, and a few from Visayas and Luzon. The main reasons they gave for relocating are marriage/child birth, job, school, or house space limitation.

Table 4.6 Previous Addresses of HIS Respondents

Previous Address		No. of Households	%
Davao City	Same District	142	35.3
	Different District	156	38.8
Region XI		44	10.9
Mindanao (except Region XI)		36	9.0
Visayas		8	2.0
Luzon		16	4.0
Total		**402**	**100.0**

Source: IM4Davao Team – HIS 2017.

Table 4.7 Reasons for Relocation

Reason for Relocation	No. of Households	%
Marriage and/or child birth	115	28.5
Getting a new job/entering school	94	23.3
Narrow living space	35	8.7
Aging house/facilities	33	8.2
Unaffordable housing cost	24	6.0
Eviction order by the owner/government	20	5.0
Troubles with neighborhood	19	4.7
Insecure or disorderly neighborhood	17	4.2
Noisy	14	3.5
Long time to commute to workplace/school/hospital	13	3.2
Damaged by a disaster	8	2.0
Bad business conditions	8	2.0
Lack of entertainment	2	0.5
Unsunny	1	0.2
Total	**403**	**100.0**

Source: IM4Davao Team – HIS 2017.

31. About 86% of the respondents own houses and 76% own lands. This suggests that people living in Davao do not have to pay rental charges and can, thus, use their money for other purposes. About 70% of rental costs is lower than PHP2,000 per month.

Table 4.8 Ownership of House and Land by Administrative District

Congressional District	Administrative District	House				Land			
		Owned	Rented	Free	Not Sure	Owned	Rented	Free	Not Sure
District 1	Poblacion	388	39	36	1	346	33	83	2
	Talomo	117	4	19	0	105	7	27	1
District 2	Agdao	118	24	13	0	89	19	46	1
	Buhangin	158	11	10	0	147	15	17	0
	Bunawan	91	5	5	0	71	5	19	6
	Paquibato	57	2	2	0	56	2	3	0
District 3	Baguio	118	4	4	0	109	4	12	1
	Calinan	236	4	17	1	197	10	49	2
	Marilog	81	0	0	0	79	0	2	0
	Toril	193	19	38	1	168	20	62	1
	Tugbok	174	5	19	0	162	5	31	0
Davao City		**1731**	**117**	**163**	**3**	**1529**	**120**	**351**	**14**

Source: IM4Davao Team – HIS 2017.

Table 4.9 Monthly Rental for House and Land

Cost (PHP)	No. of Households	%
1-500	14	10.7
501-1000	28	21.4
1001-1500	26	19.8
1501-2000	23	17.6
2001-2500	8	6.1
2501-3000	9	6.9
3001-3500	4	3.1
3501-4000	4	3.1
4001-4500	3	2.3
4501-5000	4	3.1
5001-	8	6.1
Total	**131**	**100.0**

Source: IM4Davao Team – HIS 2017.

32. Ownership of appliances and access to basic services show differences in living conditions across districts in Davao City.

Table 4.10 Ownership of Household Appliances by Administrative District

Congressional District	Administrative District	Aircon		Electric Fan		Washing Machine		Flat Iron		Refrigerator		Mobile Phone		Radio		Landline Telephone	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
District 1	Poblacion	91	373	448	16	237	227	331	133	309	155	401	63	352	112	64	400
	Talomo	17	123	115	25	65	75	75	65	85	55	110	30	124	16	8	132
District 2	Agdao	6	149	128	27	61	94	82	73	75	80	128	27	103	52	7	148
	Buhangin	16	163	161	18	79	100	91	88	99	80	138	41	166	13	9	170
	Bunawan	10	91	90	11	33	68	77	24	54	47	90	11	90	11	3	98
	Paquibato	3	58	37	24	14	47	21	40	32	29	41	20	52	9	0	61
District 3	Baguio	6	120	81	45	45	81	71	55	79	47	103	23	106	20	7	119
	Calinan	14	244	142	116	96	162	126	132	143	115	192	66	218	40	4	254
	Marilog	1	80	26	55	16	65	31	50	27	54	48	33	60	21	2	79
	Toril	14	237	176	75	73	178	137	114	137	114	208	43	196	55	9	242
	Tugbok	20	178	148	50	75	123	126	72	120	78	153	45	157	41	10	188
Davao City		**198**	**1816**	**1552**	**462**	**794**	**1220**	**1168**	**846**	**1160**	**854**	**1612**	**402**	**1624**	**390**	**123**	**1891**

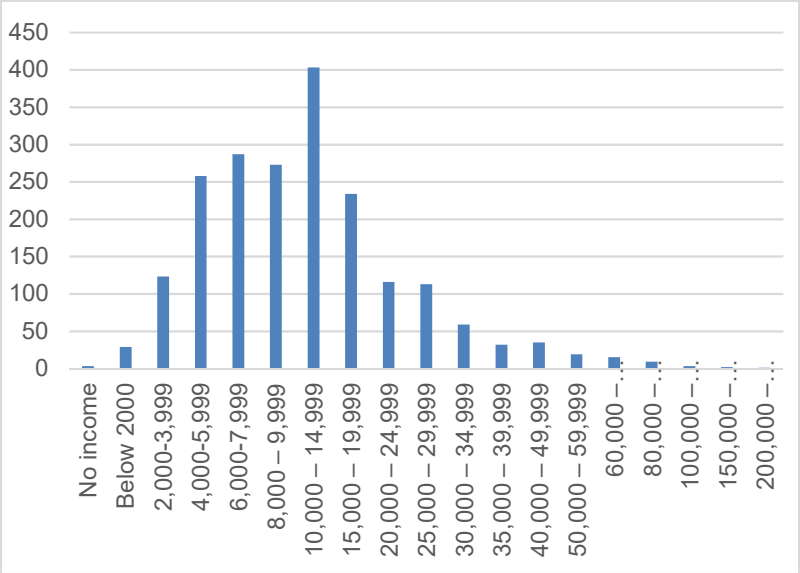
Source: IM4Davao Team – HIS 2017.

Table 4.11 Access to Internet and Property Ownership by Administrative District

Congressional District	Administrative District	Internet[1]		TV		Satellite TV		PC[2]		Power Generator		Livestock		Land[3]		Fishing Equipment	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
District 1	Poblacion	108	356	431	33	25	439	85	379	4	460	26	438	17	447	2	462
	Talomo	8	132	131	9	1	139	9	131	0	140	5	135	5	135	0	140
District 2	Agdao	11	144	146	9	3	152	6	149	2	153	3	152	2	153	0	155
	Buhangin	22	157	164	15	6	173	11	168	1	178	18	161	14	165	0	179
	Bunawan	3	98	96	5	9	92	4	97	1	100	11	90	10	91	0	101
	Paquibato	0	61	47	14	1	60	1	60	1	60	6	55	6	55	0	61
District 3	Baguio	19	107	110	16	14	112	17	109	3	123	56	70	43	83	3	123
	Calinan	19	239	224	34	10	248	22	236	1	257	87	171	87	171	2	256
	Marilog	0	81	54	27	1	80	0	81	0	81	4	77	18	63	0	81
	Toril	17	234	229	22	4	247	13	238	0	251	65	186	35	216	0	251
	Tugbok	19	179	170	28	10	188	17	181	2	196	47	151	48	150	1	197
Davao City		**226**	**1788**	**1802**	**212**	**84**	**1930**	**185**	**1829**	**15**	**1999**	**328**	**1686**	**285**	**1729**	**8**	**2006**

Source: IM4Davao Team – HIS 2017. [1] Landline / mobile [2] Desktop/Laptop [3] Agricultural, orchard, farm, etc

33. Majority of the surveyed households earn less than PHP20,000 monthly, with around 50% earning below PHP10,000 a month.



Source: IM4Davao Team – HIS 2017.

Figure 4.3 Monthly Household Incomes of HIS Respondents

34. The interviewed households are composed of 97.5% Christians and 2.5% Muslims. About 99 Muslim households belong to the Moro ethnolinguistic groups, of which there are six (i.e., Iranun, Kagan, Maguindanaon, Maranao, Sama, and Tausug). Meanwhile, some 147 of the surveyed households belong to indigenous peoples (IPs) groups, of which there are five (i.e., Ata, Klata/Guiangan, Matigsalug, Obu-Manuvu, and Tagabawa). Some 79 households belong to other ethnolinguistic groups such as the Bagobo, Bulanon, Lumad, Mandaya, and Manobo, who have minor presence in the city.

Table 4.12 Religious Affiliation

Religion	No. of Households	%
Christianity	1,963	97.5
Islam	50	2.5
None	1	0.0
Total	**2,014**	**100.0**

Source: IM4Davao Team – HIS 2017.

Table 4.13 Ethnolinguistic Groupings of HIS Respondents by Administrative District

Congressional District	Administrative District	Indigenous Peoples or Lumad					Moros					
		Ata	K'lata/ Guiangan	Obu-Manuvu	Tagabawa	Matigsalug	Iranun	Kagan	Maguindanaon	Maranao	Sama	Tausug
District 1	Poblacion	1	0	1	1	0	0	12	2	18	0	5
	Talomo	2	0	3	0	0	0	0	3	2	0	1
District 2	Agdao	0	0	0	0	0	0	0	1	0	0	0
	Buhangin	0	1	2	0	0	0	6	15	1	0	3
	Bunawan	0	0	0	0	0	2	0	0	6	0	0
	Paquibato	1	0	0	0	0	0	0	0	0	0	0
District 3	Baguio	0	6	7	0	0	0	0	0	0	0	0
	Calinan	6	38	6	1	1	0	1	1	1	0	5
	Marilog	1	0	13	0	4	0	0	0	1	1	0
	Toril	0	2	3	19	0	0	2	1	2	0	0
	Tugbok	1	23	4	0	0	0	0	1	1	3	2
Davao City		**12**	**70**	**39**	**21**	**5**	**2**	**21**	**24**	**32**	**4**	**16**

Source: IM4Davao Team – HIS 2017.

Table 4.14 Other Ethnolinguistic Groups in Davao City by Administrative District

Congressional District	Administrative District	Other Ethnolinguistic Groups								Total
		B'laan	Bagobo	Bulanon	Jangan	Lumad	Mandaya	Manobo	Others[1]	
District 1	Poblacion	3	5	0	0	0	0	0	4	12
	Talomo	0	2	0	0	0	0	0	0	2
District 2	Agdao	0	0	0	0	0	1	0	0	1
	Buhangin	0	0	0	0	0	0	0	0	0
	Bunawan	0	0	0	0	5	0	1	0	6
	Paquibato	0	0	0	0	0	0	0	1	1
District 3	Baguio	0	9	3	3	0	3	2	4	24
	Calinan	1	2	3	1	0	2	0	0	9
	Marilog	0	2	0	0	1	0	2	5	10
	Toril	0	10	1	0	0	0	1	2	14
	Tugbok	0	0	0	0	0	0	0	0	0
Davao City		**4**	**30**	**7**	**4**	**6**	**6**	**6**	**16**	**79**

Source: IM4Davao Team – HIS 2017. [1] Include Badjao, Bawa, Diangan, Higaunon, Hilongga, Isitruba, Kamayo, Kaolo, Letina, Nitibo, Tausug, Tidura.

3) Form 2: Household Members' Information

35. This section shows the compiled answers of all household members to Form 2 of the HIS. This deals with household size, gender, educational achievement, occupation and employment, and driver license ownership.

36. Half of the households have three to four members. Ages and education levels of household members are summarized below.

Table 4.15 Number of Households by Size

Size	No. of Households	%
1 person	35	1.7
2 persons	339	16.8
3 persons	502	24.9
4 persons	552	27.4
5 persons	343	17.0
6 persons	138	6.9
7 persons	62	3.1
8 persons	25	1.2
9 persons	9	0.4
10 persons	6	0.3
More than 10 persons	3	0.1
Total	**2,014**	**100.0**

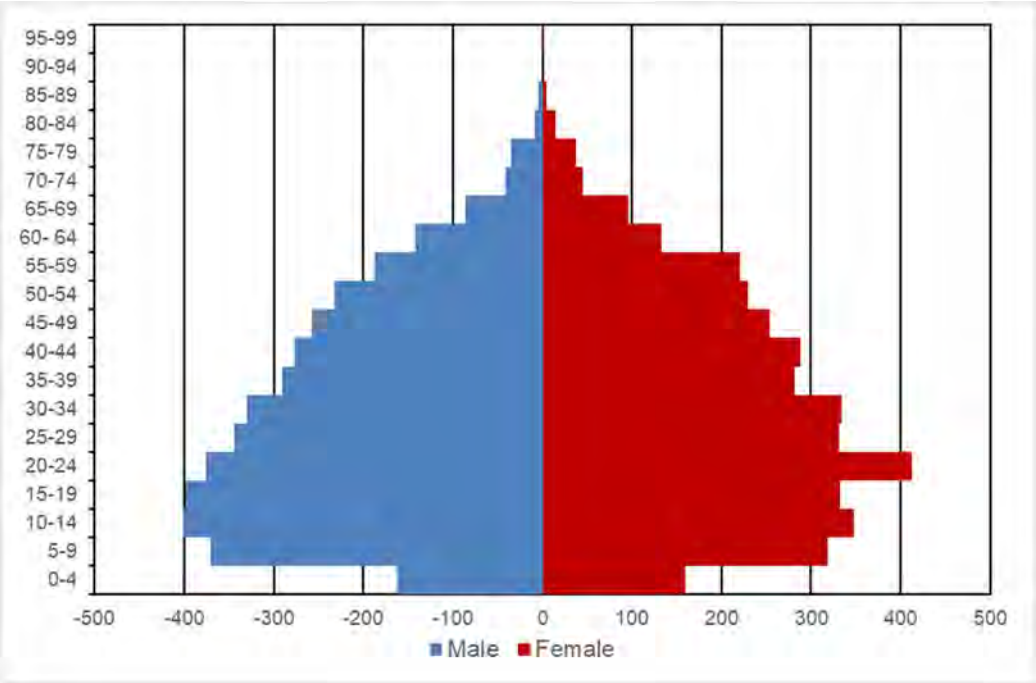
Source: IM4Davao Team – HIS 2017.

Table 4.16 Gender Distribution and Education Levels of HIS Respondents by Age Group

Age		Gender		Education Level						
		Male	Female	Master's / Doctoral Degree	Postgraduate Diploma	Bachelor's Degree	Associate Degree/Diploma	High School Graduate	Elementary School Graduate	None
1−10		621	555	0	0	0	0	0	231	945
11−20		800	683	0	0	32	18	558	604	271
21−30		709	759	9	57	247	82	945	114	14
31−40		623	597	5	51	173	66	763	152	10
41-50		505	521	6	23	122	54	627	176	18
51-60		404	436	9	15	98	37	477	196	8
61-70		210	197	2	15	57	14	209	102	8
71-80		63	80	4	1	20	4	42	67	5
81-90		10	10	0	0	3	1	6	7	3
91-100		0	2	0	0	1	0	0	1	0
Davao City	**No.**	**3,945**	**3,840**	**35**	**162**	**753**	**276**	**3,627**	**1,650**	**1,282**
	%	**50.7**	**49.3**	**0.4**	**2.1**	**9.7**	**3.5**	**46.6**	**21.2**	**16.5**

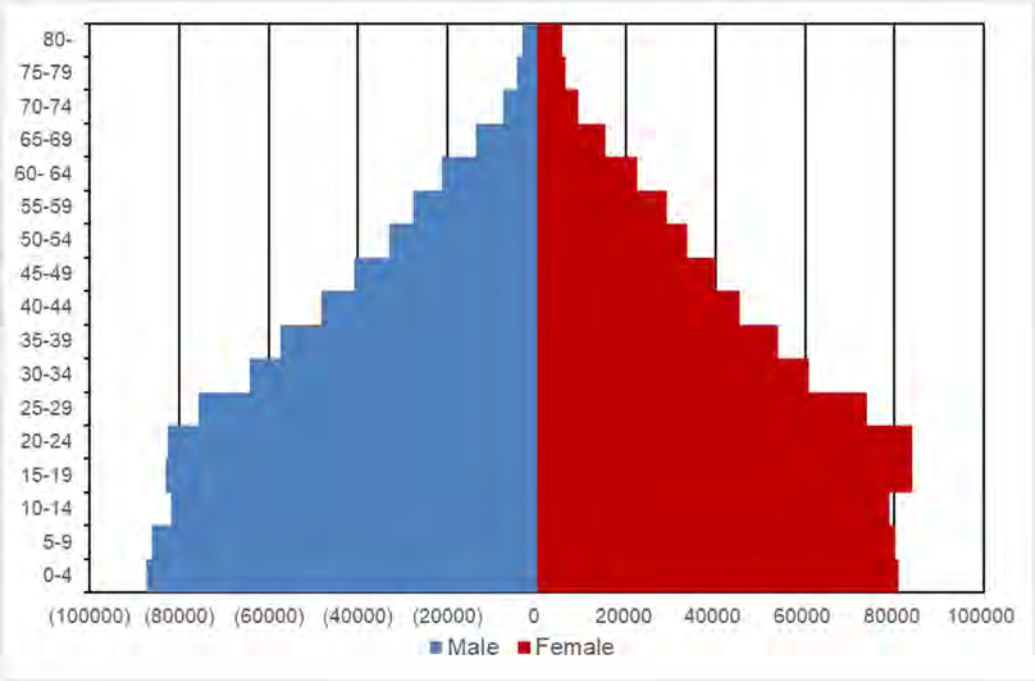
Source: IM4Davao Team – HIS 2017.

37. A population pyramid of the surveyed households according to age group is illustrated in Figure 4.4. Compared to Census data, the number of household members aged 0 to 4 was lesser, because during the survey these age group was not strictly counted. The reason for this is because those under 5 years old were presumed to be unable to make trips of their own; hence, they were not recorded by surveyors.



Source: IM4Davao Team – HIS 2017.

Figure 4.4 Population Pyramid of HIS Respondents



Source: Philippine Statistics Authority, 2015 Census of Population.

Figure 4.5 Official Population Pyramid in Davao City

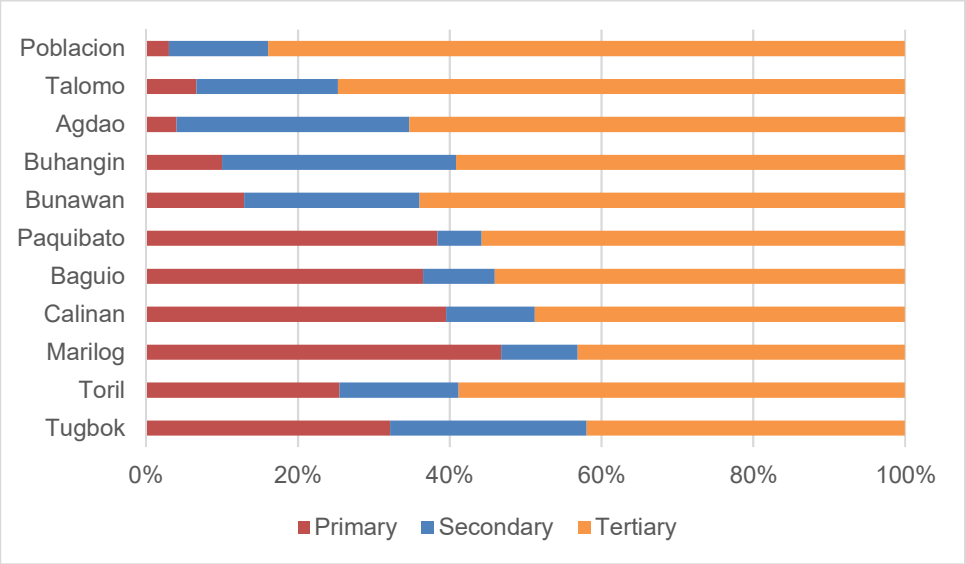
38. Daytime and nighttime population was estimated based on the location of schools and workplaces. Of the 11 districts, only Poblacion and Baguio registered a higher daytime population than nighttime population. Poblacion's figure, however, is more significant at 39%, while Baguio's is a mere 2% increase. This means people living outside Poblacion go there for various purposes, thereby making it a center of daily trips.

Table 4.17 Daytime and Nighttime Population

District		At Residence	At Workplace / School
		Nighttime Population	Daytime Population
1	Poblacion	183,475	255,240
2	Talomo	449,946	400,266
3	Agdao	117,266	109,489
4	Buhangin	303,230	294,353
5	Bunawan	155,482	146,264
6	Paquibato	22,720	21,594
7	Baguio	35,888	36,469
8	Calinan	96,190	95,966
9	Marilog	41,324	40,057
10	Toril	157,573	145,746
11	Tugbok	107,818	101,295
Davao City		**1,670,912**	**1,646,741**

Source: IM4Davao Team – HIS 2017.

39. Urban areas (Poblacion, Talomo, Agdao, Buhangin, Bunawan, and Toril) have a large share of tertiary and secondary industries, while rural areas (Paquibato, Baguio, Calinan, Marilog, and Tugbok) have more primary activities. The breakdown of occupation is shown in Table 4.18.



Source: IM4Davao Team – HIS 2017.

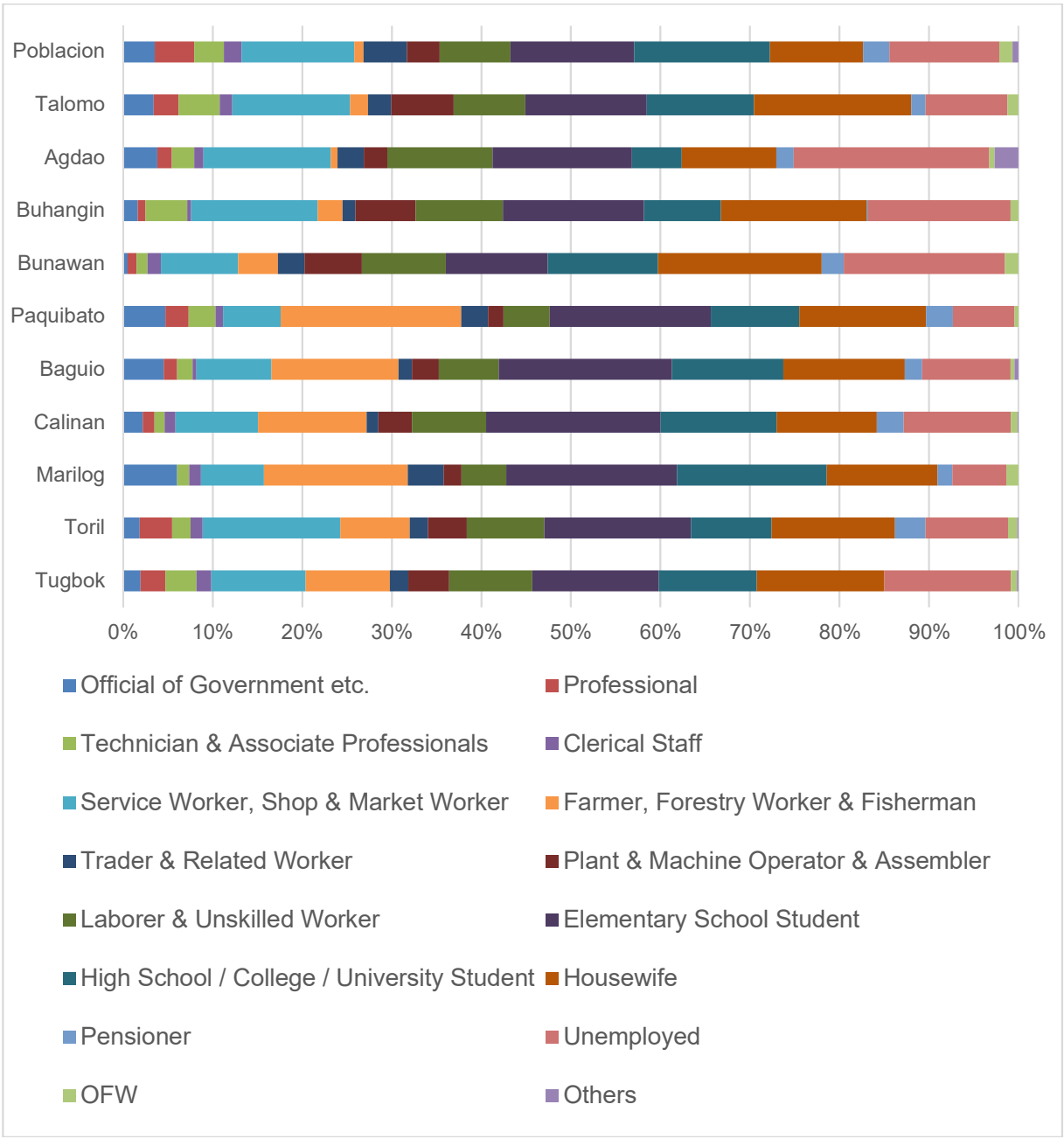
Figure 4.6 Employment among HIS Respondents by Economic Sector and District

Table 4.18 Occupation of HIS Respondents

Occupation	Economic Sector			Student	Uncategorized	Total
	Primary	Secondary	Tertiary			
Official of Government & Special Interest, Organization, Corporate Executive, Manager	0	0	224	0	0	224
Professional	11	13	169	0	3	196
Technician & Associate Professionals	4	103	105	0	0	212
Clerical Staff	0	19	82	0	4	105
Service Worker, Shop & Market Worker	0	0	912	0	0	912
Farmer, Forestry Worker & Fisherman	497	0	0	0	0	497
Trader & Related Worker	3	27	187	0	1	218
Plant & Machine Operator & Assembler	11	39	273	0	5	328
Laborer & Unskilled Worker	90	315	228	0	27	660
Elementary School Student	0	0	0	1226	0	1226
High School / College / University Student	0	0	0	915	0	915
Housewife	0	0	0	0	1015	1015
Pensioner	0	0	0	0	169	169
Unemployed	0	0	0	0	995	995
OFW	0	0	0	0	78	78
Others	0	0	0	0	35	35
Total	**616**	**516**	**2,180**	**2,141**	**2,332**	**7,785**

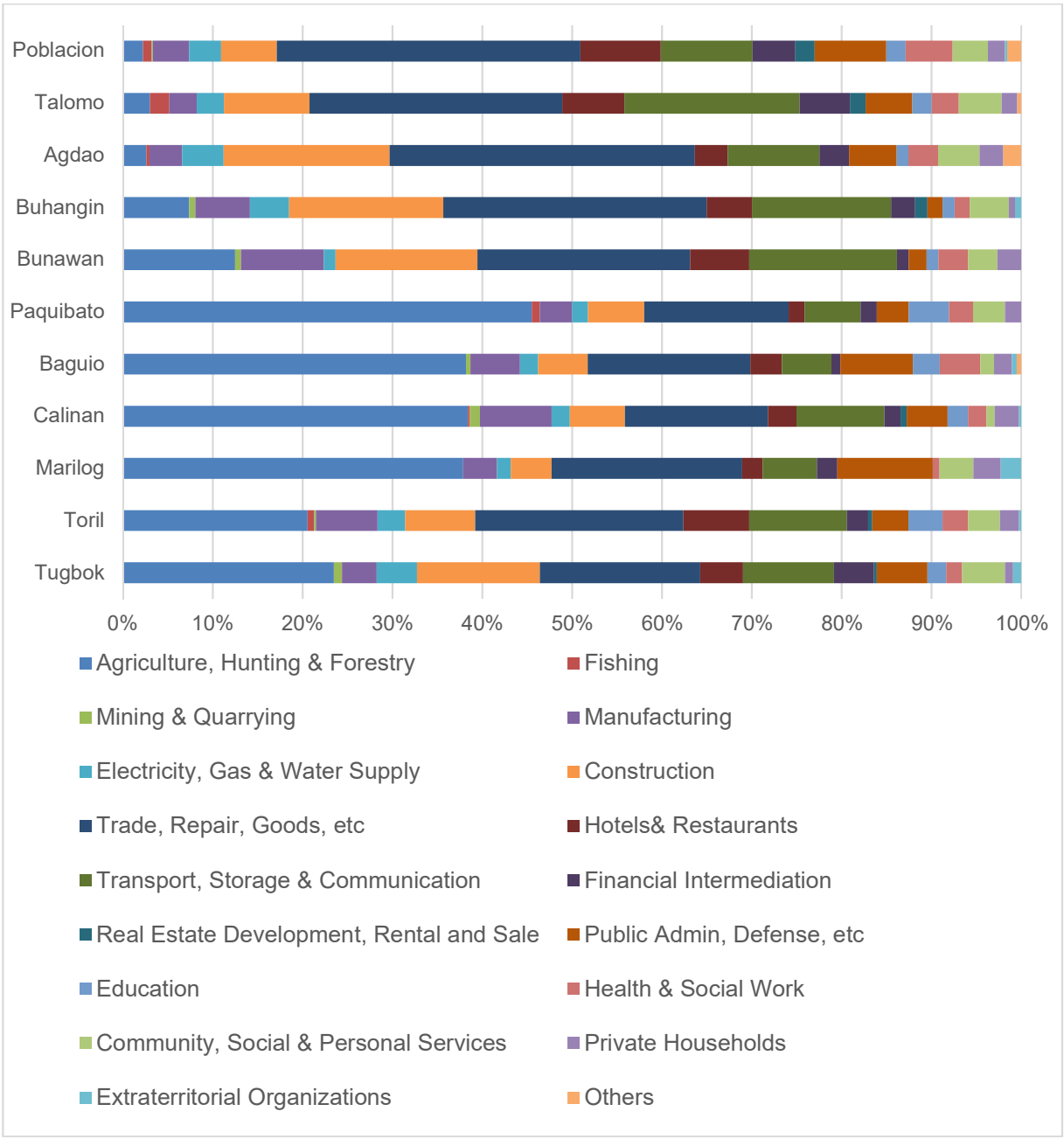
Source: IM4Davao Team – HIS 2017.

40. Occupation and employment by district are illustrated in the following figures. Majority of occupation include service worker, shop & market worker, student, housewife, and unemployed; and for those with employment, mainly are agriculture, hunting & forestry, trade, repair, and goods, etc.



Source: IM4Davao Team – HIS 2017.

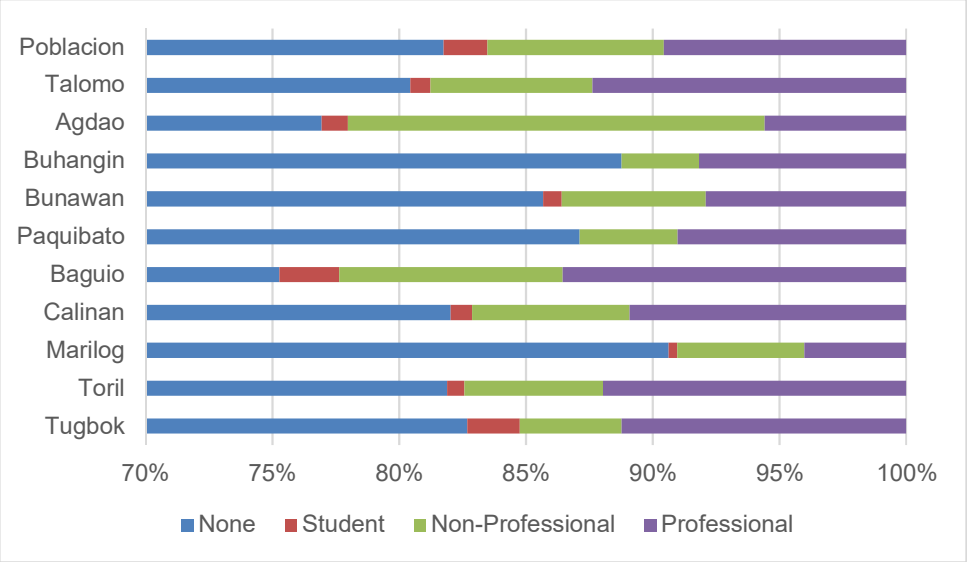
Figure 4.7 Occupation of HIS Respondents by District



Source: IM4Davao Team – HIS 2017.

Figure 4.8 Employment of HIS Respondents by Administrative District

41. Of the 11 districts, Agdao has the biggest share of non-professional driver license holders. Meanwhile, over 85% of respondents in Buhangin, Bunawan, Paquibato, and Marilog do not possess driver's licenses.



Source: IM4Davao Team – HIS 2017.

Figure 4.9 Driver's License Ownership by Administrative District

4) Form 3: People's Satisfaction with Living Conditions and Urban Services

42. This section shows the compiled answers of household heads to Form 3 of the HIS which is about their satisfaction with their living conditions and urban services. This deals with disaster preparedness, water supply, sanitation, drainage, fuel, power supply, solid waste management, and traffic management. This also shows their preferences for transport improvement measures.

(1) Disaster Preparedness

43. Davao City residents receive information on expected natural disasters such as typhoon, flooding, and high tide events through radio, TV, and barangay officials. Nearly 80% of the HIS respondents are aware of the evacuation sites when disaster happens. These shelters which are designated by the LGU or NGO include schools and gymnasiums. Some respondents, however, said that they would not evacuate because they are afraid for their properties.

Table 4.19 Sources of Information on Expected Natural Disasters

Information Source	No.	%
Radio/ TV	1918	55.7
Newspaper	116	3.4
Barangay Officials	806	23.4
Neighbors	239	6.9
Children's School	43	1.2
Social Media	126	3.7
SMS	189	5.5
No Information	4	0.1
Other	3	0.1

Source: IM4Davao Team – HIS 2017.

Table 4.20 Awareness of Evacuation Sites in Case of Natural Disasters

Awareness	No.	%
Yes	1,572	78.1
No	442	21.9

Source: IM4Davao Team – HIS 2017.

Table 4.21 Preferred Evacuation Sites among HIS Respondents

Location of Evacuation	No.	%
Evacuation site designated by the LGU	1,147	73.0
Evacuation site designated by NGO	136	8.7
House of relatives	97	6.2
House of neighbors	15	1.0
Other safer places	125	8.0
Will not evacuate	52	3.3

Source: IM4Davao Team – HIS 2017.

Table 4.22 Knowledge of Evacuation Sites Designated by LGU and NGO

Designated Location	No.	%
School	695	52.5
Gymnasium	593	44.8
Places of worship	18	1.4
Other	17	1.3

Source: IM4Davao Team – HIS 2017.

Table 4.23 Reasons given by HIS Respondents for not Evacuating during Disasters

Reason	No.	%
Risk of losing household items	59	54.6
Too late to evacuate	22	20.4
Underestimated the risk of disaster	27	25.0
Did not believe the news	0	0.0

Source: IM4Davao Team – HIS 2017.

44. Even if their houses are in areas with high risk of natural disasters, not many people were willing to relocate unless they can secure ownership of the house/land to which they would be relocated and job opportunities.

Table 4.24 Willingness of HIS Respondents to Relocate owing to Natural Disasters

Willingness to Relocate	No.	%
Yes, without condition	790	39.2
Yes, with condition	1,080	53.6
No	144	7.1

Source: IM4Davao Team – HIS 2017.e

Table 4.25 Priority Consideration of HIS Respondents before Relocation

Priority Consideration	No.	%
Job opportunity	371	34.4
Subsidy for housing	198	18.3
Ownership of land and house	488	45.2
Transfer with my neighbors and keep current community	15	1.4
Other	8	0.7

Source: IM4Davao Team – HIS 2017.

45. Surveyed households were asked to assess the level of risk they face and whether they had participated in any program on disaster awareness and preparedness in Davao. Around half of them perceive themselves to be at low risk and did not join programs on house protection. Risk evaluations are listed below.

- High: Yes, my place is prone to this disaster, already experienced it, or will surely happen in the future.
- Moderate: I think my place is safe, but I'm not sure; it might happen.
- Low: No, my place is not regarded as prone to this disaster.
- Don't know: I don't know whether or not my place is prone to this disaster.

Table 4.26 Risk Assessment among HIS Respondents and Their Participation in Disaster Preparedness Programs

Disaster	Risk Assessment								Program Participation			
	High		Moderate		Low		Don't know		Yes		No	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Flood	174	8.6	497	24.7	1066	52.9	277	13.8	667	33.1	1347	66.9
Typhoon	78	3.9	370	18.4	1123	55.8	443	22.0	566	28.1	1448	71.9
Landslide/mudslide	66	3.3	262	13.0	1118	55.5	568	28.2	450	22.3	1564	77.7
Earthquake	127	6.3	708	35.2	961	47.7	218	10.8	936	46.5	1078	53.5
Storm surge	113	5.6	319	15.8	1077	53.5	505	25.1	509	25.3	1505	74.7
Tsunami	58	2.9	154	7.6	999	49.6	803	39.9	334	16.6	1680	83.4
Forest fire	48	2.4	197	9.8	988	49.1	781	38.8	330	16.4	1684	83.6
Haze	39	1.9	181	9.0	1026	50.9	768	38.1	338	16.8	1676	83.2
Volcanic eruption	46	2.3	185	9.2	947	47.0	836	41.5	301	14.9	1713	85.1
Fire	125	6.2	474	23.5	930	46.2	485	24.1	609	30.2	1405	69.8
Armed conflict	100	5.0	280	13.9	933	46.3	701	34.8	385	19.1	1629	80.9

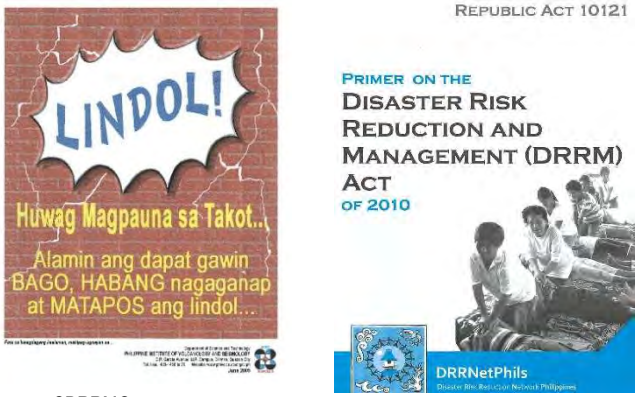
Source: IM4Davao Team – HIS 2017.

46. TV, radio, barangays/city authorities, and mobile phones are the HIS respondents' primary sources of information on hazards (Table 4.27). The CDRRMO also distributed brochures on the subject (Figure 4.10). Still, 68-70% did not join community and city level orientations, fire drills, as well as earthquake and tsunami drills, although the city government reportedly carries out school and workplace fire drills.

Table 4.27 Primary Sources of Information on Hazards

Information Source	No.	%
Radio	1,742	86.5
TV	1,821	90.4
Mobile Phone	1,143	56.8
Internet	404	20.1
Schools	570	28.3
Barangays/City	1,217	60.4
Trainings /Drills	345	17.1
NGOs	288	14.3

Source: IM4Davao Team – HIS 2017.



Source: CDRRMO.

Figure 4.10 Sample of Information Kits

Table 4.28 Participation of HIS Respondents in Disaster Awareness/Preparedness Programs and Drills

Program	Yes		No	
	No.	%	No.	%
Disaster Awareness/Preparedness Programs	860	42.7	1,154	57.3
Community-level Orientation	625	31.0	1,389	69.0
Community-level Fire Drills	644	32.0	1,370	68.0
City-level Earthquake/ Tsunami Drills	559	27.8	1,455	72.2

Source: IM4Davao Team – HIS 2017.

Table 4.29 Awareness of HIS Respondents about CDRRMO and Other Alarm Systems

Item		Yes		No	
		No.	%	No.	%
Existence of CDRRMO		1,441	71.5	573	28.5
Alarm System	Evacuation directional signs	1,252	62.2	762	37.8
	Sirens	1,305	64.8	709	35.2
	Text blast	1,210	60.1	804	39.9
	Radio communication	1,292	64.2	722	35.8
	Warnings posted on electronic billboards	623	30.9	1,391	69.1

Source: IM4Davao Team – HIS 2017.

(2) Water Supply

47. Based on the table below, almost 44% of surveyed households use water from Davao City Water District (DCWD) for drinking, while more than 21% source their drinking water from Barangay Water and Sanitation Associations (BAWASAs) or private associations. Others rely on public faucets, own wells, rainwater storage, etc. (30%), while more than 5% rely on other sources. The low share of DCWD is mainly due to the fact that the survey had more household respondents in rural areas, where DCWD service is not available.

Table 4.30 Sources of Water among HIS Respondents by Purpose

Source of Water	Drinking		Cooking/ Dishwashing		Washing Clothes		Toilet Flushing		Bathing		Car Washing		Watering Plants	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Piped Water from DCWD	879	43.6	1,044	51.8	1,046	51.9	1,045	51.9	1,047	52.0	505	50.7	933	50.1
Piped Water from Private Associations or BAWASAs	429	21.3	516	25.6	480	23.8	495	24.6	498	24.7	252	25.3	445	23.9
Neighbor's Connection	26	1.3	29	1.4	30	1.5	26	1.3	26	1.3	10	1.0	23	1.2
Public Faucets	77	3.8	91	4.5	82	4.1	81	4.0	79	3.9	42	4.2	70	3.8
Own Well	73	3.6	101	5.0	109	5.4	110	5.5	114	5.7	53	5.3	162	8.7
Public Wells	81	4.0	103	5.1	103	5.1	104	5.2	103	5.1	54	5.4	59	3.2
Water Vendor Delivery	98	4.9	13	0.6	2	0.1	2	0.1	2	0.1	1	0.1	2	0.1
Water Refilling Station	243	12.1	7	0.3	2	0.1	2	0.1	2	0.1	1	0.1	3	0.2
Rain Water Storage	6	0.3	9	0.4	30	1.5	36	1.8	32	1.6	29	2.9	50	2.7
Other	102	5.1	101	5.0	130	6.5	113	5.6	111	5.5	50	5.0	115	6.2
Total	**2,014**	**100**	**2,014**	**100**	**2,014**	**100**	**2,014**	**100**	**2,014**	**100**	**997**	**100**	**1,862**	**100**

Source: IM4Davao Team – HIS 2017.

48. Of those surveyed households who gave data on their expenses on bottled water, which is 928 out of the 2,014 households (or 46% of the total), they spend around PHP180 to PHP270 on bottled water per week on average. The total expenses on drinking water and bottled water ranges from 1% to 5% of monthly incomes.

Table 4.31 Weekly Expense on Bottled Water among HIS Respondents by Monthly Household Income

Monthly HH Income	No data/ None	PHP											Total
		<100	101-200	201- 300	301-400	401-500	501-600	601-700	701-800	801-900	901-1000	>1,000	
No income	2	0	1	0	0	0	0	0	0	0	0	0	3
Below 2,000	18	1	3	1	3	3	0	0	0	0	0	0	29
2,000–3,999	76	16	11	7	4	5	0	1	0	0	0	3	123
4,000–5,999	131	35	27	21	25	13	0	3	1	0	0	2	258
6,000 –7,999	158	37	24	22	18	14	3	3	1	0	0	7	287
8,000–9,999	145	43	33	17	10	13	3	6	0	0	0	3	273
10,000–14,999	192	63	41	34	29	26	2	9	0	0	0	7	403
15,000–19,999	134	29	31	8	11	14	3	3	0	0	0	1	234
20,000–24,999	71	9	14	9	3	5	0	1	0	0	0	4	116
25,000–29,999	60	13	13	7	5	11	1	2	0	0	0	1	113
30,000–34,999	35	6	9	3	1	4	0	0	0	0	0	1	59
35,000–39,999	16	7	9	0	0	0	0	0	0	0	0	0	32
40,000–49,999	24	3	2	4	2	0	0	0	0	0	0	0	35
50,000–59,999	11	3	0	1	3	1	0	0	0	0	0	0	19
60,000–79,999	6	4	1	1	1	2	0	0	0	0	0	0	15
80,000–99,999	4	1	2	2	0	0	0	0	0	0	0	0	9
100,000–149,999	1	0	0	2	0	0	0	0	0	0	0	0	3
150,000–199,999	1	0	0	1	0	0	0	0	0	0	0	0	2
200,000–299,999	1	0	0	0	0	0	0	0	0	0	0	0	1
300,000–499,999	0	0	0	0	0	0	0	0	0	0	0	0	0
Above 500,000	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1,086**	**270**	**221**	**140**	**115**	**111**	**12**	**28**	**2**	**0**	**0**	**29**	**2,014**

Source: IM4Davao Team – HIS 2017.

49. Regarding the DCWD's service coverage by district, more than 60% of the surveyed households in the districts of Poblacion, Talomo, Agdao, and Buhangin are connected to the DCWD; in Tugbok, it is around 36%; in Bunawan, Toril, Calinan, and Baguio, less than 20%; in Paquibato, 3.3%; and none in Marilog.

Table 4.32 DCWD Connection by District

District	Yes		No		No. of HIS Respondents	
	No.	%	No.	%	No.	%
Poblacion	455	98.1	9	1.9	464	23.0
Talomo	105	75.0	35	25.0	140	7.0
Agdao	144	92.9	11	7.1	155	7.7
Buhangin	106	59.2	73	40.8	179	8.9
Bunawan	17	16.8	84	83.2	101	5.0
Paquibato	2	3.3	59	96.7	61	3.0
Baguio	25	19.8	101	80.2	126	6.3
Calinan	39	15.1	219	84.9	258	12.8
Marilog	0	0.0	81	100.0	81	4.0
Toril	55	21.9	196	78.1	251	12.5
Tugbok	72	36.4	126	63.6	198	9.8
Total	**1,020**		**944**		**2,014**	**100.0**

Source: IM4Davao Team – HIS 2017.

50. The main reason for the low or lack of connection to the DCWD is the absence of the service in certain areas. The second and third reasons cited are the unaffordability of connection fees and the expensiveness of DCWD water.

Table 4.33 Reasons for not Connecting to DCWD System

Reason	No.	%
DCWD water is very expensive.	307	17.0
DCWD does not supply our area.	744	41.3
We prefer the water service provider in our area.	259	14.4
We cannot afford the connection fee being charged by DCWD.	339	18.8
We cannot comply with DCWD's many requirements.	141	7.8
The quality of DCWD water is not good.	13	0.7

Source: IM4Davao Team – HIS 2017.

51. The HIS also asked non-DCWD customers about their willingness to connect to the DCWD; only around 62% of the 994 households were willing.

Table 4.34 Willingness of Non-DCWD Customers to Connect to DCWD

Willingness	No.	%
Yes	615	61.9
No	379	38.1
Total	**994**	**100.0**

Source: IM4Davao Team – HIS 2017.

52. The ratio of connection to a piped water supply system is 47%. This is because the number of interviewees in the rural area is larger than the number of interviewees in the urban area.

Table 4.35 HIS Respondents' Connection to A Piped Water Supply System

Current Situation	No.	%
Yes, connected.	428	47.1
No, not connected.	526	52.9
Total	**954**	**100.0**

Source: IM4Davao Team – HIS 2017.

53. DCWD charges its customers for their water consumption and issues water bills. However, some BAWASAs and associations do not issue bills because they charge flat rates, hence "No" got nearly 50% response in the table below.

Table 4.36 Receive of Water Bill

Receive	No.	%
Yes	1020	50.6
No	994	49.4

Source: IM4Davao Team – HIS 2017.

54. About 16.3% of the surveyed households consume from 60 liters to 300 liters (0.06-0.30 m^3) of water per day or 1.8 to 9 m^3 per month (Table 4.37). Of the surveyed households, the average daily water consumption of each household member is 140 liters (Table 4.38). In DCWD areas, the per-capita water consumption is 190 liters per day.

Table 4.37 Monthly Household Water Consumption by HIS Respondents

Volume	No.	%	Cost	No.	%
< 11 m^3	220	16.3	<101PHP	54	4.0
11 – 20 m^3	245	18.2	101-200PHP	129	9.6
21 – 30 m^3	98	7.3	201-300PHP	141	10.5
31 – 40 m^3	85	6.3	301-400PHP	126	9.4
41 – 50 m^3	57	4.2	401-500PHP	40	3.0
> 50 m^3	57	4.2	>500PHP	94	7.0

Source: IM4Davao Team – HIS 2017.

Table 4.38 Daily Per-capita Water Consumption by HIS Respondents in DCWD Service Areas

Volume (liter)	No.of HHs	%
< 21	1	0.1
21 – 40	80	5.3
41 – 60	402	26.6
61 – 80	285	18.8
81 – 100	92	6.1
101 – 120	311	20.5
121 – 140	130	8.6
141 – 160	35	2.3
161 – 180	8	0.5
181 – 200	0	0.0
201 – 220	117	7.7
> 220	53	3.5
Total	**2014**	**100**

Source: IM4Davao Team – HIS 2017.

55. It is estimated that per-capita consumption in BAWASA areas ranges from 60 to 100 liters per day. On the other hand, daily consumption of well water by a household of five is less than 100 liters or 0.1 m^3. Meanwhile natural spring, rain water, and public wells make up around 70% of other water sources. Public faucets and neighbor's connections make up 12% as other water source.

Table 4.39 Monthly Household Water Consumption among HIS Respondents in BAWASA Service Areas

Volume (m^3)	No.	%	Cost (PHP)	No.	%
<11	110	14.9	>51	99	13.5
11-20	73	9.9	51-100	70	9.5
21-30	17	2.3	101-150	96	13.0
31-40	8	1.1	151-200	97	13.2
41-50	6	0.8	201-250	29	3.9
>50	20	2.7	251-300	54	7.3
			>300	57	7.7

Source: IM4Davao Team – HIS 2017.

Table 4.40 Daily Household Well-Water Consumption

Volume (m^3)	No.	%
<0.5	79	55.6
0.5-1	11	7.7
1.1-2	9	6.3
2.1-3	7	4.9
3.1-5	10	7.0
5.1-7	3	2.1
>7	23	16.2

Source: IM4Davao Team – HIS 2017.

Table 4.41 Other Water Sources

Source	No.	%
Rivers	4	4.76
Natural Spring	31	36.90
Rain	18	21.43
Public Wells	15	17.86
Public Faucet	6	7.14
Refilling Station	5	5.95
Neighbor's Connection	5	5.95

Source: IM4Davao Team – HIS 2017.

56. About 60% of the surveyed households are satisfied with their current water sources. However, more than 36% of the households are concerned about the capacity of their water sources especially during the dry season.

Table 4.42 HIS Respondents' Perception of Water Sufficiency

Perception	No.	%
Sufficient all year round	1165	57.8
Insufficient during dry season	246	12.2
Sometime insufficient	485	24.1
Insufficient most of the time	118	5.9
Total	**2014**	**100.0**

Source: IM4Davao Team – HIS 2017.

57. More than 80% of the surveyed households are satisfied with their current water suppliers in terms of water quantity, quality, pressure, hours of supply, and price.

Table 4.43 Satisfaction with Current Water Suppliers

Satisfaction Level	Water Quantity		Water Quality		Water Pressure		Hours of Supply		Price	
	No.	%	No.	%	No.	%	No.	%	No.	%
Highly Dissatisfied	81	4.0	55	2.7	65	3.2	103	5.1	68	3.4
Dissatisfied	233	11.6	191	9.5	249	12.4	258	12.8	148	7.3
Average	846	42.0	800	39.7	823	40.9	748	37.1	880	43.7
Satisfied	534	26.5	647	32.1	548	27.2	576	28.6	518	25.7
Highly Satisfied	296	14.7	295	14.6	304	15.1	302	15.0	295	14.6
No response	24	1.2	26	1.3	25	1.2	27	1.3	105	5.2
Total	**2014**	**100.0**	**2014**	**100.0**	**2014**	**100.0**	**2014**	**100.0**	**2014**	**100.0**

Source: IM4Davao Team – HIS 2017.

58. More than 85% of the surveyed households using well water are satisfied with its quantity and quality.

Table 4.44 Satisfaction with Well Water

	Water Quantity		Water Quality	
	No.	%	No.	%
Highly Dissatisfied	23	3.4	20	2.9
Dissatisfied	69	10.1	61	8.9
Average	355	51.8	364	53.3
Satisfied	170	24.8	183	26.8
Highly Satisfied	68	9.9	55	8.1
Total	**685**	**100.0**	**683**	**100.0**

Source: IM4Davao Team – HIS 2017.

59. About 38% of 321 well owners said they do not use water from their wells anymore because it is polluted. Groundwater especially in the northeastern area of the city is contaminated with iron and manganese, thereby affecting its color. Some 30% of well owners also said that their wells are drying up.

Table 4.45 Reasons Given by Well Owners for Not Using Well Water

Reason	No.	%
Wells Drying Up	96	29.9
Pollution	122	38.0
Salt Water Intrusion	12	3.7
Introduction of Piped Water Supply	91	28.3
Total	**321**	**100.0**

Source: IM4Davao Team – HIS 2017.

(3) Sanitation

60. On average, 98.5% of surveyed households have toilets. About 1.5% use communal or pay toilets or open areas such as riverbanks and the sea.

Table 4.46 Toilet Ownership among HIS Respondents by Administrative District

District	Yes		No	
	No.	%	No.	%
Poblacion	462	99.6	2	0.4
Talomo	140	100.0	0	0.0
Agdao	143	92.3	12	7.7
Buhangin	170	95.0	9	5.0
Bunawan	100	99.0	1	1.0
Paquibato	60	98.4	1	1.6
Baguio	125	99.2	1	0.8
Calinan	256	99.2	2	0.8
Marilog	81	100.0	0	0.0
Toril	249	99.2	2	0.8
Tugbok	198	100.0	0	0.0
Total/Average	**1,984**	**98.5**	**30**	**1.5**

Source: IM4Davao Team – HIS 2017.

Table 4.47 Defecation Sites for HIS Respondents without Toilets

Location	No.	%
Communal Toilets	11	36.7
Neighbor's Toilets for a Fee	8	26.7
Riverbank, Sea	6	20.0
Open Areas	4	13.3
Other	1	3.3
Total	**30**	**100.0**

Source: IM4Davao Team – HIS 2017.

61. The manual-flush type of toilet is the most common in Davao City. Payment for using a neighbor's toilet is around PHP2-5 per use or PHP60-150 monthly. This is 0.5 to 1.2% of a household's monthly income. About 33.3% of surveyed households with no toilets defecate outdoors. This sector of society's ratio of this value to the whole Davao is very small, at about 0.5% (1.5%*(20.0%+13.3%)).

Table 4.48 Costs of Using Communal/Neighbor's Toilets

Activity	Fee per Usage			Monthly Fee			
	Sample No.	Average	Median	Sample No.	Average	Median	Average/ Monthly HH Income (%)
Urinating	14	2.21 PHP	2 PHP	8	62.00 PHP	31 PHP	0.5
Defecating	19	4.16 PHP	3 PHP	13	116.62 PHP	90 PHP	1.1
Bathing	12	5.67 PHP	5 PHP	6	150.00 PHP	150 PHP	1.2

Source: IM4Davao Team – HIS 2017.

Table 4.49 Types of Toilets Owned by HIS Respondents

Type	No.	%
Flush Toilet	235	11.84
Manual-flush Toilet	1688	85.08
Latrine	44	2.22
Open Pit	10	0.50
Other	2	0.10
No Response	5	0.25
Total	**1,984**	**100.0**

Source: IM4Davao Team – HIS 2017.

62. Almost 94% of surveyed households have septic tanks, while 80% can access them. About 46% of the surveyed households have unlined septic tanks which have become a source of soil and groundwater contamination. Households with lined septic tanks account for only less than half of the HIS respondents. The difference between lined and unlined septic tanks is illustrated in Figure 4.11.

Table 4.50 Ownership of and Access to Septic Tanks among HIS Respondents

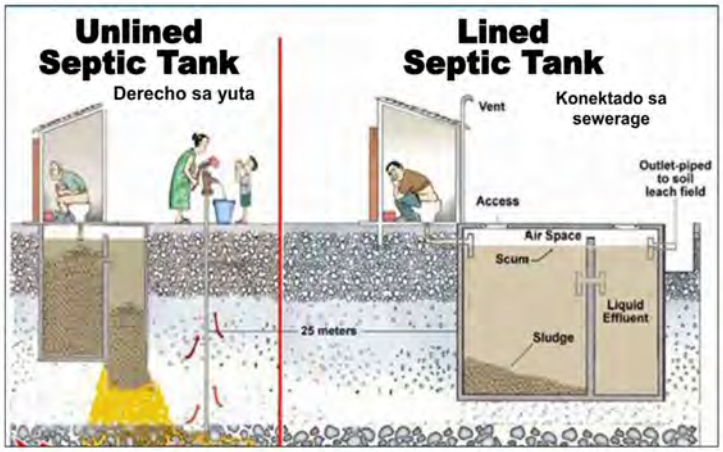
Item	Ownership of Septic Tanks		Access to Septic Tanks	
	No.	%	No.	%
Yes	1,865	93.7	1,559	80.2
No	126	6.3	386	19.8
No Response	23		69	
Total	**2,014**	**100.0**	**2,014**	**100.0**

Source: IM4Davao Team – HIS 2017.

Table 4.51 Types of Septic Tanks Owned by HIS Respondents

Type	No.	%
Unlined Septic Tank	825	44.24
Lined Septic Tank	848	45.47
I Don't Know	114	6.11
Other	7	0.38
No Response	71	3.81
Total	**1,865**	**100.0**

Source: IM4Davao Team – HIS 2017.



Source: IM4Davao Team – HIS 2017.

Figure 4.11 Unlined and Lined Septic Tanks

63. Many households have not desludged their septic tanks appropriately and regularly. Around 50% infiltrate to the ground, and the percentage of those who answered "Never" and "Not sure" regarding the frequency of desludging septic tanks is over 80%.

Table 4.52 Effluent Discharge Points of Septic Tanks among HIS Respondents

Discharge Point	No.	%
Discharge to sewer pipe	596	33.3
Discharge to roadside ditch	114	6.4
Discharge to road	8	0.4
Infiltrate to ground	883	49.4
Discharge to public water body (river, sea, etc.)	21	1.2
I don't know	167	9.3
No response	184	
Total	**1,865**	**100.0**

Source: IM4Davao Team – HIS 2017.

Table 4.53 Frequency of Desludging Septic Tanks among HIS Respondents

Frequency	No.	%
Annually	36	2.0
Once per 2 years	91	5.1
Once per 3-5 years	109	6.2
Once per more than 5 years	86	4.9
Never	1105	62.5
Not sure	341	19.3
No response	97	
Total	**1,865**	**100.0**

Source: IM4Davao Team – HIS 2017.

64. About 85% of surveyed households with septic tanks do not pay for desludging, but among those who paid, the cost per service averaged PHP2,779.38, and the median cost is PHP2,550. The sludge should be treated in plants before it is disposed, but 91% of respondents do not know if they are treated properly.

Table 4.54 Payment for Desludging Service of Septic Tanks

Payment	No.	%
Yes	269	15.5
No	1466	84.5
No response	130	
Total	**1,865**	**100.0**

Source: IM4Davao Team – HIS 2017.

65. About 74% of surveyed households understood that if wastewater from toilets goes directly to water bodies, it would pollute them. For gray water (wastewater from kitchen, lavatory, such as handwashing, gargling, brushing teeth, bath, etc.), 39.2% of households said they discharge to roadside ditches and 38.6% infiltrate to the ground.

Table 4.55 Gray Water Discharge Points among HIS Respondents

Discharge Point	No.	%
Discharge to sewer pipe	316	15.9
Discharge to roadside ditch	780	39.2
Discharge to road	12	0.6
Infiltrate to ground	768	38.6
Discharge to public water body (river, sea, etc.)	62	3.1
I don't know	51	2.6
No respondents	25	
Total	**2,014**	**100.0**

Source: IM4Davao Team – HIS 2017.

66. Although 57% of respondents had not experienced water-borne diseases, 16.5% admitted to having had diarrhea, hay fever, etc. Other negative health conditions, such as cough, dengue, fever, hypertension, runny nose, spot in lungs, stroke, tooth ache, typhoid fever, and urinary tract infection are also included. Diseases may have influence on daily life and extra payment for treatment is needed.

67. Although many have expressed they have had "No problem" regarding sanitation, proper wastewater treatment is necessary for a better living environment for all (Table 4.59). In order to grasp the willingness to pay for wastewater treatment, a scenario was designed for HIS respondents.

Table 4.56 Water-borne Diseases in the Past Year among HIS Respondents

Disease	No.	%
None	1,299	56.9
Diarrhea	377	16.5
Skin Diseases	75	3.3
Schistosomiasis	10	0.4
Cholera	59	2.6
Dysentery	7	0.3
Meningitis	1	0.0
Otitis externa sore	65	2.8
Amoebiasis	31	1.4
Hepatitis A	0	0.0
Typhoid	49	2.1
Hay Fever	214	9.4
Leptospirosis	2	0.1
Polio	1	0.0
Others	94	4.1

Source: IM4Davao Team – HIS 2017.

Table 4.57 Impact of Water-borne Diseases among HIS Respondents

Day	No. of Sick Days		No. of Absences from Work / School	
	No.	%	No.	%
< 1 day	1394	69.2	1448	71.9
1–3 days	464	23.0	401	19.9
4–7 days	134	6.7	144	7.1
8–30 days	19	0.9	17	0.8
>30 days	3	0.1	4	0.2

Source: IM4Davao Team – HIS 2017.

Table 4.58 Amount Spent by HIS Respondents on Cures for Water-borne Diseases

Cost (PHP)	No.	%
<100	1513	75.1
100–300	219	10.9
300–500	124	6.2
500–700	62	3.1
>700	96	4.8

Source: IM4Davao Team – HIS 2017.

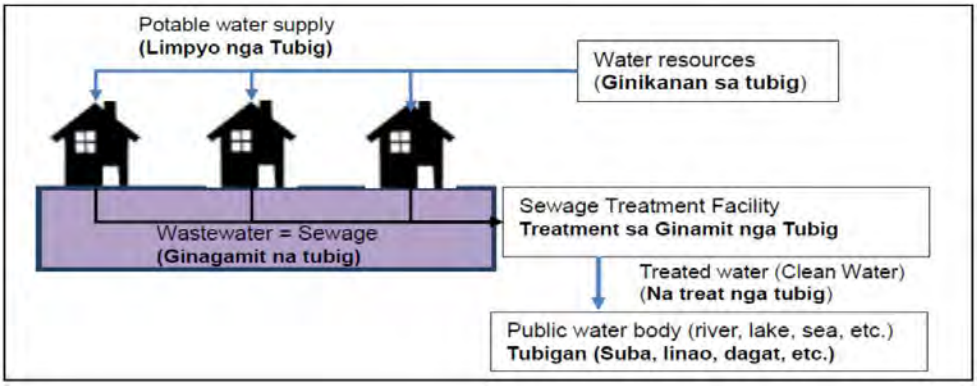
Table 4.59 Evaluation of HIS Respondents' about Sanitation in/around Houses

Evaluation	Offensive Odor		Pipe Clogging		Overflow of Wastewater	
	No.	%	No.	%	No.	%
Always	52	2.6	10	0.5	23	1.1
Frequently	81	4.0	65	3.2	92	4.6
Sometimes	664	33.0	397	19.7	437	21.7
No problem	1,189	59.0	1,437	71.4	1,375	68.3
Not sure	28	1.4	105	5.2	87	4.3
Total	**2,014**	**100.0**	**2,014**	**100.0**	**2,014**	**100.0**

Source: IM4Davao Team – HIS 2017.

68. Sewerage should be treated prior to discharge to water bodies. Davao City does not have a sewerage treatment system. This situation further exacerbates pollution of water bodies and results in incidences of water-borne diseases which affect the economy and public health. Sewerage treatment is the gold standard in preventing water pollution. In this regard, the city government and DCWD are planning to include a new sewerage management project in their development priorities (i.e., the construction of a sewerage collection pipe network and construction of a sewerage treatment facility).

69. This will eventually improve river/groundwater quality, thereby reducing incidences of water-borne diseases and improving economic conditions. Sewerage management, however, entails high investment costs; hence, the collection of tariffs to recover costs is necessary. The HIS results show that almost 40% of households are willing to pay only less than PHP100 per month, and almost 24% are not willing to pay anything.



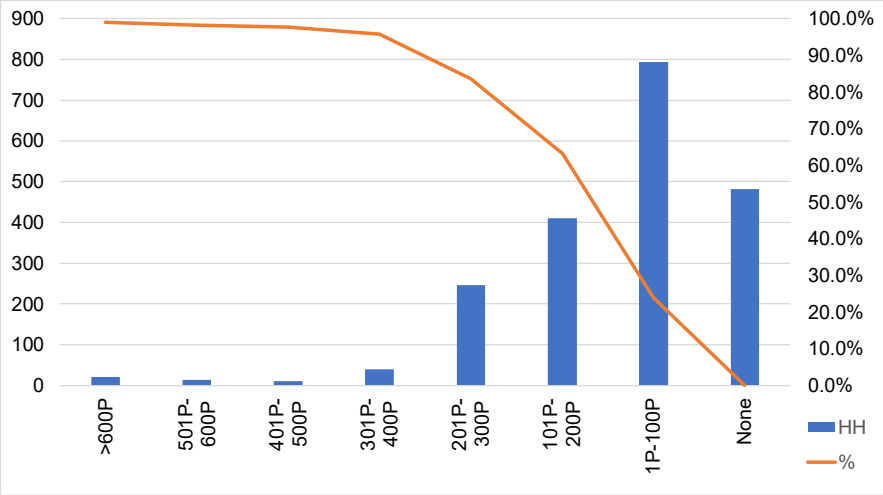
Source: IM4Davao Team – HIS 2017.

Figure 4.12 Illustration of a Sewerage System

Table 4.60 HIS Respondents' Willingness to Pay for a Sewerage System by Monthly Household Income

Monthly Household Income		Monthly Fee (PHP)							
		>600	501-600	401-500	301-400	201-300	101-200	1-100	None
No income		0	0	0	0	0	0	3	0
Below 2,000		0	0	0	0	3	4	13	9
2,000 – 3,999		0	0	0	1	6	23	58	35
4,000 – 5,999		0	0	2	3	27	52	106	68
6,000 – 7,999		1	1	2	4	33	46	120	80
8,000 – 9,999		4	0	1	5	22	61	112	68
10,000 – 14,999		5	0	1	8	64	79	166	80
15,000 – 19,999		4	4	1	4	33	49	84	55
20,000 – 24,999		1	1	2	6	21	27	39	19
25,000 – 29,999		1	1	1	3	11	28	40	28
30,000 – 34,999		1	1	1	3	9	16	18	10
35,000 – 39,999		0	0	0	2	5	9	11	5
40,000 – 49,999		3	1	0	1	5	6	8	11
50,000 – 59,999		0	2	0	0	2	5	4	6
60,000 – 79,999		0	0	0	0	2	3	8	2
80,000 – 99,999		0	1	0	0	2	2	1	3
100,000 – 149,999		1	0	0	0	0	0	1	1
150,000 – 199,999		0	0	0	0	0	0	1	1
200,000 – 299,999		0	1	0	0	0	0	0	0
300,000 – 499,999		0	0	0	0	0	0	0	0
Above 500,000		0	0	0	0	0	0	0	0
Total	**No.**	**21**	**13**	**11**	**40**	**245**	**420**	**793**	**481**
	%	**1.0**	**0.7**	**0.6**	**2.0**	**12.2**	**20.4**	**39.4**	**23.9**

Source: IM4Davao Team – HIS 2017.



Source: IM4Davao Team – HIS 2017.

Figure 4.13 HIS Respondents' Willingness to Pay for a Sewerage System

(4) Drainage

70. Only 77% of surveyed households said they have drainage systems in their neighborhood. As to their condition, 67.8% said the drainage systems are in good or neutral status. The criteria how respondents evaluated are based on whether water is clogged by waste and plants, water is turbid, or has offensive odor or not. Due to bad or lack of drainage system, 25% of households had flood problem, denoting the importance of better drainage system.

Table 4.61 Existence of Drainage Systems around Homes of HIS Respondents

Possession	No.	%
Yes	1,555	77.2
No	459	22.8
Total	**2,014**	**100.0**

Source: IM4Davao Team – HIS 2017.

Table 4.62 Condition of Drainage Systems around Homes of HIS Respondents

Condition	No.	%
Very bad	198	12.7
Bad	304	19.5
Average	533	34.3
Good	414	26.6
Very Good	106	6.8
Total	**1,555**	**100.0**

Source: IM4Davao Team – HIS 2017.

Table 4.63 Reasons for HIS Respondents' Negative Assessment of Drainage Systems

Reason	Yes		No		Total
	No.	%	No.	%	
Drainage is clogged by waste, plants, etc.	438	87.3	64	12.7	**502**
Water is turbid	380	75.7	122	24.3	**502**
Water has offensive odor	358	71.3	144	28.7	**502**

Source: IM4Davao Team – HIS 2017.

Table 4.64 Frequency of HIS Respondents' House/Neighborhood Getting Flooded

Frequency	No.	%
More than once/month	78	3.9
Once/month	100	5.0
More than 5 times/year	61	3.0
2- 5 times/year	67	3.3
Once a year	103	5.1
Once per 2 years	54	2.7
Once per 3 years	46	2.3
Never	1117	55.5
Not sure	388	19.3
Total	**2,014**	**100.0**

Source: IM4Davao Team – HIS 2017.

(5) Cooking Fuel and Power Sources

71. The main fuel for cooking and boiling water among surveyed households is firewood (49%), while some families use LPG and charcoal/briquette coal. Still others use gas and lamps. While there are still some households who has no electricity, or are merely connected to their neighbors' lines, most of the surveyed households are connected to an electric company.

Table 4.65 Fuel for Cooking and Water Boiling among HIS Respondents

Source	Cooking		Boiling Water	
	No.	%	No.	%
Stove using firewood	993	49.3	986	49.0
Stove using rice husk	2	0.1	4	0.2
Stove using charcoal/briquette coal	296	14.7	328	16.3
Stove using kerosene	12	0.6	15	0.7
Stove using LPG	672	33.4	634	31.5
Stove using piped gas	5	0.2	5	0.2
Electric stove	21	1.0	27	1.3
Other	13	0.6	15	0.7
Total	**2,014**	**100.0**	**2,014**	**100.0**

Source: IM4Davao Team – HIS 2017.

Table 4.66 Sources of Electricity among HIS Respondents by District

District	Electric Company		Generator		Solar		Battery		Other	
	No.	%	No.	%	No.	%	No.	%	No.	%
Poblacion	460	22.84	1	0.05	0	0.00	0	0.00	3	0.15
Talomo	140	6.95	0	0.00	0	0.00	0	0.00	0	0.00
Agdao	150	7.45	1	0.05	0	0.00	1	0.05	3	0.15
Buhangin	177	8.79	0	0.00	1	0.05	0	0.00	1	0.05
Bunawan	97	4.82	1	0.05	1	0.05	2	0.10	0	0.00
Paquibato	60	2.98	1	0.05	0	0.00	0	0.00	0	0.00
Baguio	122	6.06	1	0.05	1	0.05	1	0.05	1	0.05
Calinan	248	12.31	1	0.05	1	0.05	0	0.00	8	0.40
Marilog	68	3.38	1	0.05	5	0.25	3	0.15	4	0.20
Toril	247	12.26	1	0.05	1	0.05	0	0.00	2	0.10
Tugbok	195	9.68	0	0.00	0	0.00	0	0.00	3	0.15
Total	**1,964**	**97.52**	**8**	**0.4**	**10**	**0.5**	**7**	**0.35**	**25**	**1.25**

Source: IM4Davao Team – HIS 2017.

(6) Solid Waste Management

72. Over 80% of the household respondents of Davao City are aware of solid waste management policies such as the Ecological Solid Waste Management Act or city ordinances to enforce solid waste reduction by recycling, segregation, etc.

Table 4.67 Awareness of Solid Waste Management Policies

Awareness	No.	%
Yes	1647	81.8
No	367	18.2
Total	**2,014**	**100.0**

Source: IM4Davao Team – HIS 2017.

73. The three administrative districts covered by CENRO for the waste collection service are the Poblacion, Talomo, and Buhangin. Still many respondents in these areas claim that they are not provided with the service.

Table 4.68 Solid Waste Collection Services among HIS Respondents by District

District	Yes		No		Total	
	No.	%	No.	%	No.	%
Poblacion	***279***	***60.1***	***185***	***39.9***	***464***	***100***
Talomo	***79***	***56.4***	***61***	***43.6***	***140***	***100***
Agdao	124	80.0	31	20.0	155	100
Buhangin	***110***	***61.5***	***69***	***38.5***	***179***	***100***
Bunawan	52	51.5	49	48.5	101	100
Paquibato	6	9.8	55	90.2	61	100
Baguio	49	38.9	77	61.1	126	100
Calinan	29	11.2	229	88.8	258	100
Marilog	4	4.9	77	95.1	81	100
Toril	94	37.5	157	62.5	251	100
Tugbok	44	22.2	154	77.8	198	100
Total	**870**		**1,144**		**2,014**	

Source: IM4Davao Team – HIS 2017.

74. HIS results show that public waste containers at designated points are the more common collection practice than the house-to-house collection. And the frequency of collection is usually done at least once a week or 2 to 4 times a week.

Table 4.69 Availability and Frequency of Solid Waste Collection Services

Solid Waste Collection	Availability				Frequency							
	Yes		No		Daily		2 – 4 times a week		Once a week		Less than once a week	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
House	690	79.1	182	20.9	219	32.0	220	32.1	234	34.2	12	1.8
Public waste container	762	84.5	140	15.5	188	25.0	249	33.1	308	41.0	7	0.9
Solid Waste Collection	**Availability**				**Frequency**							
	Yes		**No**		**Daily**		**2 – 4 times a week**		**Once a week**		**Less than once a week**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
House	690	79.1	182	20.9	219	32.0	220	32.1	234	34.2	12	1.8
Public waste container	762	84.5	140	15.5	188	25.0	249	33.1	308	41.0	7	0.9

Source: IM4Davao Team – HIS 2017.

75. Daily house-to-house waste collection is done mainly at the Poblacion District. For other areas, respondents put their trash in public containers for pickup by waste collectors.

Table 4.70 Daily Solid Waste Collection among HIS Respondents by Administrative District

District	House		Public Waste Container	
	No.	%	No.	%
Poblacion	153	69.9	107	56.9
Talomo	6	2.7	6	3.2
Agdao	30	13.7	36	19.1
Buhangin	18	8.2	19	10.1

District	House		Public Waste Container	
	No.	%	No.	%
Bunawan	4	1.8	4	2.1
Paquibato	1	0.5	1	0.5
Baguio	2	0.9	2	1.1
Calinan	5	2.3	7	3.7
Marilog	0	0.0	0	0.0
Toril	0	0.0	0	0.0
Tugbok	0	0.0	6	3.2
Total	**219**	**100.0**	**188**	**100.0**

Source: IM4Davao Team – HIS 2017.

76. As for service payment, it would seem that only 20% of the households formally pay for the service while around 47% do not pay. The non-paying households are mainly from the Poblacion, Buhangin, and Toril districts.

Table 4.71 Payment for Solid Waste Collection among HIS Respondents

Payment	Households with Solid Waste Collection Services			
	Yes		No	
	No.	%	No.	%
Yes	254	20.42	4	0.32
No	581	46.70	405	32.56

Source: IM4Davao Team – HIS 2017.

Table 4.72 HIS Respondents Not Paying for Solid Waste Collection Service by Administrative District

District	No.	%
Poblacion	180	30.98
Talomo	42	7.23
Agdao	58	9.98
Buhangin	71	12.22
Bunawan	38	6.54
Paquibato	5	0.86
Baguio	43	7.40
Calinan	27	4.65
Marilog	2	0.34
Toril	87	14.97
Tugbok	28	4.82
Total	**581**	**100.0**

Source: IM4Davao Team – HIS 2017.

77. For most of those who pay for the service, including also those who pay to the informal waste collection providers, their monthly payments range from PHP11 to PHP20 (29.9% of the surveyed households) and PHP60 to PHP100 (28.4%). These figures are much lower than those stipulated by the city, which is PHP100 to PHP200 per month.

Table 4.73 Monthly Payment for Solid Waste Collection Service

Amount	No.	%
<11 PHP	21	7.75
11-20 PHP	81	29.89
21-30 PHP	9	3.32
31-40 PHP	9	3.32
41-50 PHP	30	11.07
60-100 PHP	77	28.41
100-200 PHP	29	10.70
>200 PHP	15	5.54
Total	**271**	**100.0**

Source: IM4Davao Team – HIS 2017.

78. Respondents stated that the informal waste collectors, who require payment for their service, are children who pick up the garbage to earn some money (i.e., 35% of service providers). Payments are also rendered to the barangay (34%), garbage collectors (26%), and others such as male garbage scavengers or respondents' male relatives (brothers). Collection fees should be paid by each waste generator like households, and for more efficient revenue collection, Davao City should formulate a direct payment system to the city government and prioritize districts to strengthen collection.

Table 4.74 Persons who Collect Payment of Solid Waste Collection Service

Person	No.	%
Homeowners' association	2	0.70
Barangay	96	33.68
Children who pick up the garbage	100	35.09
Garbage collector	74	25.96
Other	13	4.56

Source: IM4Davao Team – HIS 2017.

79. Based on the overall satisfaction of surveyed households with the solid waste collection service in the city and the fact that most of the roads in Davao City are cleaner than those in other big cities in the Philippines, it can be said that the provision of this service in Davao is successful to a certain extent.

Table 4.75 HIS Respondents' Assessment of Solid Waste Collection Service

Aspect	Highly Dissatisfied		Dissatisfied		Average		Satisfied		Highly Satisfied		Don't know	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Frequency of collection	17	1.9	38	4.2	442	49.1	310	34.4	83	9.2	10	1.1
Method of collection	18	2.0	17	1.9	418	46.4	348	38.6	87	9.7	13	1.4
Fee	41	4.7	29	3.3	369	42.5	218	25.1	101	11.6	110	12.7
Cleanliness of surroundings (neighborhood, collection points)	14	1.6	57	6.3	371	41.2	349	38.8	95	10.6	14	1.6
Situation in city's dump site	20	2.2	57	6.3	374	41.6	291	32.4	70	7.8	86	9.6

Source: IM4Davao Team – HIS 2017.

80. For those who are not covered by the service (1,144 surveyed households or nearly 57%), they bury or burn their wastes in nearby land or throw them in nearby dumpsites, which suggests that dumping waste in open dumpsites is an issue.

81. Food waste is usually disposed of at the dumpsite/landfill. However, in Davao City, even food waste can be reused. Based on HIS results, MRF installation in the future targeting organic waste can be considered even with lower capacity than expected by CENRO.

Table 4.76 Solid Waste Disposal for Unserved HIS Respondents

Disposal Method	No.	%
Bury in nearby land	409	29.8
Burn in nearby land	485	35.4
Throw to nearby dump sites	370	27.0
Bring to city's dump sites with tipping fee	78	5.7
Throw to nearby drainage or river	16	1.2
Other (barangay, compost pit, segregate, and open garbage bin)	13	0.9

Source: IM4Davao Team – HIS 2017.

82. Although 71% of the respondents understand the importance of waste disposal

and processing facilities (Table 4.78), about 35% do not want to pay to have proper solid waste management (Table 4.79), while nearly 30% are willing to pay PHP1-20 only. The average value of willingness to pay is PHP29.88. As shown in Figure 4.14, PHP100 per month can be a potential fee for the rest of the households.

Table 4.77 Segregation of Household Solid Wastes among HIS Respondents

Solid Waste	Separation from Other Waste				Disposal after Segregation													
	Yes		No		Give all to collectors		Reuse containers, e.g., bottles		Give food waste to animals		Use bio-waste as compost		Sell recyclable/reusable materials to buyers who visit house		Sell to junk/recycling shops		Other	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Wet Wastes[1]	1479	73.4	535	26.6	414	25.5	111	6.8	827	50.9	111	6.8	82	5.0	63	3.9	18	1.1
Plastic Bottles	1846	91.7	168	8.3	333	18.0	116	6.3	15	0.8	13	0.7	557	30.2	795	43.1	17	0.9
Other Plastic Wastes	1763	87.5	251	12.5	407	23.1	105	6.0	12	0.7	21	1.2	461	26.1	725	41.1	32	1.8
Aluminum Cans	1826	90.7	188	9.3	306	16.8	85	4.7	8	0.4	6	0.3	528	28.9	881	48.2	12	0.7
Metal	1831	90.9	183	9.1	290	15.8	108	5.9	9	0.5	16	0.9	523	28.6	871	47.6	14	0.8
Paper	1688	83.8	326	16.2	413	24.5	142	8.4	8	0.5	85	5.0	348	20.6	623	36.9	69	4.1
Glass Bottles	1747	86.7	267	13.3	378	21.6	146	8.4	9	0.5	10	0.6	439	25.1	753	43.1	12	0.7
Other	1	0.0	1783	99.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	100.0	0	0.0

Source: IM4Davao Team – HIS 2017. [1] Including food.

Table 4.78 HIS Respondents' Evaluation of Waste Disposal and Processing Facilities

Aspect	Very Important		Important		Neutral		Not so Impt.		Not Impt. at all		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Contamination of groundwater	703	34.9	653	32.4	503	25.0	73	3.6	82	4.1	2,014	100.0
Air pollution	733	36.4	614	30.5	526	26.1	66	3.3	75	3.7	2,014	100.0
Waste incineration	447	22.2	494	24.5	682	33.9	261	13.0	130	6.5	2,014	100.0
Offensive smell and pests	528	26.2	544	27.0	651	32.3	177	8.8	114	5.7	2,014	100.0
Volume of landfill disposal	480	23.8	565	28.1	849	42.2	79	3.9	41	2.0	2,014	100.0
Total cost of processing and disposal	450	22.3	465	23.1	754	37.4	241	12.0	104	5.2	2,014	100.0
Safety and sanitation control for scavengers	708	35.2	653	32.4	547	27.2	66	3.3	40	2.0	2,014	100.0
Thermal and/or electric supply from facilities	747	37.1	674	33.5	531	26.4	38	1.9	24	1.2	2,014	100.0

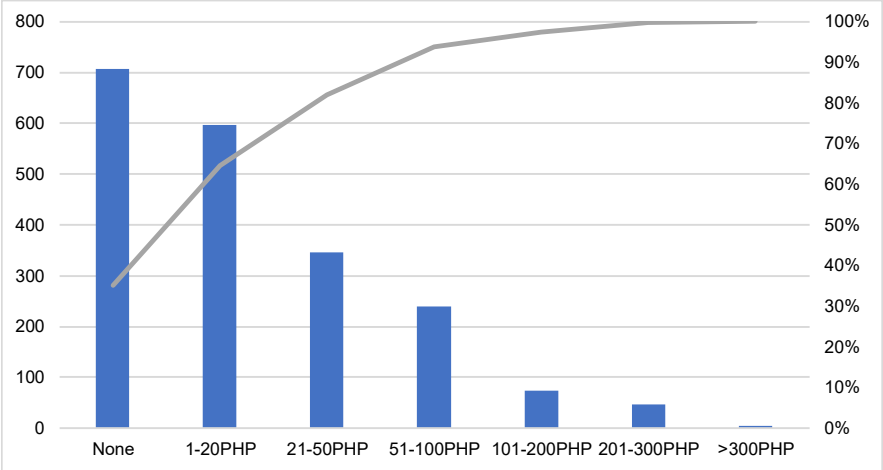
Source: IM4Davao Team – HIS 2017.

Table 4.79 HIS Respondents' Willingness to Pay for Proper Solid Waste Management by Monthly Household Income

Monthly HH Income	Monthly Fee (PHP)						None
	>300P	201-300P	101-200P	51-100P	21-50P	1-20P	
No income	0	0	0	0	1	1	1
Below 2,000	0	1	0	2	2	7	17
2,000 – 3,999	0	1	3	5	20	43	51
4,000 – 5,999	0	5	3	26	44	81	99
6,000 – 7,999	0	3	9	25	48	90	112
8,000 – 9,999	1	5	7	34	40	93	93
10,000 – 14,999	2	8	16	48	88	120	121
15,000 – 19,999	0	7	14	42	37	59	75
20,000 – 24,999	1	4	7	19	23	24	38
25,000 – 29,999	0	4	6	16	19	31	37
30,000 – 34,999	0	2	5	10	8	16	18
35,000 – 39,999	0	2	1	5	6	8	10
40,000 – 49,999	1	2	2	4	6	9	11
50,000 – 59,999	0	0	0	1	3	5	10
60,000 – 79,999	0	2	0	1	0	8	4
80,000 – 99,999	0	0	1	2	0	0	6
100,000 – 149,999	0	0	0	0	1	1	1
150,000 – 199,999	0	0	0	0	0	0	2
200,000 – 299,999	0	0	0	0	0	0	1

Monthly HH Income		Monthly Fee (PHP)						None
		>300P	201-300P	101-200P	51-100P	21-50P	1-20P	
300,000 – 499,999		0	0	0	0	0	0	0
Above 500,000		0	0	0	0	0	0	0
Total	**No.**	**5**	**46**	**74**	**240**	**346**	**596**	**707**
	%	**0.25**	**2.28**	**3.67**	**11.92**	**17.18**	**29.59**	**35.10**

Source: IM4Davao Team – HIS 2017.



Source: IM4Davao Team – HIS 2017.

Figure 4.14 HIS Respondents' Willingness to Pay for Proper Solid Waste Management

(7) Traffic Management

83. Over 70% of surveyed households in Talomo and Agdao districts have a bad assessment of the traffic situation in their areas, suggesting the urgent improvement measures are needed. In the more rural districts, respondents give an average evaluation, probably due to extremely light traffic flows.

84. Respondents attribute traffic congestion to increased number of cars and undisciplined driving manner. Others also cited on-street vendors, illegal parking, and increasing population.

Table 4.80 HIS Respondents' Assessment of Traffic to Workplaces/Schools by Administrative District

District	Very Bad		Bad		Average		Good		Very Good		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Poblacion	94	20.3	133	28.7	192	41.4	29	6.3	16	3.4	464	100.0
Talomo	32	22.9	67	47.9	38	27.1	2	1.4	1	0.7	140	100.0
Agdao	44	28.4	87	56.1	21	13.5	3	1.9	0	0.0	155	100.0
Buhangin	22	12.3	66	36.9	89	49.7	1	0.6	1	0.6	179	100.0
Bunawan	17	16.8	20	19.8	56	55.4	6	5.9	2	2.0	101	100.0
Paquibato	1	1.6	6	9.8	34	55.7	9	14.8	11	18.0	61	100.0
Baguio	0	0.0	32	25.4	57	45.2	33	26.2	4	3.2	126	100.0
Calinan	30	11.6	50	19.4	103	39.9	64	24.8	11	4.3	258	100.0
Marilog	2	2.5	4	4.9	56	69.1	4	4.9	15	18.5	81	100.0
Toril	55	21.9	85	33.9	85	33.9	20	8.0	6	2.4	251	100.0
Tugbok	26	13.1	64	32.3	54	27.3	51	25.8	3	1.5	198	100.0
Total	**323**	**16.0**	**614**	**30.5**	**785**	**39.0**	**222**	**11.0**	**70**	**3.5**	**2,014**	**100.0**

Source: IM4Davao Team – HIS 2017.

Table 4.81 Causes of Traffic Congestion according to HIS Respondents

Cause	No.	%
Increased car use	538	25.1
Lack of traffic signals	192	9.0

Cause	No.	%
Overlapping jeepney routes	411	19.2
Lack of roads or bad roads	198	9.2
Undisciplined driving manner	429	20.0
Insufficient public transportation	81	3.8
Lack of traffic management and enforcement	278	13.0
Other	17	0.8

Source: IM4Davao Team – HIS 2017.

85. More than 30% of respondents think congestion, safety, convenience, road condition and air pollution have gotten worse compared to 5 years ago. In particular, traffic congestion shows the highest negative evaluation at around 67%.

Table 4.82 HIS Respondents' Assessment of Current Traffic Situation Compared to 5 Years Ago

Traffic Impact	Much Worse		Worse		Slightly Worse		Same		Better		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Congestion	282	14.0	345	17.1	720	35.7	532	26.4	135	6.7	2,014	100.0
Safety	53	2.6	137	6.8	518	25.7	825	41.0	481	23.9	2,014	100.0
Convenience	111	5.5	151	7.5	601	29.8	841	41.8	310	15.4	2,014	100.0
Road Condition	116	5.8	213	10.6	532	26.4	622	30.9	531	26.4	2,014	100.0
Air Pollution	262	13.0	272	13.5	601	29.8	724	35.9	155	7.7	2,014	100.0

Source: IM4Davao Team – HIS 2017.

(8) Transport Measures

86. Nearly 98% of respondents think it is necessary to improve and expand current public transport services, preferring urban railway (38%) and streetcar/on-street LRT (29.4%) more than others.

Table 4.83 HIS Respondents' Agreement to Improve/Expand Public Transport Service

Position	No.	%
Yes, I agree	1,967	97.7
No, I don't agree	17	0.8
Don't Know	30	1.5
Total	**2,014**	**100.0**

Source: IM4Davao Team – HIS 2017.

Table 4.84 Public Transport Services preferred by HIS Respondents

Public Transport Service[1]	No.	%
Jeepney	274	7.0
Ordinary Bus	219	5.6
Bus Rapid Transit	776	19.7
Urban Railway	1,496	38.0
Streetcar / On-street LRT	1,155	29.4
Ferry / Passenger Craft	14	0.4

Source: IM4Davao Team – HIS 2017.
[1] Respondents were asked to select three.

Ordinary Bus

Bus Rapid Transit

Urban Railway

Streetcar / On-street LRT

Source: IM4Davao Team – HIS 2017.

Figure 4.15 Examples of Public Transport Services

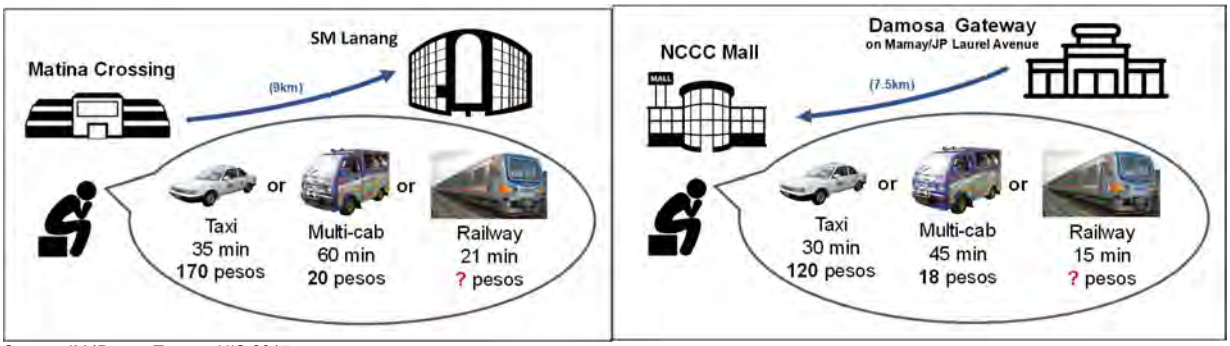
87. About 79 to 97% of respondents also agree to improve roads and road facilities, as well as impose traffic management measures. However, a lower share of respondents agree to increase user charges (55%) or prohibit cars and motorcycles from certain areas (67%). Education and enforcement of parking rules are given high marks.

Table 4.85 HIS Respondents' Agreement to Future Transport Improvement Measures

Measure	Agree		Disagree		Not Sure		Total	
	No.	%	No.	%	No.	%	No.	%
Construction/Improvement of roads & flyovers	1957	97.2	17	0.8	40	2.0	2,014	100.0
Improvement of traffic signals	1956	97.1	16	0.8	42	2.1	2,014	100.0
Improvement of sidewalks, pedestrian crossings, and pedestrian bridges	1969	97.8	19	0.9	26	1.3	2,014	100.0
Introduction of bus rapid transit	1835	91.1	62	3.1	117	5.8	2,014	100.0
Construction of urban railway (elevated/at-grade)	1835	91.1	57	2.8	122	6.1	2,014	100.0
Improvement of water transportation system (new watercraft, piers, service routes, etc.)	1745	86.6	53	2.6	216	10.7	2,014	100.0
Restriction of truck traffic entering the city center	1585	78.7	165	8.2	264	13.1	2,014	100.0
Restriction of car/motorcycle use in designated areas	1350	67.0	315	15.6	349	17.3	2,014	100.0
Increase in user charges for cars/motorcycles (registration, license, fuel tax, and parking fees)	1112	55.2	544	27.0	358	17.8	2,014	100.0
Restriction of bicycles, motorcycles, pedicabs, tricycles, and kalesa	1256	62.4	368	18.3	390	19.4	2,014	100.0
Strict control of unauthorized on-road parking and development of public parking facilities	1874	93.0	65	3.2	75	3.7	2,014	100.0
Control of air pollution	1866	92.7	42	2.1	106	5.3	2,014	100.0
Enhancement of people's understanding of transportation problems and measures	1933	96.0	23	1.1	58	2.9	2,014	100.0

Source: IM4Davao Team – HIS 2017.

88. Regarding a proposal for an elevated urban railway (LRT or monorail) from Toril to the airport passing through JP Laurel Avenue and MacArthur Highway, with air-conditioned train cars stopping at each station every 5 minutes, 2 scenarios were presented to respondents to determine their willingness to pay. Around 80% of respondents indicated that they would be willing to pay PHP50, which is more than the maximum fare in Metro Manila. While the result hints at the limitation of the survey, it also shows the respondents' eagerness to ease traffic congestion. A more detailed study of fare affordability will take into account several factors, such as passenger incomes, trip purposes, etc.



Source: IM4Davao Team – HIS 2017.

Figure 4.16 Scenarios on Willingness to Pay for Urban Rail Services

Table 4.86 HIS Respondents' Willingness to Pay for an Elevated Urban Railway

Amount (PHP)	Scenario 1		Scenario 2	
	No.	%	No.	%
50	1611	80.0	1623	80.6
40	71	3.5	48	2.4
30	71	3.5	75	3.7
20	77	3.8	73	3.6
10	51	2.5	71	3.5
None	133	6.6	124	6.2

Source: IM4Davao Team – HIS 2017.

(9) Governance

89. Results reveal that the respondents participate in policy making and that they have a channel to express their opinions, so that the LGU can decide on policies.

Table 4.87 HIS Respondents' Assessment of Public Participation in Policy Making and Development Process

Assessment	A. Respondent's Level of Participation in Policy Making[1]	B. Reflection of Community's Interests and Views in LGU Policies	C. Local Government's Transparency and Accountability for Policies and Decisions
Very High	313	409	356
High	391	512	456
Medium	850	825	902
Low	193	113	111
None	143	64	72
Don't know	124	91	117
Total	**2,014**	**2,014**	**2,014**

Source: IM4Davao Team – HIS 2017. [1] E.g., public meetings, local council sessions

90. Respondents are generally satisfied with the decisions and administrative functions of the city government, but are slightly dissatisfied with the collection of local taxes, fees, and charges.

Table 4.88 Satisfaction with Local Government Decisions and Administrative Functions

Satisfaction	A. Local Development Plans	B. Municipal Budgets	C. Issuance of Licenses, Documents	D. Collection of Local Taxes, Fees, Charges	E. Information Disclosure	F. Public Services compared to Tax Paid	G. Overall Performance of Local Gov't
Very satisfied	562	483	433	357	508	490	508
Satisfied	754	642	662	553	703	628	684
Neutral/Neither	568	639	678	710	633	641	637
Not satisfied	51	118	110	225	85	138	77
Not satisfied at all	11	18	26	59	23	27	24
Don't know	68	114	105	110	62	90	84
Total	**2,014**	**2,014**	**2,014**	**2,014**	**2,014**	**2,014**	**2,014**

Source: IM4Davao Team – HIS 2017.

91. Lack of financial resources and lack of cooperation among stakeholders (e.g., governments, the private sector, civil society) are considered to be the major causes of urban problems including polluted water, flood, traffic jam, and inaccessibility in Davao City.

Table 4.89 HIS Respondents' Perception of Major Causes of Prolonged Urban Problems

Reason	%
Lack of financial resources/ economic problems	19.2
Lack of technical capability and technologies	11.3
Lack of appropriate plans and policies	13.6
Lack of strict regulations and control of development	10.5
Lack of political will/ leadership change	7.6
Lack of understanding/ awareness on the urban issues	10.6
Lack of cooperation among stakeholders (e.g., governments, the private sector, civil society)	17.9
Lack of the private sector participation and cooperation	8.9
Other	0.5
Total	**100.0**

Source: IM4Davao Team – HIS 2017.

(10) Overall Assessment

92. Respondents were asked to evaluate 21 aspects of city services and infrastructure on a 5-point scale (1: highly dissatisfied, 2: dissatisfied, 3: average, 4: satisfied, 5: highly satisfied), and average numbers for each item are summarized. Of the 21 aspects, respondents gave high importance to education, water supply, electricity, and safety and security.

Table 4.90 HIS Respondents' Assessment of their Living Environment and Services (1)

Congressional District	Administrative District	A. Safety and Security	B. Natural Disaster Preparedness	C. Neighborhood Association	D. Housing	E. Air Quality	F. Odor	G. Noise	H. Watershed	I. Greenery / Parks	J. Wildlife	K. Landscape/ Historical Places
District 1	Poblacion	4.01	3.91	3.53	3.62	3.46	3.36	3.05	3.68	3.62	3.06	3.56
	Talomo	3.82	3.91	3.45	3.76	3.64	3.39	2.74	3.69	3.63	2.74	3.41
District 2	Agdao	4.30	4.18	3.69	4.20	3.43	3.28	2.71	4.07	3.95	2.90	3.99
	Buhangin	3.62	3.82	3.37	3.51	3.42	3.25	2.82	3.47	3.51	2.92	3.46
	Bunawan	4.02	4.01	3.97	3.99	3.95	3.86	3.46	3.91	3.91	3.84	3.98
	Paquibato	3.03	3.10	3.23	3.31	3.31	3.26	3.15	3.18	3.28	3.02	3.20
District 3	Baguio	3.48	3.60	3.31	3.39	3.60	3.56	3.39	3.51	3.54	3.24	3.29
	Calinan	3.80	3.83	3.74	3.35	3.60	3.45	3.40	3.56	3.50	3.02	3.46
	Marilog	3.52	3.28	3.30	3.41	3.42	3.31	3.21	3.44	3.35	3.19	3.30
	Toril	3.79	3.65	3.30	3.29	3.51	3.37	3.29	3.49	3.63	3.19	3.35
	Tugbok	3.79	3.67	3.27	3.28	3.70	3.37	3.25	3.76	3.46	3.11	3.36

Source: IM4Davao Team – HIS 2017.

Table 4.91 HIS Respondents' Assessment of their Living Environment and Services (2)

Congressional District	Administrative District	L. Entertain-ment	M. Electricity	N. Water Supply	O. Sewerage System	P. Drainage System	Q. Telecoms	R. Solid Waste Collection	S. Health Care	T. Education	U. Public Transport
District 1	Poblacion	3.63	3.98	4.02	3.50	3.37	3.67	3.66	3.88	3.90	3.63
	Talomo	3.44	3.88	3.94	3.61	3.62	3.74	3.79	3.96	4.12	3.94
District 2	Agdao	3.99	4.48	4.52	3.95	3.70	4.17	4.08	4.35	4.50	4.04
	Buhangin	3.28	3.76	3.58	3.22	3.35	3.47	3.47	3.86	3.99	3.79
	Bunawan	3.97	4.03	3.99	3.96	3.96	4.05	4.02	4.04	4.07	4.04
	Paquibato	3.21	3.34	3.25	3.23	3.21	2.84	3.16	3.18	3.28	2.95
District 3	Baguio	3.29	3.65	3.49	3.29	3.31	3.05	3.31	3.59	3.71	3.17
	Calinan	3.26	3.97	3.62	3.44	3.43	3.29	3.40	3.85	3.88	3.74
	Marilog	3.26	3.44	3.54	3.30	3.20	2.94	3.22	3.28	3.32	3.12
	Toril	3.36	3.91	3.34	3.47	3.56	3.33	3.33	3.67	3.76	3.50
	Tugbok	3.52	4.15	3.73	3.46	3.47	3.46	3.39	3.77	3.91	3.66

Source: IM4Davao Team – HIS 2017.

Table 4.92 HIS Respondents' Perception of Important Urban Aspects

Aspect	%	Aspect	%
A. Safety and security	10.1	L. Entertainment	0.9
B. Preparedness for natural disasters	3.1	M. Electricity supply	13.6
C. Neighborhood association	1.3	N. Water supply	15.0
D. Housing	2.1	O. Sewerage system	1.6
E. Air quality	2.2	P. Drainage system	3.6
F. Odor	1.0	Q. Telecommunication	3.7
G. Noise	0.7	R. Solid waste collection	3.1
H. Watershed	1.7	S. Health care	9.9
I. Greenery area / Parks	0.8	T. Education	15.2
J. Wildlife	0.2	U. Public transportation	9.5
K. Landscape/ historical places	0.8	**Total**	**100.0**

Source: IM4Davao Team – HIS 2017.

ANNEX 3: TRAFFIC SURVEYS

1 Developed Traffic Database

1. To better understand the current traffic conditions in Davao, JPT conducted three traffic surveys, namely:

(i) Cordon Line Survey;

(ii) Screen Line Survey; and

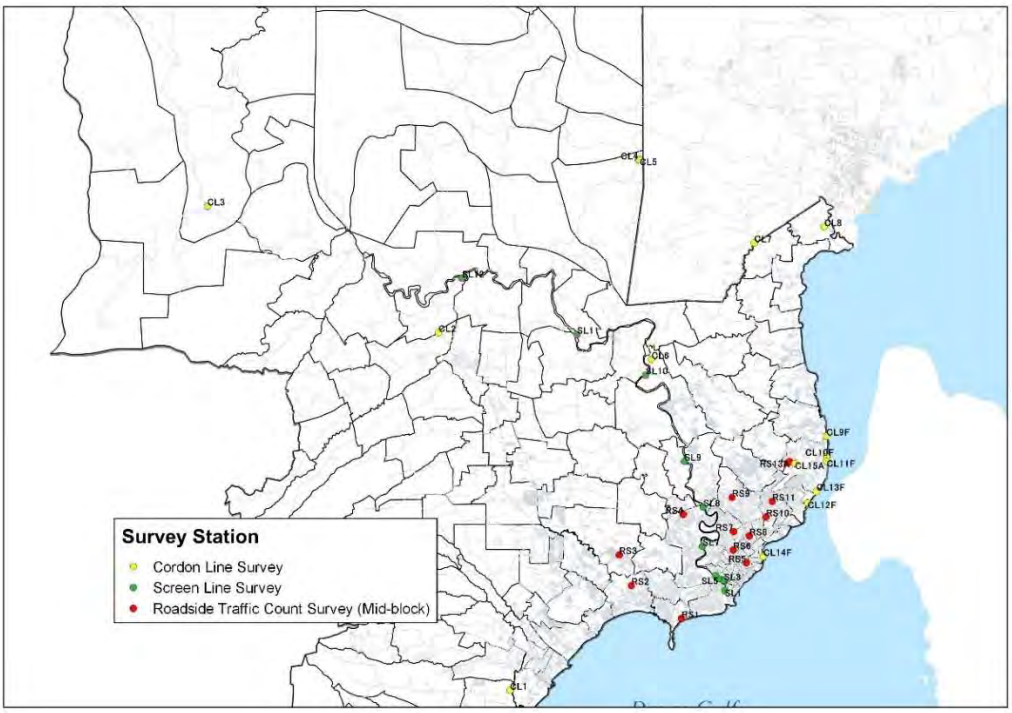
(iii) Roadside Traffic Count Survey (mid-block).

2. Table 1.1 shows the summary of traffic database developed under this project. The detailed database structure is described in each data file. All items are available in Microsoft Excel format. The survey locations are illustrated in Figure 1.1.

Table 1.1 List of Traffic Database

Seq.	Survey	Item	Attributes
1	Cordon Line Survey at Roadsides	Vehicular Traffic Volume	Number of vehicles by survey station, direction, time period, and vehicle class
2		Vehicle Occupancy	Number of sampled vehicles and passengers by survey station, direction, time period, and vehicle class
3		Passenger OD Record	Survey station, direction, time, vehicle class, number of occupants, origin, destination, trip purpose, residence, payload capacity, load factor, package, and commodity
4	Cordon Line Survey at Ferry Terminals	Passenger Volume	Number of disembarking passengers, number of embarking passengers, destination, time period
5		Passenger O-D Record	Survey station, direction, time, residence, origin, destination, trip purpose, and travel mode for terminal access
6	Cordon Line Survey at Airport Terminals	Passenger Volume	Origin/destination, arrival/departure time, and number of arriving/departing passengers
7		Passenger O-D Record	Survey station, direction, time, origin, destination, trip purpose, travel mode for terminal access, and residence
8	Screen Line Survey	Vehicular Traffic Volume	Number of vehicles by survey station, direction, time period, and vehicle class
9		Vehicle Occupancy	Number of sampled vehicles and passengers by survey station, direction, time period, and vehicle class
10		Ferry Passenger Volume	Number of disembarking passengers, number of embarking passengers, destination, time period
11	Roadside Traffic Count Survey (Mid-block)	Vehicular Traffic Volume	Number of vehicles by survey station, direction, time period, and vehicle class
12		Vehicle Occupancy	Number of sampled vehicles and passengers by survey station, direction, time period, and vehicle class

Source: IM4Davao Team



Source: IM4Davao Team

Figure 1.1 Traffic Survey Stations

3. The survey items include (i) vehicular/passenger traffic count; (ii) vehicle occupancy; and (iii) trip information (e.g. origin and destination, trip purpose, freight, access/egress mode, etc.). Vehicles are classified into 14 types: (i) bicycle; (ii) motorcycle; (iii) car/ jeep/ SUV/ pick-up; (iv) pedicab; (v) tricycle; (vi) taxi; (vii) VAN/ V-hire (public and private); (viii) PUJ/multicab; (ix) small delivery truck; (x) truck; (xi) trailer; (xii) minibus; (xiii) bus (public and private); and (xiiii) others (including ambulance, fire engine, towing car, construction vehicle, armored car, animal-driven cart, etc.).

Source: IM4Davao Team

Figure 1.2 Traffic Survey Photos

2 Cordon Line Survey

1) Cordon Line Survey Methodology

4. The Cordon Line Survey aims to determine the trips to/from the survey area made by residents living outside the survey area. To obtain such data/information, roadside origin-destination (OD) interview survey, traffic count survey, and vehicle occupancy survey were conducted on the boundaries of the survey area.

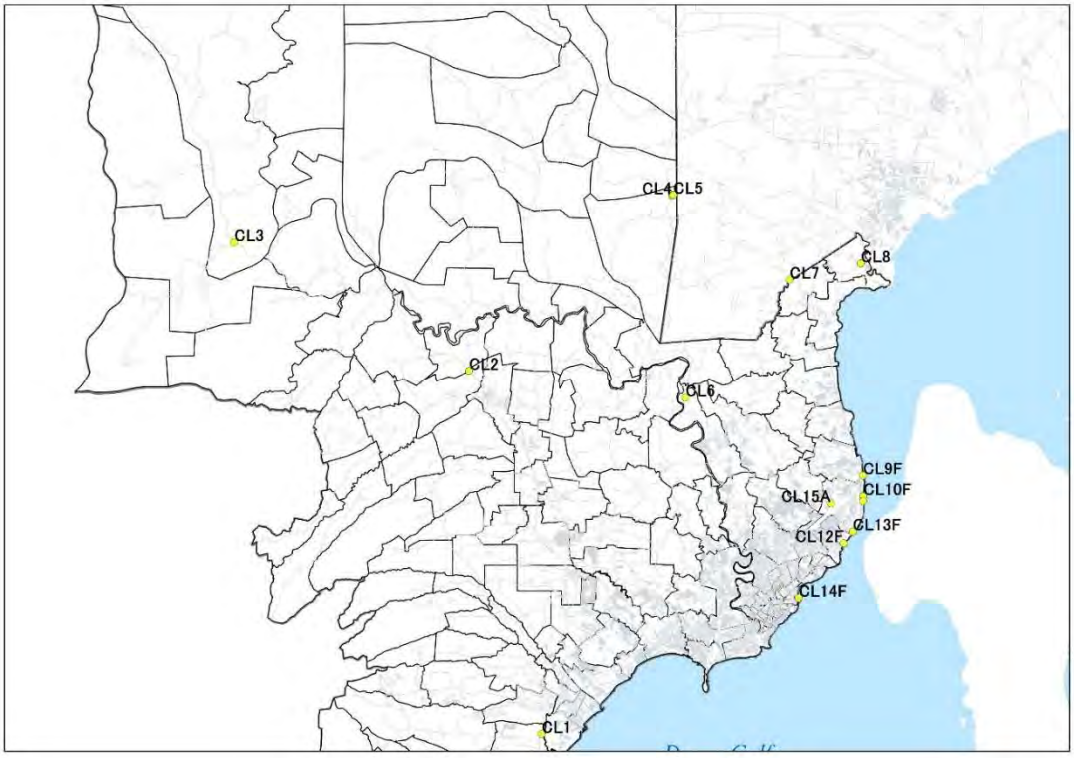
5. Survey stations are listed in Table 2.1. Basically, the survey was conducted for 24 hours, but due to the traffic police's schedule and high security risk in some areas, the survey hours were shortened. Moreover, the survey periods at the ferry terminals were fitted to the operating hours or the timetables of ferries if not open for 24 hours.

Table 2.1 List of Cordon Line Survey Stations

Seq.	Category	Code	Survey Station	Location	Survey Period (hours)		
					Traffic Count	Vehicle Occupancy	OD Interview
1	Roadside	CL1	Davao-Cotabato Rd	Boundary of Davao City and Digos City	06:00-06:00	06:00-06:00	06:00-20:00
2		CL2	Dologon-Busco-Quezon Rd	Boundary of Davao City and Arakan	06:00-06:00	06:00-06:00	06:00-20:00
3		CL3	Davao-Bukidon Hwy	Boundary of Davao City and Arakan	06:00-06:00	06:00-06:00	06:00-20:00
4		CL4	Barangay Lacson Rd	Boundary of Davao City and Panabo City	06:00-13:00	06:00-13:00	06:00-13:00
5		CL5	Barangay Lacson Rd	Boundary of Davao City and Panabo City	06:00-13:00	06:00-13:00	06:00-13:00
6		CL6	Near 7.18980N, 125.56325E	Boundary of Davao City and Panabo City	06:00-18:00	06:00- 18:00	06:00-18:00
7		CL7	7.25618N, 125.62219E	Boundary of Davao City and Panabo City	06:00-18:00	06:00-18:00	06:00-18:00
8		CL8	Daang Maharlika Hwy	Boundary of Davao City and Panabo City	06:00-06:00	06:00-06:00	06:00-21:00
9	Ferry Terminal	CL9F	Davsam	Ferry Port to Samal	06:00-19:00		06:00-19:00
10		CL10F	Sasa Ferry Terminal	Ferry Port to Samal	06:00-23:00		06:00-23:00

Seq.	Category	Code	Survey Station	Location	Survey Period (hours)		
					Traffic Count	Vehicle Occupancy	OD Interview
11		CL11F	Samal Ferry Wharf	Ferry Port to Samal	06:00-06:00		06:00-06:00
12		CL12F	Paradise Private Port	Ferry Port to Samal	06:00-15:00		06:00-15:00
13		CL13F	BlueJaz Private Port	Ferry Port to Samal	07:00-16:00		07:00-16:00
14		CL14F	Sta. Ana Pier	Ferry Port to Talikud	06:00-17:00		06:00-17:00
15	Airport Terminal	CL15A	Arrival Area & Departure Area	Francisco Bangoy International Airport	06:00-06:00		06:00-06:00

Source: IM4Davao Team



Source: IM4Davao Team.

Figure 2.1 Cordon Line Survey Stations

6. This survey was undertaken at 15 stations for two days on 23, 26 or 28 March 2017. Table 2.2 shows the actual dates of surveys in all Cordon Line stations.

Table 2.2 Survey Duration by Station - Cordon Line

Seq.	Category	Code	Survey Station	March								
				20	21	22	23	24	25	26	27	28
				M	T	W	Th	F	S	Su	M	T
1	Roadside	CL1	Davao–Cotabato Rd									
2		CL2	Dologon-Busco–Quezon Rd									
3		CL3	Davao–Bukidon Hwy									
4		CL4	Barangay Lacson Rd									
5		CL5	Barangay Lacson Rd									
6		CL6	Near 7.18980N, 125.56325E									
7		CL7	7.25618N, 125.62219E									
8		CL8	Daang Maharlika Hwy									

Seq.	Category	Code	Survey Station	March								
				20	21	22	23	24	25	26	27	28
				M	T	W	Th	F	S	Su	M	T
9	Ferry Terminal	CL9F	Davsam				■			■		
10		CL10F	Sasa Ferry Terminal				■			■		
11		CL11F	Samal Ferry Wharf				■			■		
12		CL12F	Paradise Private Port							■		■
13		CL13F	BlueJaz Private Port							■		■
14		CL14F	Sta. Ana Pier				■			■		
15	Airport Terminal	CL15A	Arrival Area & Departure Area				■			■		

Source: IM4Davao Team

2) Cordon Line Survey Results

7. The following figures show hour vehicular count and passenger volume inbound and outbound Davao City by direction for one weekday and one weekend:

(i) Digos and Santa Cruz direction composed of survey station CL1;

(ii) Bukidnon direction composed of survey station CL2;

(iii) Cotabato direction composed of survey station CL3;

(iv) Paquibato direction composed of survey stations CL4 to CL7;

(v) Panabo and Tagum direction composed of survey station SL8;

(vi) Samal direction composed of survey stations CL9F to CL13F;

(vii) Talikud direction composed of survey station CL14F; and,

(viii) Luzon, Visayas, Singapore direction composed of survey station CL15A.

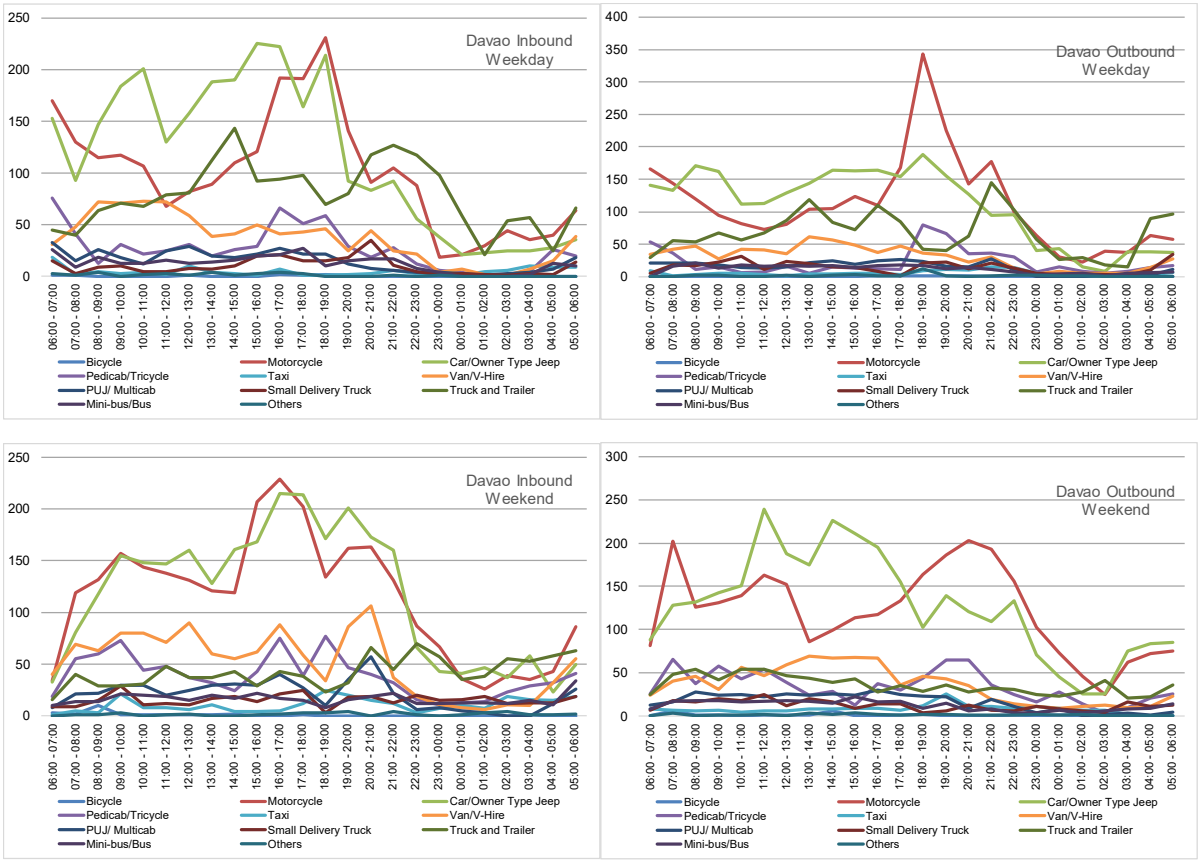
8. There is a considerable amount of inter-city traffic from/to Digos/Santa Cruz and Panabo/Tagum. With regard to sea transport, passengers from/to nearby destinations (e.g., Samal, Talikud) use ferry and RO-RO services. Air transport (Francisco Bangoy International Airport) provides service between Luzon, Visayas, and the only international flight to Singapore. Daily vehicular traffic volume is summarized in Table 2.3 and hourly data in Figures 2.2 to 2.9.

Table 2.3 Daily Vehicular Traffic Volume of Cordon Line Survey Stations

To/From	Code	Survey Station	Day	Direction	Vehicle										
					Bicycle	Motorcycle	Car/Owner Type Jeep	Pedicab/ Tricycle	Taxi	Van/V-Hire	PUJ/ Multicab	Small Delivery Truck	Truck and Trailer	Mini-bus/Bus	Others
Digos and Santa Cruz	CL1	Davao-Cotabato Rd	weekday	Inbound	9	2402	2788	639	119	877	359	239	1879	303	31
				outbound	9	2672	2628	522	131	724	350	338	1612	274	33
			weekend	Inbound	24	2742	2798	924	256	1232	498	372	1015	391	38
				outbound	23	2902	3048	809	191	855	390	295	865	293	31
Bukidnon	CL2	Dologon-Busco-Quezon Rd	weekday	Inbound	1	1190	337	18	1	50	65	10	162	15	1
				outbound	2	393	228	74	1	90	10	56	368	42	4
			weekend	Inbound	1	636	520	149	0	68	0	1	396	32	0
				outbound	7	1255	173	88	0	130	68	58	176	20	0
Cotabato	CL3	Davao-Bukidon Hwy	weekday	Inbound	71	688	181	29	0	15	20	6	52	0	4
				outbound	74	302	36	5	0	1	23	7	9	1	2

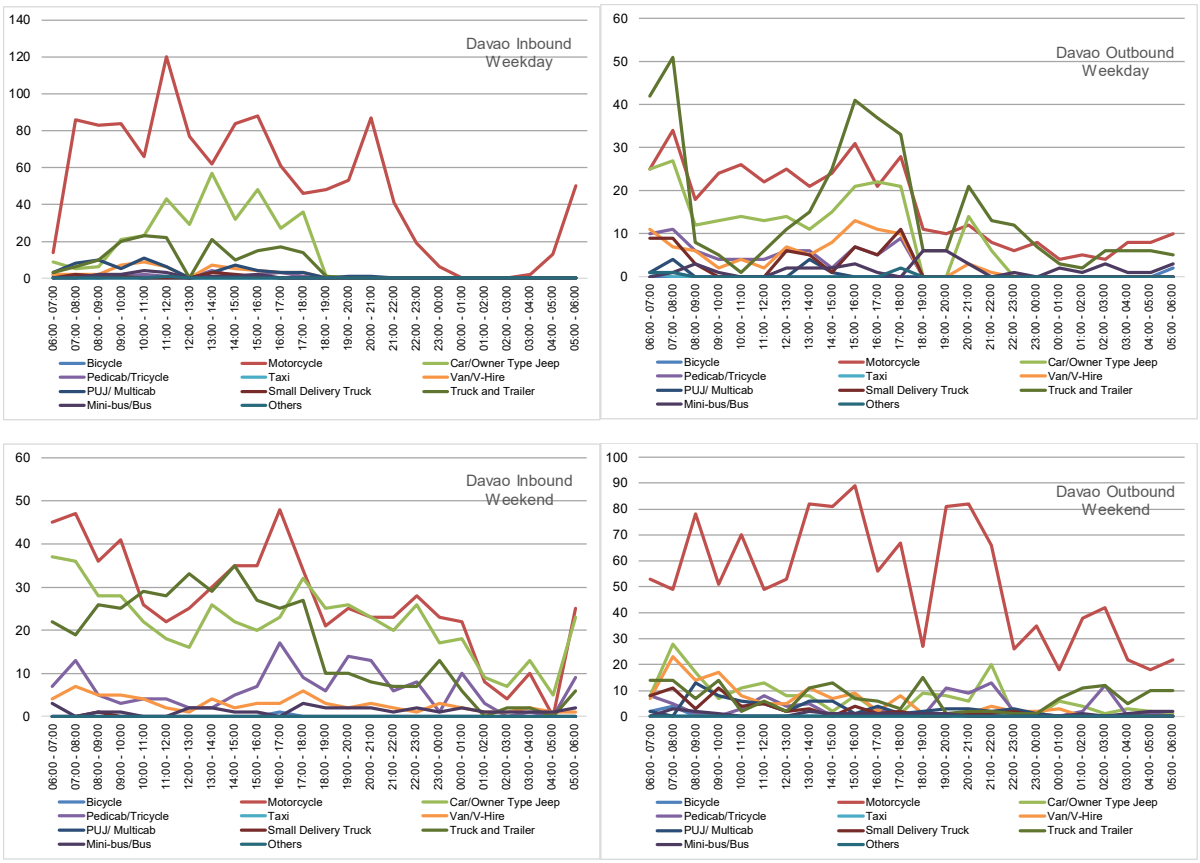
To/From	Code	Survey Station	Day	Direction	Vehicle										
					Bicycle	Motorcycle	Car/Owner Type Jeep	Pedicab/ Tricycle	Taxi	Van/V-Hire	PUJ/ Multicab	Small Delivery Truck	Truck and Trailer	Mini-bus/Bus	Others
			weekend	Inbound	1	1552	282	319	2	64	102	81	110	14	0
				outbound	5	1649	3	0	0	0	7	1	4	0	0
Paquibato	CL4	Barangay Lacson Rd	weekday	Inbound	14	321	56	177	1	0	44	5	31	0	3
	CL5	Barangay Lacson Rd		outbound	28	545	55	157	1	0	44	15	31	1	2
	CL6	Near 7.18980N, 125.56325E	weekend	Inbound	6	161	37	95	1	1	13	19	15	0	0
	CL7	7.25618N, 125.62219E		outbound	12	157	22	65	0	1	18	9	18	0	0
Panabo and Tagum	CL8	Daang Maharlika Hwy	weekday	Inbound	172	3213	3530	426	287	1943	1265	1067	3742	1799	59
				outbound	256	3683	3329	1305	253	1271	1019	1765	2661	787	59
			weekend	Inbound	141	3641	3295	771	1282	972	527	465	1146	517	11
				outbound	160	2994	3281	824	488	1594	2194	1276	2076	1639	116

Source: IM4Davao Team



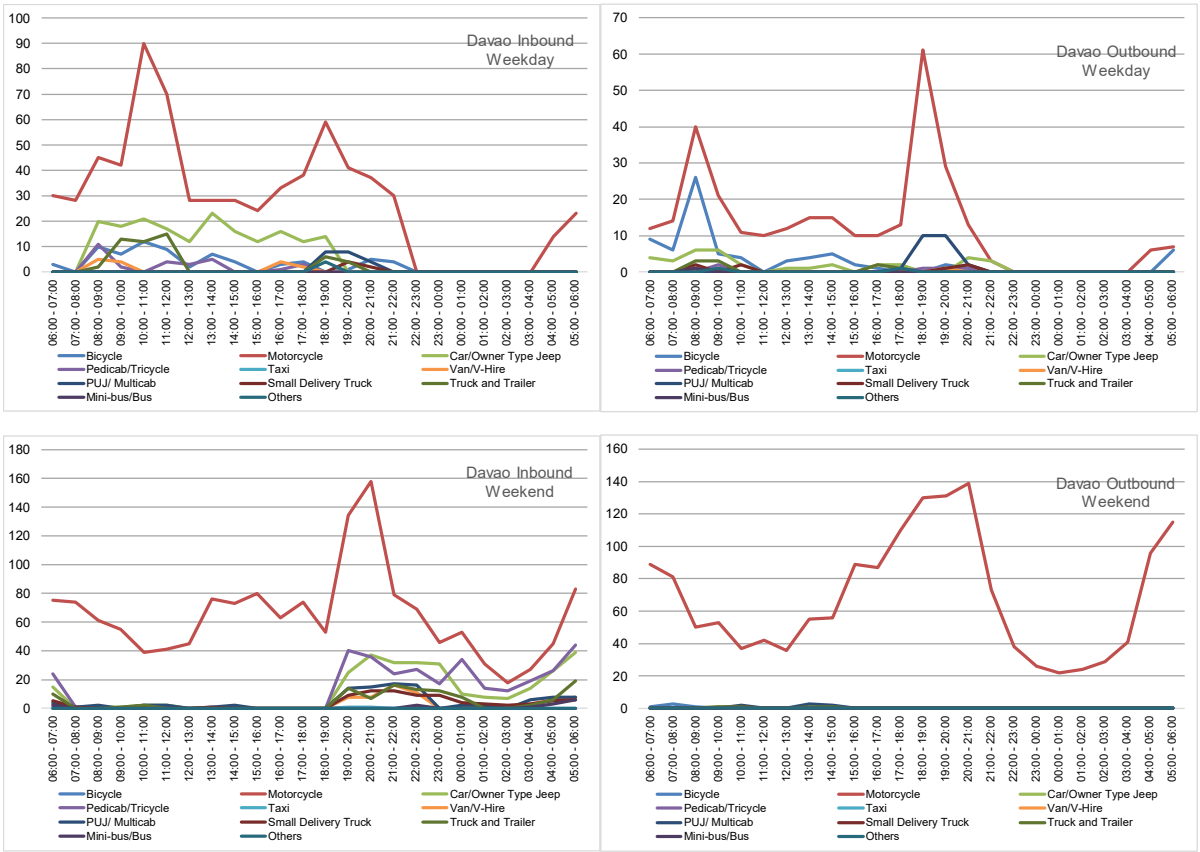
Source: IM4Davao Team

Figure 2.2 Hourly Vehicular Traffic Volume Across CL1 (Digos and Santa Cruz Direction)



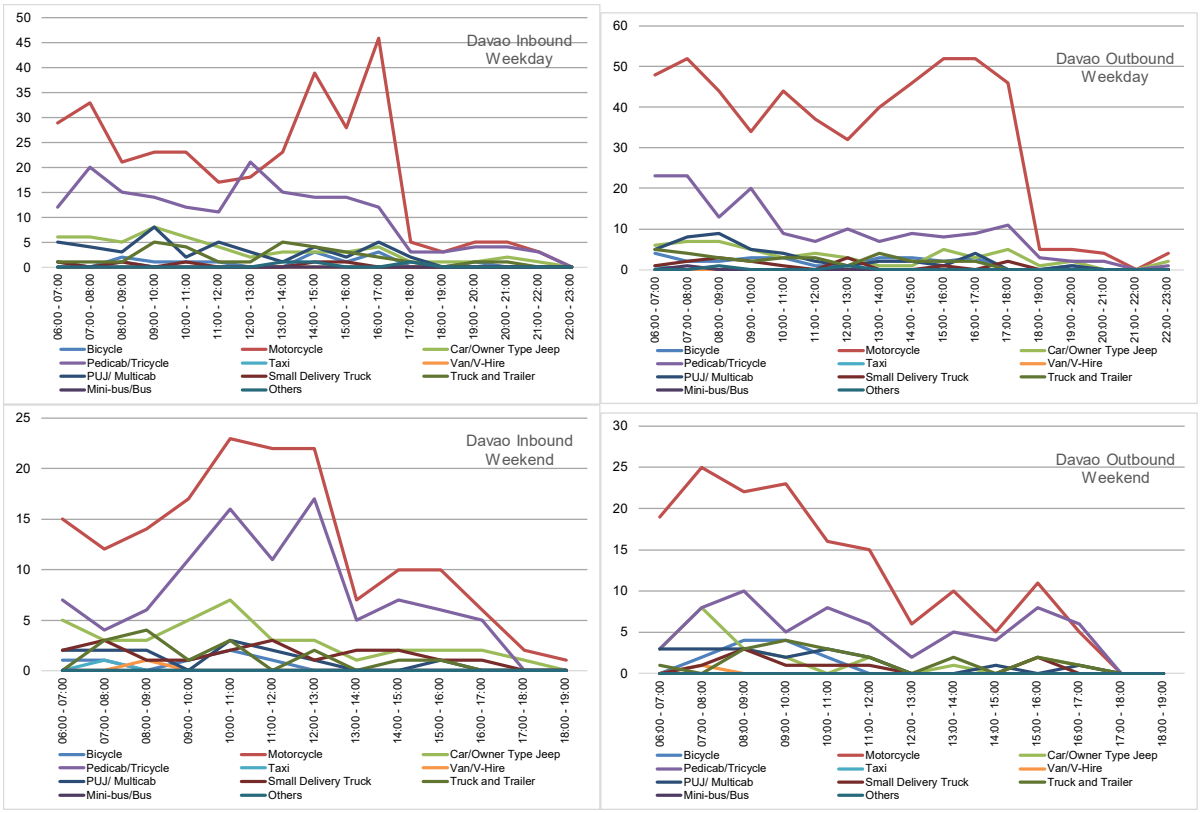
Source: IM4Davao Team

Figure 2.3 Hourly Vehicular Traffic Volume Across CL2 (Bukidnon Direction)



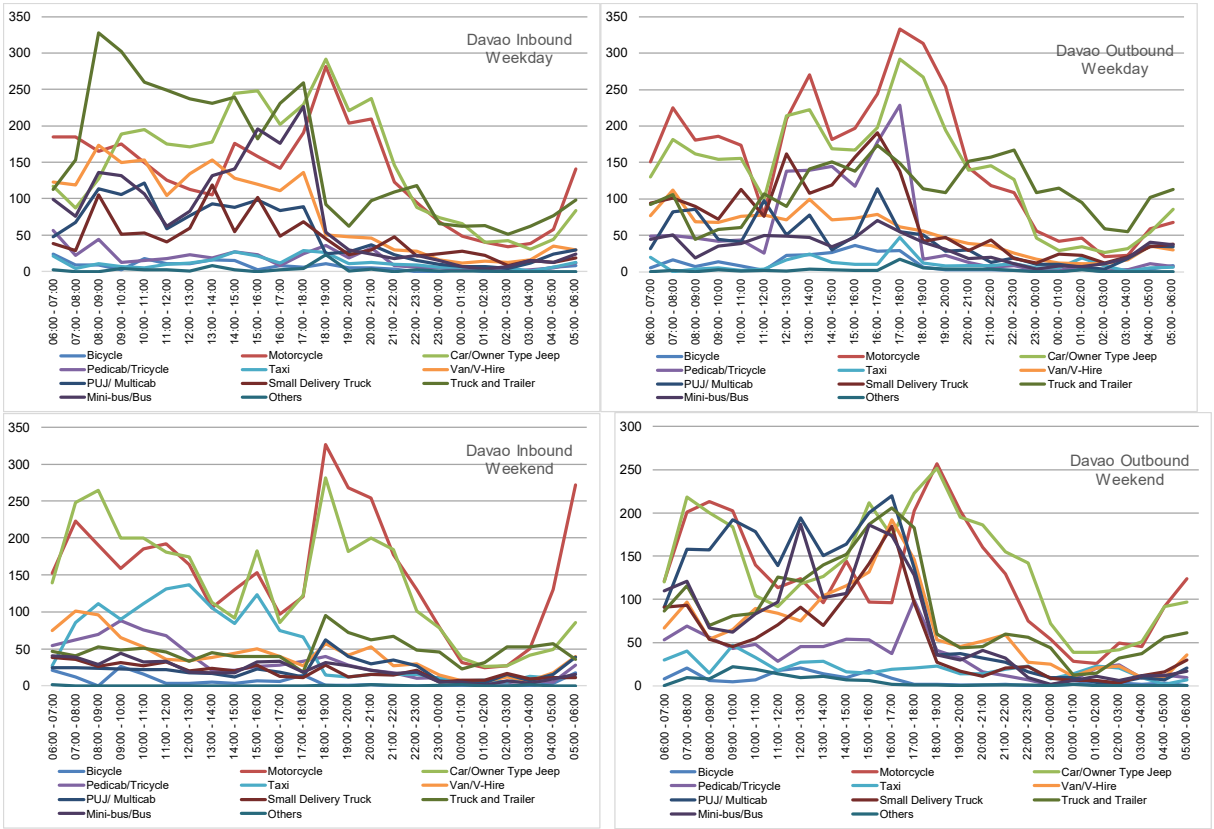
Source: IM4Davao Team

Figure 2.4 Hourly Vehicular Traffic Volume Across CL3 (Cotabato Direction)



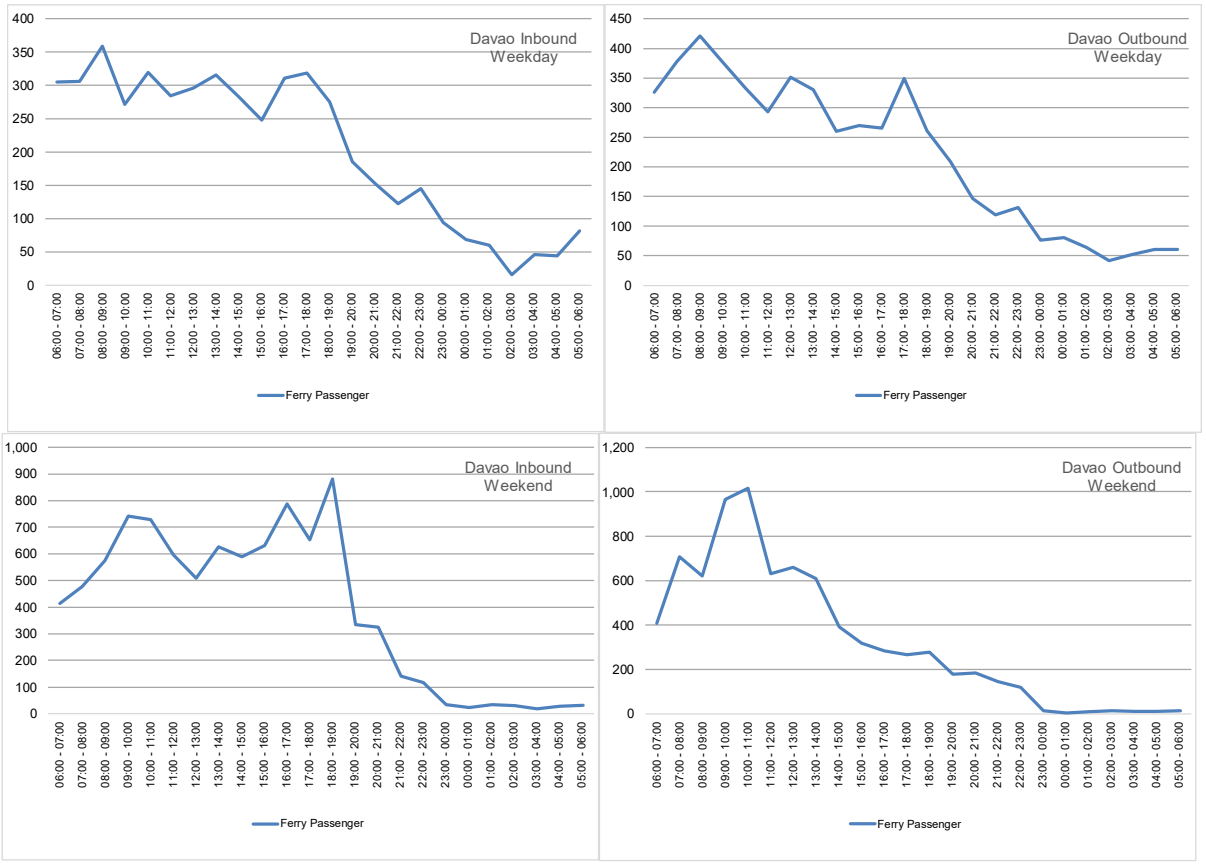
Source: IM4Davao Team

Figure 2.5 Hourly Vehicular Traffic Volume Across CL4 to CL7 (Paquibato Direction)



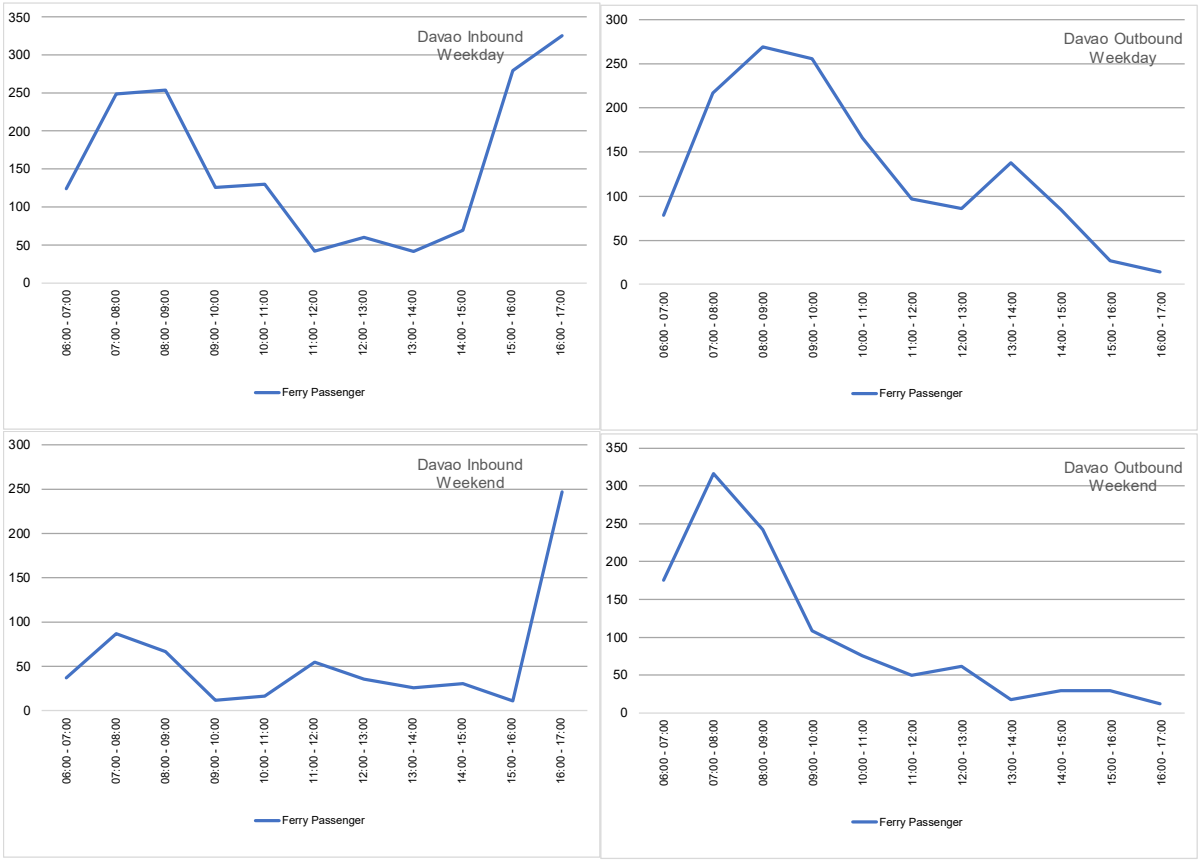
Source: IM4Davao Team.

Figure 2.6 Hourly Vehicular Traffic Volume Across CL8 (Panabo and Tagum Direction)



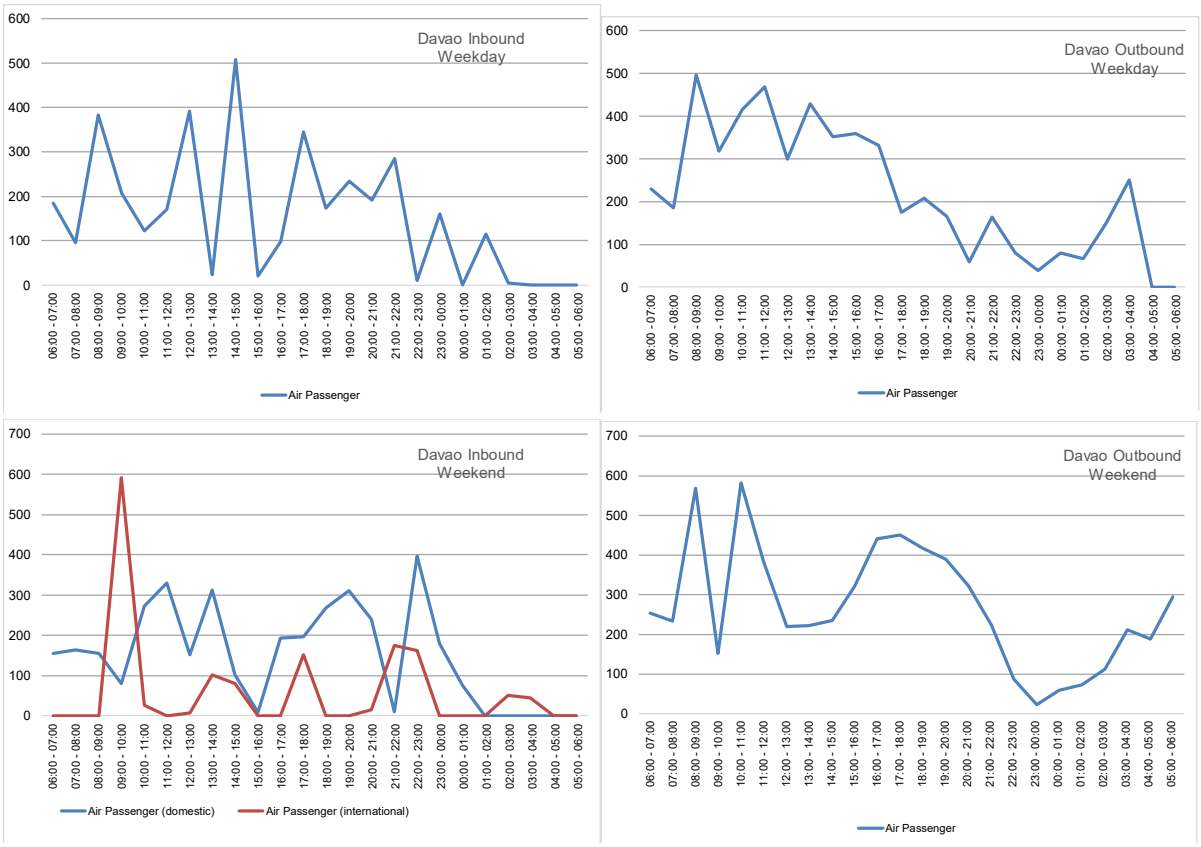
Source: IM4Davao Team

Figure 2.7 Hourly Ferry Passenger Volume Across CL9F to CL13F (Samal Direction)



Source: IM4Davao Team

Figure 2.8 Hourly Ferry Passenger Volume Across CL14F (Talikud Direction)



Source: IM4Davao Team.

Figure 2.9 Hourly Airplane Passenger Volume Across CL15A (Luzon, Visayas, Singapore Direction)

3 Screen Line Survey

1) Screen Line Survey Methodology

9. The Screen Line Survey aims to provide vehicular and passenger traffic information crossing Davao River to calibrate the current distributed traffic volume. To obtain the required data, two surveys, namely traffic count survey and the vehicle occupancy survey, were conducted at road sections or ferry ports crossing the screen line in the city. Table 3.1 reveals all Screen Line Survey stations.

Table 3.1 List of Screen Line Survey Stations

Seq.	Category	Code	Survey Station	Location	Survey Period (hours)	
					Traffic Count	Vehicle Occupancy
1	Bridge	SL1	Quezon Blvd Bolton Bridge	Davao River	06:00 - 06:00	06:00 - 06:00
2	Ferry	SL2	SIR 1	Davao River - SIR	06:00 - 22:00	-
3	Ferry	SL3	SIR 2	Davao River - SIR	06:00 - 22:00	-
4	Ferry	SL4	SIR 3	Davao River - SIR	06:00 - 22:00	-
5	Bridge	SL5	MacArthur Highway	Davao River	06:00 - 06:00	06:00 - 06:00
6	Ferry	SL6	Bankaan 2 Ferry	Davao River	06:00 - 23:00	-
7	Bridge	SL7	Eden-Gold St	Davao River	06:00 - 06:00	06:00 - 06:00
8	Bridge	SL8	Diversion Road	Davao River	06:00 - 06:00	06:00 - 06:00
9	Bridge	SL9	Wa-an	Davao River	06:00 - 19:00	06:00 - 19:00

Seq.	Category	Code	Survey Station	Location	Survey Period (hours)	
					Traffic Count	Vehicle Occupancy
10	Bridge	SL10	7.18118N, 125.55996E	Davao River	06:00 - 18:00	06:00 - 18:00
11	Bridge	SL11	7.20414N, 125.52132E	Davao River	06:00 - 18:00	06:00 - 18:00
12	Bridge	SL12	Barangay Lacson Rd.	Davao River	06:00 - 18:00	06:00 - 18:00

Source: IM4Davao Team.

Source: IM4Davao Team.

Figure 3.1 Screen Line Survey Stations

10. This survey was undertaken simultaneously for 24 hours at 12 stations on 22 March 2017 (Table 3.2). However, at remote and high security risk areas the surveys were conducted for 12 to 13 hours, and were adjusted to operation hours at the ferry ports.

Table 3.2 Survey Duration by Station - Screen Line

Seq.	Category	Code	Survey Station	March								
				20	21	22	23	24	25	26	27	28
				M	T	W	Th	F	S	Su	M	T
1	Bridge	SL1	Quezon Blvd Bolton Bridge									
2	Ferry	SL2	SIR 1									
3	Ferry	SL3	SIR 2									
4	Ferry	SL4	SIR 3									
5	Bridge	SL5	MacArthur Highway									
6	Ferry	SL6	Bankaan 2 Ferry									
7	Bridge	SL7	Eden-Gold St									
8	Bridge	SL8	Diversion Road									
9	Bridge	SL9	Wa-an									
10	Bridge	SL10	7.18118N, 125.55996E									
11	Bridge	SL11	7.20414N, 125.52132E									
12	Bridge	SL12	Barangay Lacson Rd.									

Source: IM4Davao Team.

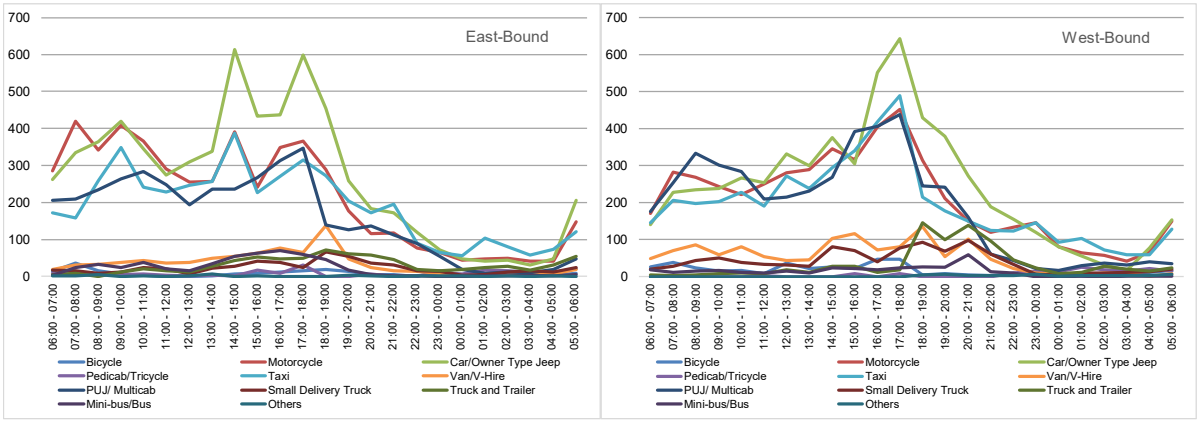
2) Screen Line Survey Results

11. Table 3.3 is daily vehicular traffic volume. Figures 3.2 to 3.10 show hourly vehicular traffic volume across Screen Line, Davao River, by direction, and vehicle class. The figures show clear morning (between 6:00 to 8:00 AM), noon, and evening (between 5:00 to 7:00 PM) peaks commonly seen in metropolitan areas. It should be pointed out that the morning peak at SL8 is particularly sharp. A possible traffic demand management measure is the promotion of off-peak commuting to ease road congestion in the morning and evening peak hours.

Table 3.3 Daily Vehicular Traffic Volume of Screen Line Survey Stations

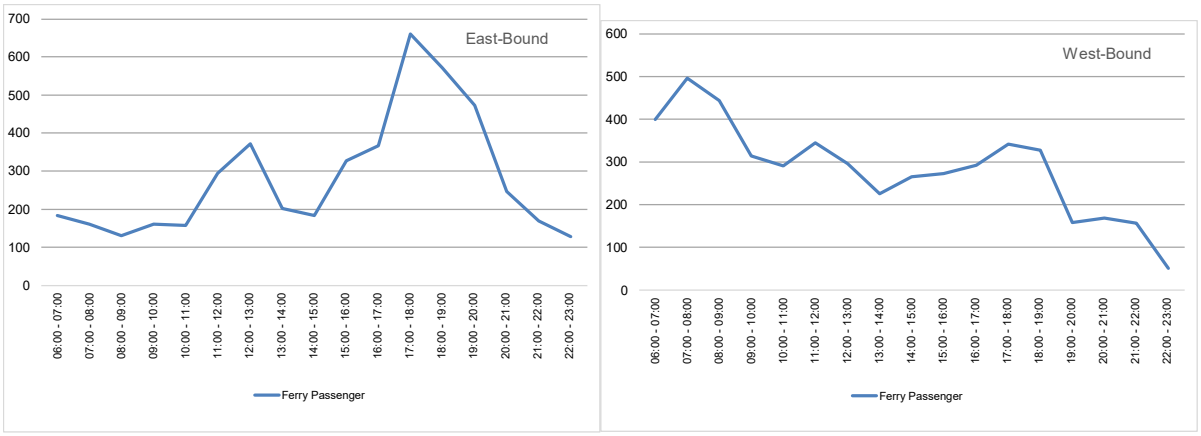
Code	Survey Station	Day	Direction	Vehicle										
				Bicycle	Motorcycle	Car/Owner Type Jeep	Pedicab/ Tricycle	Taxi	Van/V-Hire	PUJ/ Multicab	Small Delivery Truck	Truck and Trailer	Mini-bus/Bus	Others
SL1	Quezon Blvd Bolton Bridge	weekday	eastbound	206	5177	6400	201	4596	826	3802	537	733	517	29
			westbound	402	5064	5831	147	4672	1264	4474	968	804	328	41
SL5	MacArthur Highway	weekday	eastbound	500	6284	7692	449	6361	895	8053	502	365	31	79
			westbound	612	6778	6942	1174	5406	721	7635	805	667	88	113
SL7	Eden-Gold St	weekday	eastbound	182	2666	3630	689	1688	267	144	729	524	3	64
			westbound	265	3174	4006	826	1788	320	93	806	543	11	28
SL8	Diversion Road	weekday	eastbound	69	5250	6899	61	2723	394	132	817	2593	299	51
			westbound	44	4651	6069	44	2814	335	117	2284	3610	370	112
SL9	Waan	weekday	eastbound	24	537	94	178	20	4	30	13	526	0	3
			westbound	38	544	148	164	38	32	69	37	555	0	7
SL10	7.18118N, 125.55996E	weekday	eastbound	25	167	0	0	0	0	0	0	0	0	53
			westbound	29	158	0	0	0	0	0	0	0	0	44
SL11	7.20414N, 125.52132E	weekday	eastbound	15	240	3	29	0	0	7	2	45	0	0
			westbound	1	11	0	0	0	0	12	0	0	0	0
SL12	Barangay Lacson Rd.	weekday	eastbound	15	263	7	54	0	0	13	2	41	0	0
			westbound	41	290	3	59	2	1	13	4	89	0	0

Source: IM4Davao Team.



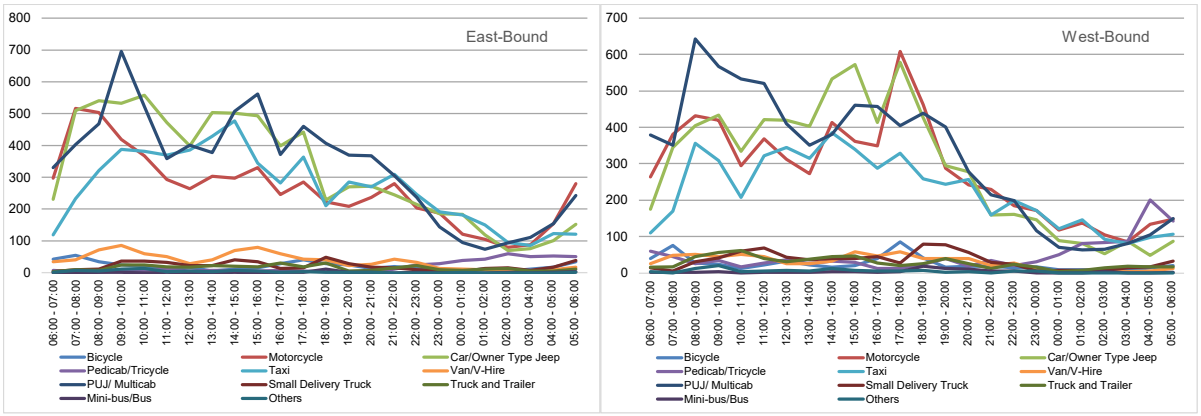
Source: IM4Davao Team

Figure 3.2 Hourly Vehicular Traffic Volume Across SL1



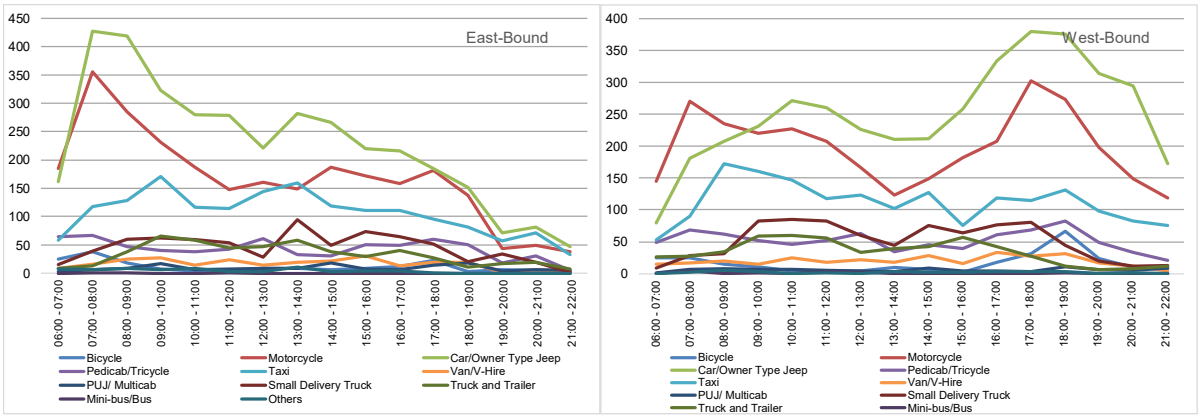
Source: IM4Davao Team

Figure 3.3 Hourly Ferry Passenger Volume Across SL2, SL3, SL4, SL6



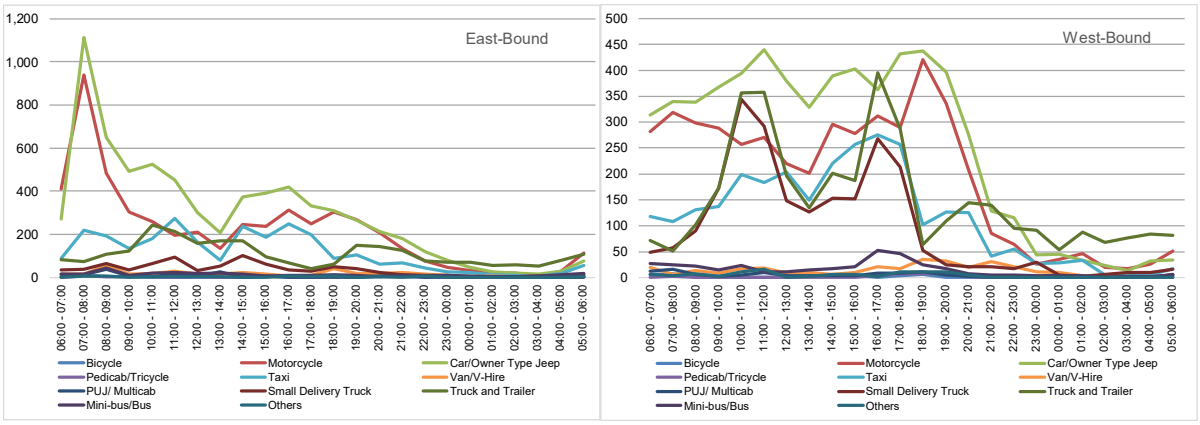
Source: IM4Davao Team

Figure 3.4 Hourly Vehicular Traffic Volume Across SL5



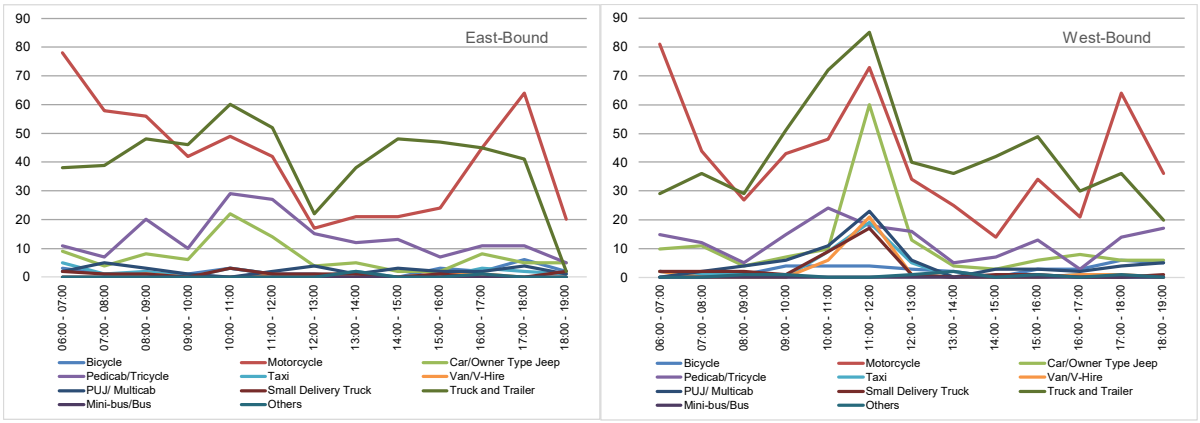
Source: IM4Davao Team

Figure 3.5 Hourly Vehicular Traffic Volume Across SL7



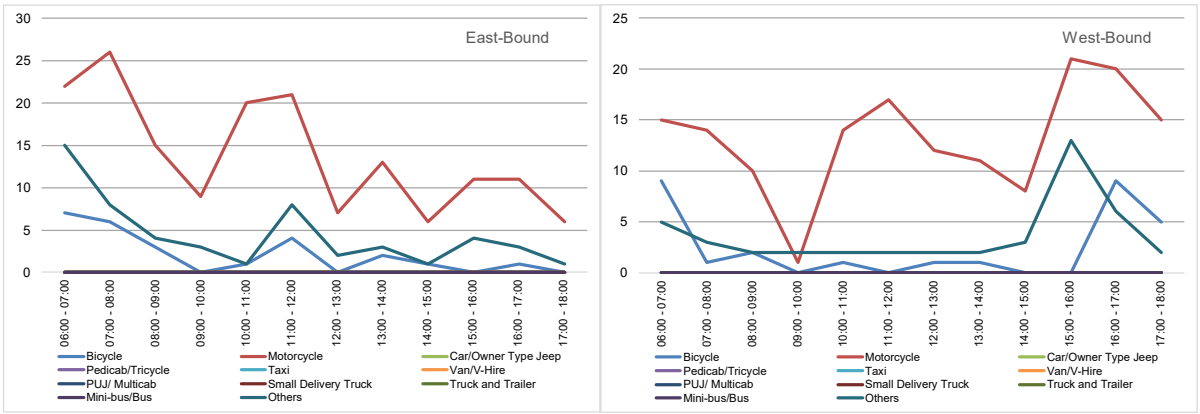
Source: IM4Davao Team

Figure 3.6 Hourly Vehicular Traffic Volume Across SL8



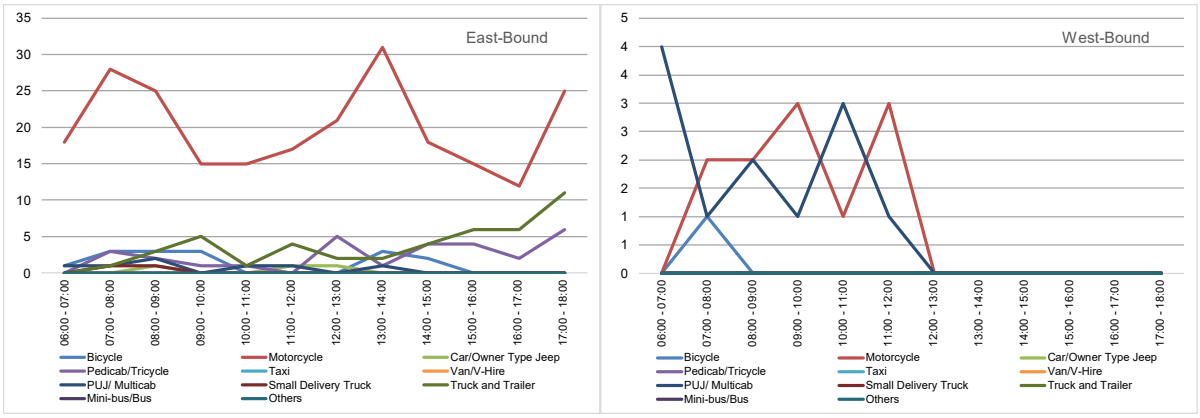
Source: IM4Davao Team

Figure 3.7 Hourly Vehicular Traffic Volume Across SL9



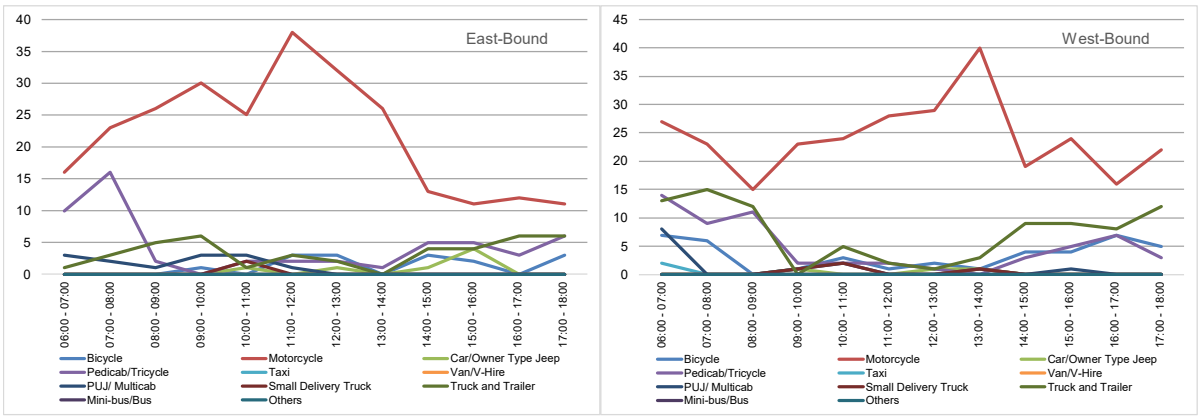
Source: IM4Davao Team

Figure 3.8 Hourly Vehicular Traffic Volume Across SL10



Source: IM4Davao Team

Figure 3.9 Hourly Vehicular Traffic Volume Across SL11



Source: IM4Davao Team

Figure 3.10 Hourly Vehicular Traffic Volume Across SL12

4 Roadside Traffic Count Survey (Mid-Block)

1) Roadside Traffic Count Survey Methodology

12. The Traffic Count Survey (Mid-Block) aims to understand traffic conditions to calibrate the above two surveys. For this purpose, the traffic count survey and the vehicle occupancy survey were conducted at mid-block of road sections at major roads within the Davao City urban area.

Table 4.1 List of Mid-Block Survey Stations

	Code	Survey Station	Survey Period (hours)	
			Traffic Count	Vehicle Occupancy
1	RS1	Near Sunday's Carwash, Matina Aplaya Rd	06:00-06:00	06:00-06:00
2	RS2	SPED Bangkal	06:00-06:00	06:00-06:00
3	RS3	Catalunan Grande	06:00-06:00	06:00-18:00
4	RS4	Ma-a Rd near Diversion Rd Crossing	06:00-06:00	06:00-18:00
5	RS5	R. Magsaysay Avenue	06:00-06:00	06:00-18:00
6	RS6	Near Coco's South Bistro, F. Torres St	06:00-06:00	06:00-06:00
7	RS7	Redemptorist Church, J.P. Laurel Avenue	06:00-06:00	06:00-18:00
8	RS8	M. Tanoy Concepts, Dacudao Avenue	06:00-06:00	06:00-18:00
9	RS9	Merco, Mandug Road	06:00-06:00	06:00-18:00
10	RS10	Carmelite Church, J.P. Laurel Ave	06:00-06:00	06:00-06:00
11	RS11	Near HB1, Angliongto/Mamay Road	06:00-06:00	06:00-06:00
12	RS12A	Cargo Terminal Access Rd (2 directions)	06:00-06:00	06:00-06:00
13	RS13A	Airport Terminal Entry Rd & Exit Rd	06:00-06:00	06:00-06:00

Source: IM4Davao Team

Source: IM4Davao Team

Figure 4.1 Roadside Traffic Count Survey (Mid-Block) Stations

13. This survey was undertaken for one day either on 21 or 22 of March 2017 at 13 stations (Table 4.2). The traffic count surveys were all implemented for 24 hours, while vehicle occupancy survey was conducted at selected stations for 12 hours only.

Table 4.2 Survey Duration by Station - Midblock

Seq.	Code	Survey Station	March								
			20	21	22	23	24	25	26	27	28
			M	T	W	Th	F	S	Su	M	T
1	RS1	Near Sunday's Carwash, Matina Aplaya Rd		■							
2	RS2	SPED Bangkal		■							
3	RS3	Catalunan Grande		■							
4	RS4	Ma-a Rd near Diversion Rd Crossing		■							
5	RS5	R. Magsaysay Avenue		■							
6	RS6	Near Coco's South Bistro, F. Torres St		■							
7	RS7	Redemptorist Church, J.P. Laurel Avenue		■							
8	RS8	M. Tanoy Concepts, Dacudao Avenue		■							
9	RS9	Merco, Mandug Road			■						
10	RS10	Carmelite Church, J.P. Laurel Ave			■						
11	RS11	Near HB1, Angliongto/Mamay Road			■						
12	RS12A	Cargo Terminal Access Rd (2 directions)			■						
13	RS13A	Airport Terminal Entry Rd & Exit Rd			■						

Source: IM4Davao Team

2) Roadside Traffic Count Survey Results

14. Daily vehicular traffic volume at survey stations are summarized in Table 4.3. Figures 4.2 to 4.14 illustrate hourly vehicular traffic volume by direction and vehicle class within selected Davao City roads. Morning and evening are peak hours; majority of vehicles are cars, motorcycles, and taxis.

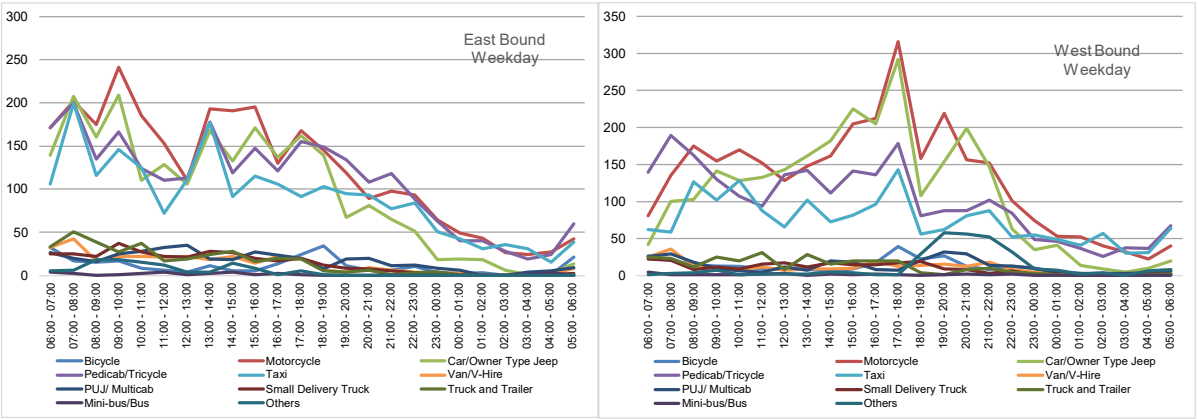
15. The traffic flow results also indicate that traffic mainly happens in the core urban area, particularly near shopping malls, main corridors, and the Diversion Road. Stations RS7 (near Abreeza, J.P. Laurel Avenue) and RS10 (near SM Lanang, J.P. Laurel Avenue) have huge traffic which cause serious traffic congestion. Main corridors such as RS8 (Dacudao Avenue), RS5 (Magsaysay Avenue), RS6 (F. Torres St.), and RS11 (Mamay Road) also have heavy traffic volumes, but traffic jams mostly occur during peak hours. Traffic flow involves vehicle volume, so to reduce congestion, these locations should be high on the priority for improvement. At the 6-lane Diversion Road, traffic jams do not occur, but huge traffic flows in RS4 (Ma-a Road near Diversion Road Crossing) and SL8 (Ma-a Bridge at Diversion Road) suggest the necessity of traffic control.

Table 4.3 Daily Vehicular Traffic Volume of Roadside Traffic Count Survey Stations

Code	Survey Station	Day	Direction	Vehicle										
				Bicycle	Motorcycle	Car/Owner Type Jeep	Pedicab/ Tricycle	Taxi	Van/V-Hire	PUJ/ Multicab	Small Delivery Truck	Truck and Trailer	Mini-bus/Bus	Others
RS1	Near Sunday's Carwash, Matina Aplaya Rd	weekday	eastbound	255	2933	2311	2610	2152	319	390	333	355	28	111
			westbound	291	3137	2660	2408	1793	253	307	231	283	26	296
RS2	SPED Bangkal	weekday	eastbound	50	3877	4203	55	844	445	301	1266	2053	86	67
			westbound	69	3052	3695	130	753	318	509	909	2384	96	92

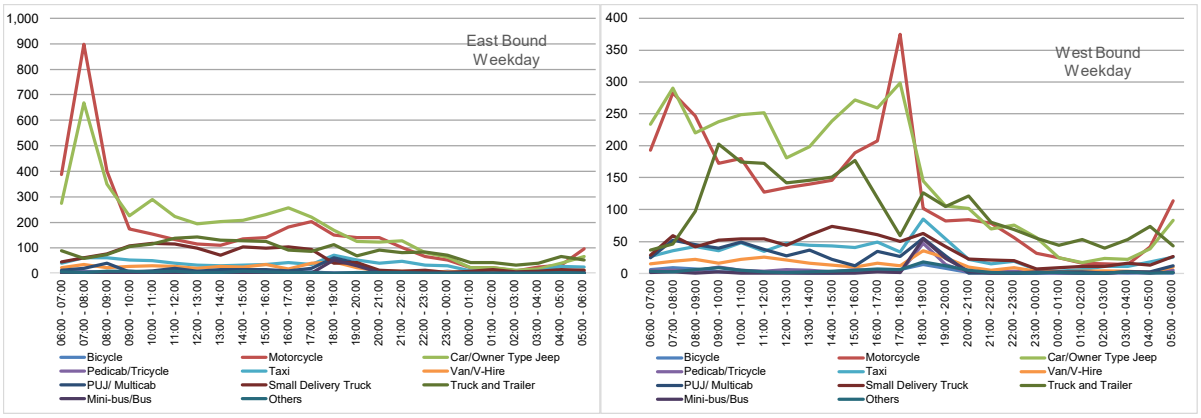
Code	Survey Station	Day	Direction	Vehicle										
				Bicycle	Motorcycle	Car/Owner Type Jeep	Pedicab/ Tricycle	Taxi	Van/V-Hire	PUJ/ Multicab	Small Delivery Truck	Truck and Trailer	Mini-bus/Bus	Others
RS3	Catalunan Grande	weekday	northbound	163	3953	1877	3062	956	139	499	396	135	0	110
			southbound	95	4975	3565	3232	1015	548	903	484	342	5	31
RS4	Ma-a Rd near Diversion Rd Crossing	weekday	northbound	112	2869	3836	125	1954	799	3350	622	1765	748	150
			southbound	112	2918	3387	100	1446	368	1896	365	1328	306	110
RS5	R. Magsaysay Avenue	weekday	eastbound	205	1788	1847	215	1015	26	5207	129	91	1	59
			westbound	240	1959	2107	263	1247	174	4378	198	63	2	81
RS6	Near Coco's South Bistro, F. Torres St	weekday	eastbound	222	2852	5272	3418	2951	302	907	390	144	3	33
			westbound	308	3631	5075	3810	3150	313	376	401	111	1	181
RS7	Redemptorist Church, J.P. Laurel Avenue	weekday	eastbound	242	2940	5340	75	4169	448	8070	282	138	30	38
			westbound	210	2372	5230	88	3300	365	6561	441	247	30	36
RS8	M. Tanoy Concepts, Dacudao Avenue	weekday	northbound	327	3873	4634	812	2825	833	1084	841	759	325	288
			southbound	291	4601	5887	669	3216	871	1138	997	823	293	77
RS9	Merco, Mandug Road	weekday	eastbound	105	4154	2184	2303	1206	136	823	303	490	1	32
			westbound	107	4757	2984	2765	1682	150	864	280	461	0	122
RS10	Carmelite Church, J.P. Laurel Ave	weekday	eastbound	283	3571	6225	172	3597	555	3275	1036	247	11	81
			westbound	336	3359	6739	136	4229	691	3365	574	455	10	77
RS11	Near HB1, Angliongto/Mamay Road	weekday	northbound	202	3083	4927	802	2669	438	271	588	554	7	21
			southbound	209	3338	4898	861	2410	328	448	558	660	14	243
RS12A	Cargo Terminal Access Rd (2 directions)	weekday	leaving airport	8	395	338	3	211	50	30	174	86	3	51
			entering airport	6	410	386	7	159	59	37	182	157	0	32
RS13A	Airport Terminal Entry Rd & Exit Rd	weekday	leaving airport	3	365	2229	1	4581	347	62	22	15	2	24
			entering airport	10	587	3420	1	5002	2201	441	84	174	0	160

Source: IM4Davao Team.



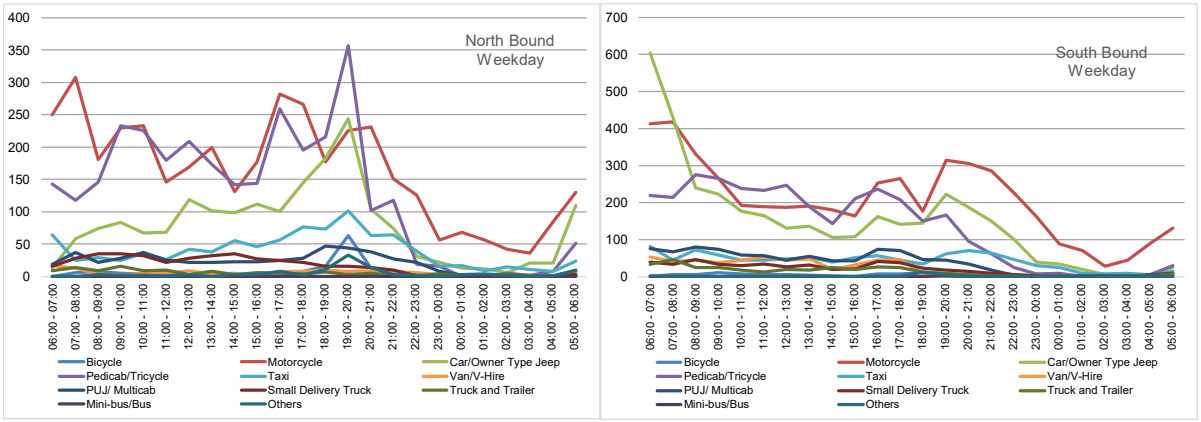
Source: IM4Davao Team

Figure 4.2 Hourly Vehicular Traffic Volume Across RS1



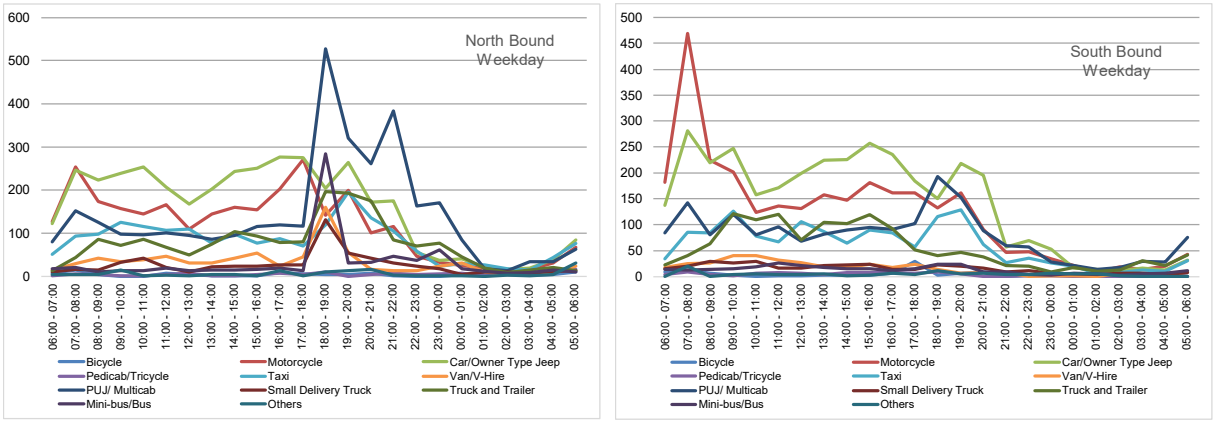
Source: IM4Davao Team

Figure 4.3 Hourly Vehicular Traffic Volume Across RS2



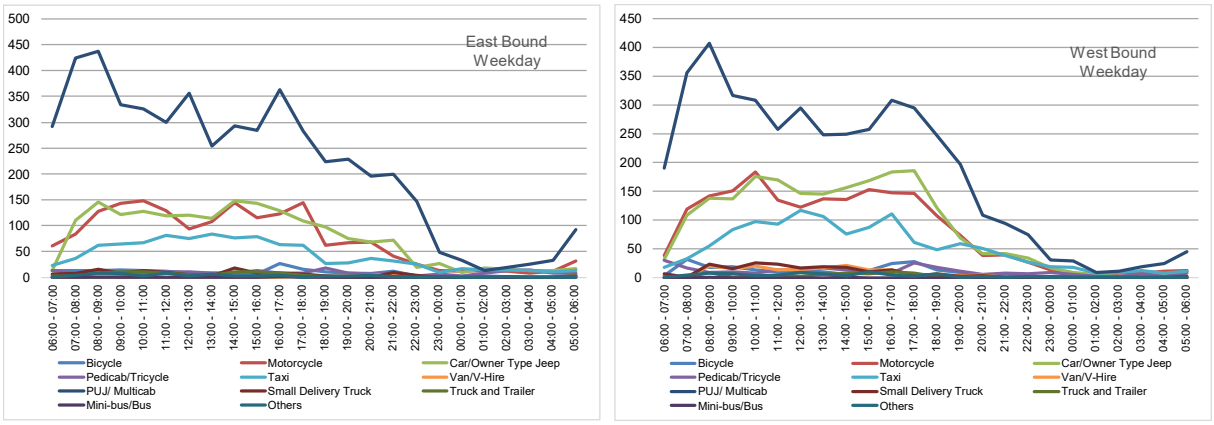
Source: IM4Davao Team

Figure 4.4 Hourly Vehicular Traffic Volume Across RS3



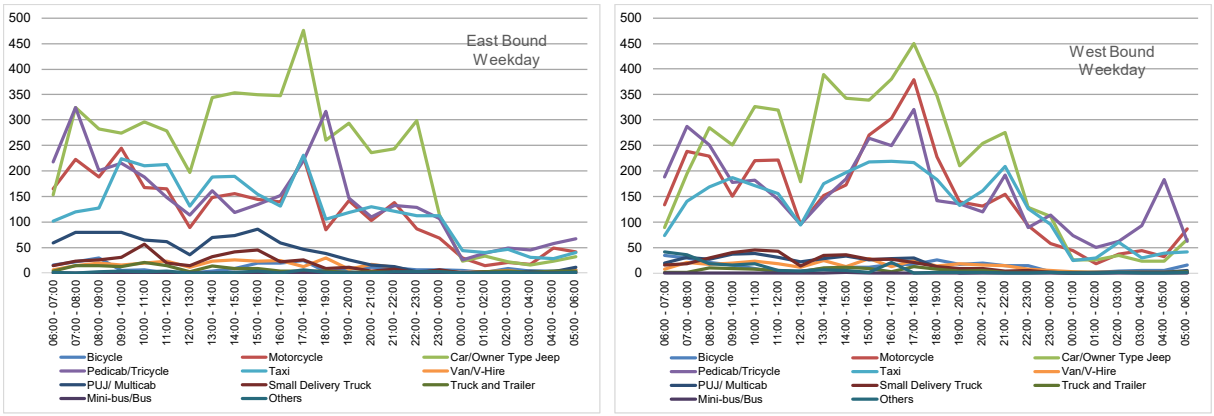
Source: IM4Davao Team

Figure 4.5 Hourly Vehicular Traffic Volume Across RS4



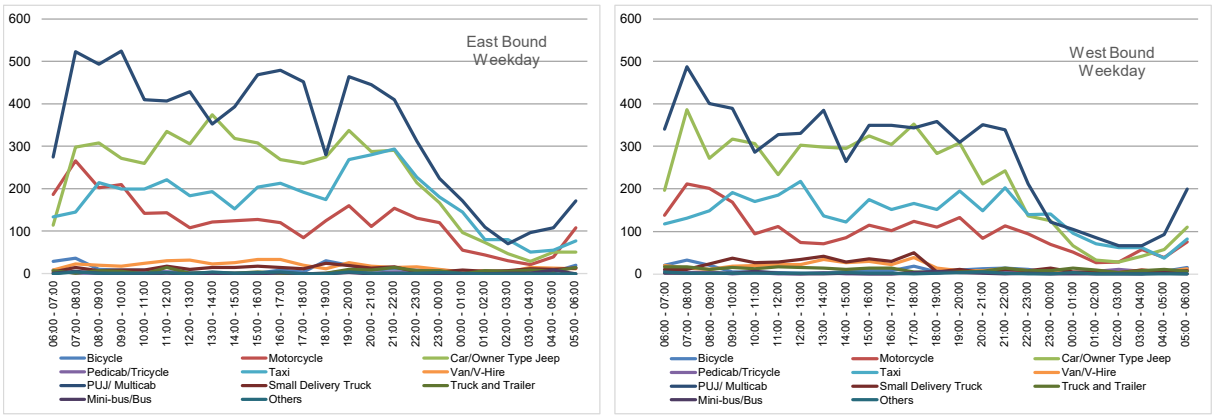
Source: IM4Davao Team

Figure 4.6 Hourly Vehicular Traffic Volume Across RS5



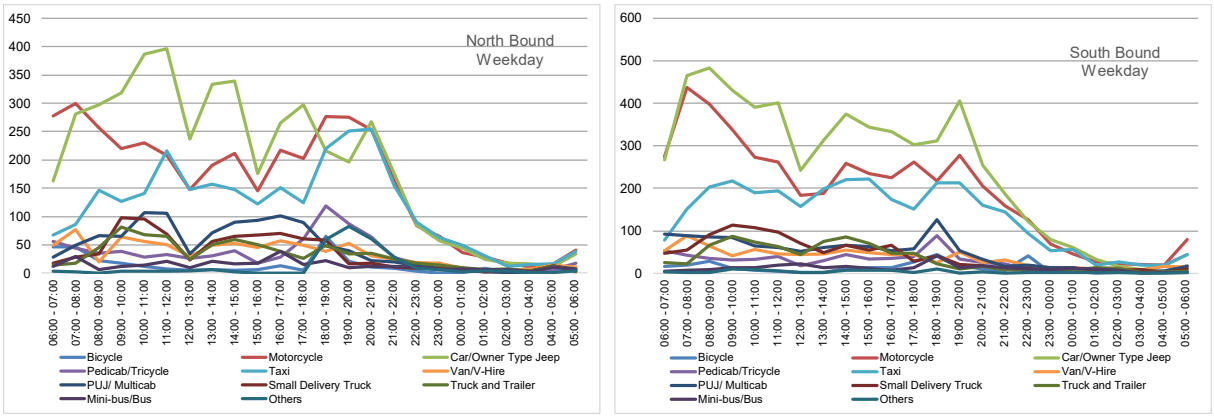
Source: IM4Davao Team

Figure 4.7 Hourly Vehicular Traffic Volume Across RS6



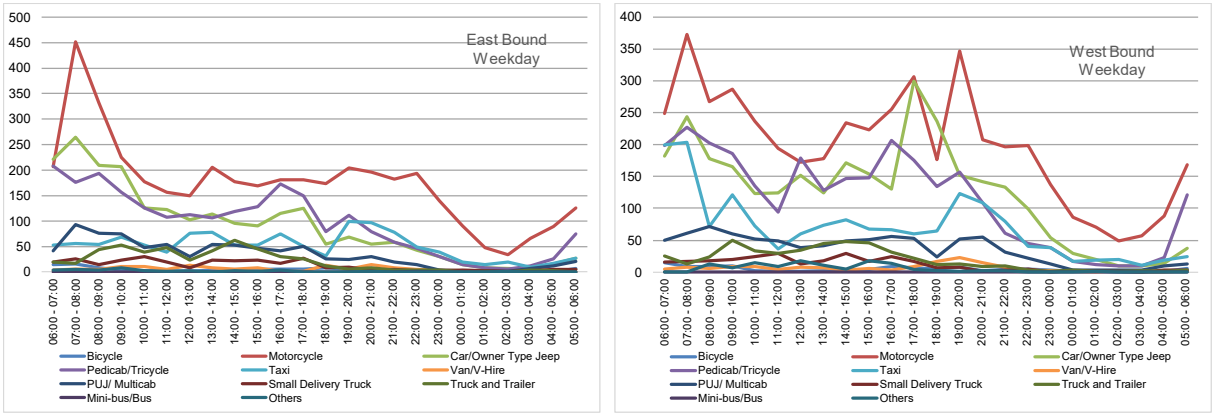
Source: IM4Davao Team

Figure 4.8 Hourly Vehicular Traffic Volume Across RS7



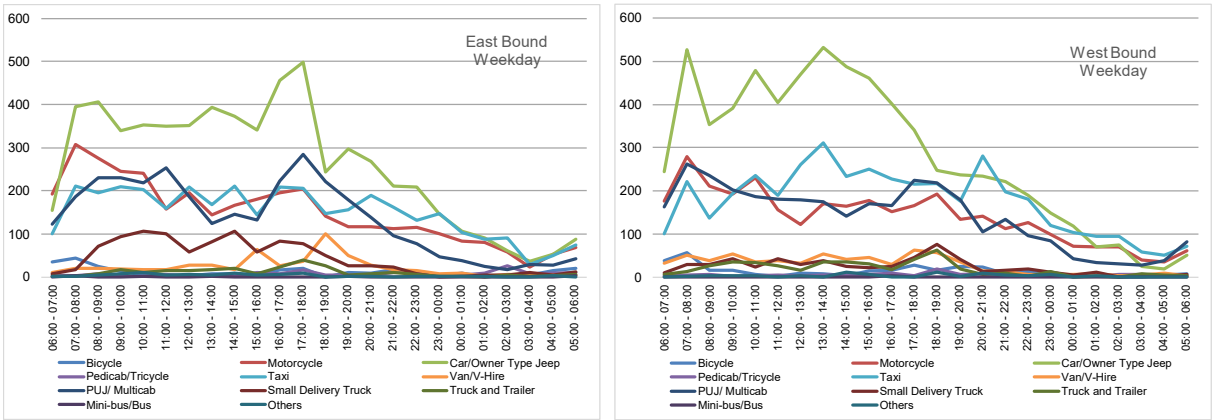
Source: IM4Davao Team

Figure 4.9 Hourly Vehicular Traffic Volume Across RS8



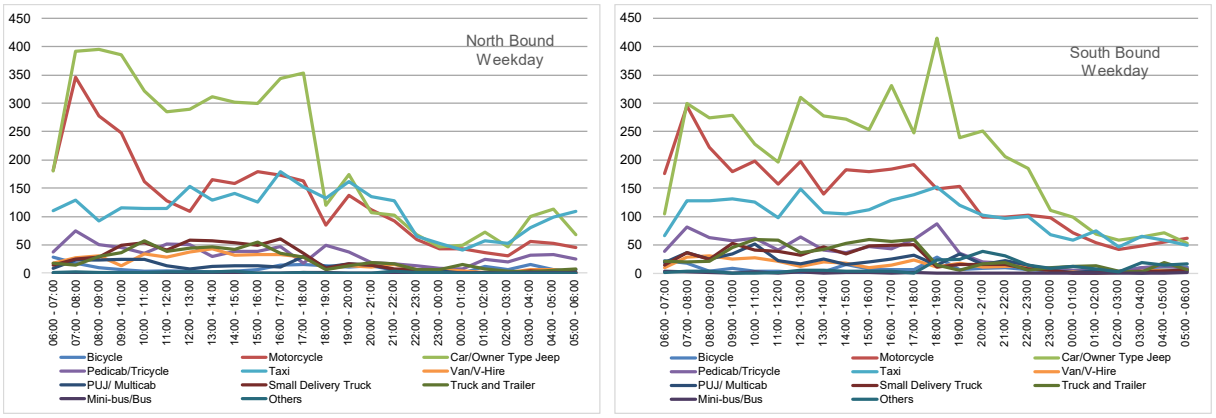
Source: IM4Davao Team

Figure 4.10 Hourly Vehicular Traffic Volume Across RS9



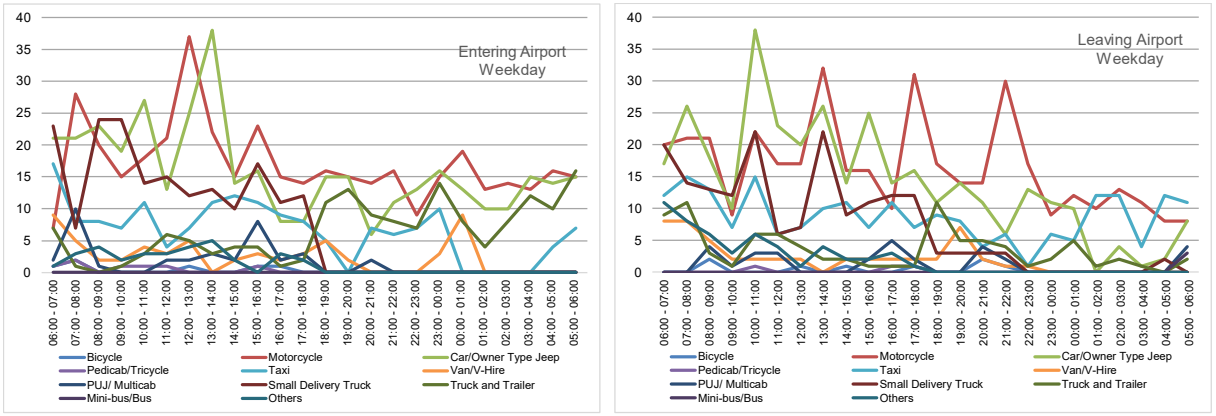
Source: IM4Davao Team

Figure 4.11 Hourly Vehicular Traffic Volume Across RS10



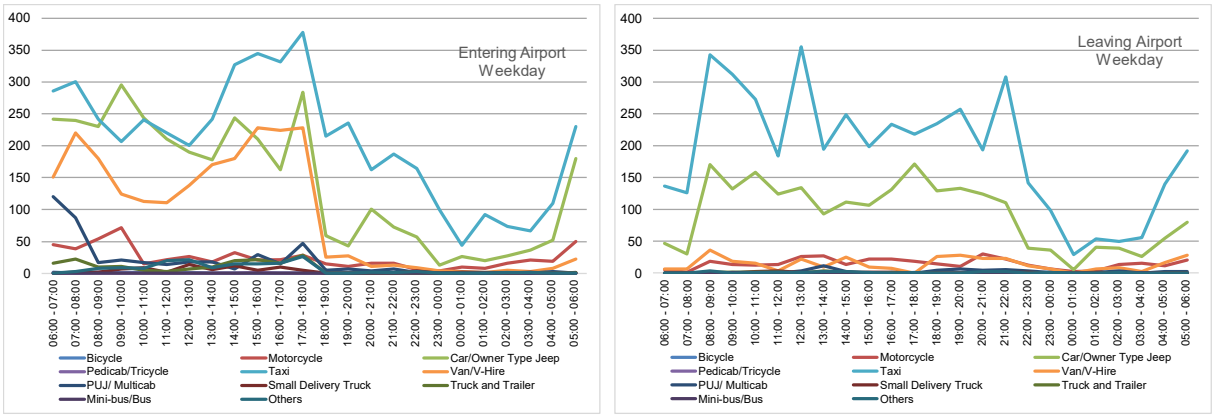
Source: IM4Davao Team

Figure 4.12 Hourly Vehicular Traffic Volume Across RS11



Source: IM4Davao Team

Figure 4.13 Hourly Vehicular Traffic Volume Across RS12A



Source: IM4Davao Team

Figure 4.14 Hourly Vehicular Traffic Volume Across RS13A

ANNEX 4: PUBLIC TRANSPORT INTERVIEW SURVEY

1 Background and Objectives

1. Davao City's economic activities and population are concentrated on limited urban area, so the urban center faces serious traffic congestions together with rapid urbanization and disorderly development. An appropriate urban infrastructure development plan from the economic, social and environmental viewpoints, based on a plausible future scenario, needs to be formulated before urban issues get worse.

2. In order to understand people's perceptions on current transport infrastructure and services, IM4Davao Team executed the Public Transport Interview Survey (hereinafter referred as "PTIS"). With rapid growth and huge amount of public transport usage, PTIS aims to know passengers' trip purpose, trip frequency, and perceptions on existing and future public transport services as well as socio-economic characteristics such as age, gender, occupation, employment sector, car ownership, and so on. Development directions of mass rapid transit services and public transport terminals will be provided with the data collected in this survey. The contents of the survey include:

(i) socio-economic characteristics of the passengers;

(ii) trip information and reason for modal choice;

(iii) perceptions on the level of present public transport services;

(iv) willingness to pay for a planned mass rapid transit service; and

(v) willingness to walk from public transport station to destination.

2 Survey Methodology

1) Survey Process

(a) Preparation

3. Prior to the implementation of the survey, the subcontractor visited each survey station (port, airport, logistic terminals, bus terminals) with IM4Davao Team to see the layout for considering surveyor deployment, and asked approval of the owner of the survey station, police, and other concerned authorities in close coordination with IM4Davao Team and Davao City to conduct the survey. Interviewers were selected from the HIS for this survey. Surveyors training and a dry run were conducted during the end of March 2017 to ensure a better understanding of the survey method by the survey staff.

4. Passenger interviews were coordinated with the terminal management of SM City Ecoland, SM City Premier Lanang, Abreeza Mall, GMall, Victoria Plaza, Civil Aviation Authority of the Philippines (CAAP), Davao Ferry Terminals, Davao City Overland Transport Terminal, and Davao City Traffic Management Center for the city public terminals.

(b) Field survey

5. The subcontractor allocated surveyors at suitable locations in each survey site to conduct interviews to passengers waiting for the departure. Passengers were interviewed at random and IM4Davao Team set the hourly number of target samples by survey site and vehicle type in order to conduct interviews evenly for each time period of morning peak, off-peak, and evening peak hours.

(c) Data encoding

6. Encoders checked and compiled collected data into a database according to the format to be specified by IM4Davao Team.

2) Survey Items

7. The questionnaire items are listed below.

(i) **Assessment on the level of present public transport services:** This questionnaire uses five-point Likert scale to evaluate public opinion on operation service (frequency, fare, travel time, driver's/conductor's behavior), onboard environment (crowdedness, safety, comfort, air quality, noise, cleanness), and mobility and facilities (access, easiness of transfer, information provision, waiting conditions, terminal).

(ii) **Willingness to walk from public transport station to destination:** Providing traffic condition, this item asks as how long a pedestrian is willing to walk.

(iii) **Willingness to pay for a planned mass rapid transit service:** Given two routes of LRT or Monorail in Davao City (Matina Crossing-SM Lanang and NCCC Mall-Damosa Gateway), willingness to pay for using railway compared to taxi and multi-cab.

(iv) **Trip information of the passenger:** Trip OD, purpose, frequency, and reason for modal choice are listed to understand passenger flows.

(v) **Socio-economic characteristics of the passenger:** This questionnaire covers the socio-economic information such as age, occupation, employment, location of residence, and car ownership.

Source: IM4Davao Team

Figure 2.1 Location of Public Transport Interview Survey Stations

3) Implementation of PTIS

8. Survey was conducted at 19 major public transport terminals including bus/van terminals, jeepney/taxi stops, airport, and ports in Davao City (Figure 2.2) for two days, one weekday, and one weekend; started at 6 AM and finished at 6 PM in most of the terminals except those at malls, i.e. SM City Ecoland, SM City Premier Lanang, Abreeza Mall, Victoria Plaza, and GMall which started at 10 AM and lasted up to 8 PM. Passengers were interviewed at random while waiting for their departure.

Source: IM4Davao Team

Figure 2.2 Public Transport Interview Survey Photos

4) Survey Schedule

9. Supervisors and interviewers for PTIS were selected from HIS teams to ensure their familiarity of conducting interviews and conditions in the survey areas. Training and dry-run were conducted for one day for interviewers to have a better understanding of the survey forms. The results of the dry-run and discussions during training were reflected to final survey questionnaires. Survey schedule was summarized in Table 2.1.

Table 2.1 Field PTIS Survey Schedule

Activity	Schedule
Review of PTIS Forms	March 23-24
Recruitment of Supervisors	March 24
Training of Supervisors	March 25-26
Recruitment of Interviewers	March 25-26
Training of Interviewers	March 27
Dry-Run/Pilot Interviews	March 27
Coordination with City Hall and Terminals	March 27-28

Activity	Schedule
Preparation of Survey Deployment Plan	March 28
Finalization of HIS Forms	March 28
Actual Fieldwork	March 29, April 1
Re-fielding and Editing	April 1-8

Source: IM4Davao Team

3 PTIS Results

10. The survey collected data from 1,137 samples, broken down across the different transport modes (Table 3.1). The survey was conducted at all terminal locations on 29 March 2017 (for a weekday) and 1 April 2017 (for a weekend). Sample number of respondents for five modes is illustrated in Figure 3.1.

Table 3.1 Number of Public Transport Interview Survey Samples

Seq.	Code	Survey Station	Number of Samples by Mode					
			Bus	V-hire	Jeepney	Taxi	Ferry	Total
1	T1	Davao City Overland Transport Terminal	93					93
2	T2	SM Ecoland Taxi/Van Terminal		35	31	33		99
3	T3	NCCC Mall Taxi Terminal				51		51
4	T4	L300 Van at Bankerohan Public Market		71	2			73
5	T5	Jeepney Terminal at Acacia Street			35			35
6	T6	Monvoda Terminal / Taxi Terminal at Gaisano Mall		24	34	17		75
7	T7	Vp North Bound Van Satellite Terminal / Victoria Plaza Taxi Terminal		25	38	17		80
8	T8	Abreeza Bus Terminal / Abreeza Taxi Terminal	1	23	41	25		90
9	T9	SM Lanang Taxi Terminal				24		24
10	T10	Cabantian Jeepney Terminal		1	53	5		59
11	T11	Tigatto Jeepney Terminal			50	1		51
12	T12	Mintal Road Van terminal		49				49
13	T13-1	Toril Jeepney Terminal			25			25
14	T13-2	Toril Jeepney Terminal			43			43
15	T14F	Sta. Ana Pier					49	49
16	T15F	Sasa Ferry Km 11(to Samal)		1	1		68	70
17	T16F	Sasa Onse Ferry Terminal			1		51	52
18	T17A	Airport Taxi Terminal for Arrival Passengers				47		47
19	T18A	Davao City International Airport			72			72
Total			94	229	426	220	168	1137

Source: IM4Davao Team

11. Figures 3.1 and 3.2 indicate interviewed respondents' gender, age, purpose, and frequency.

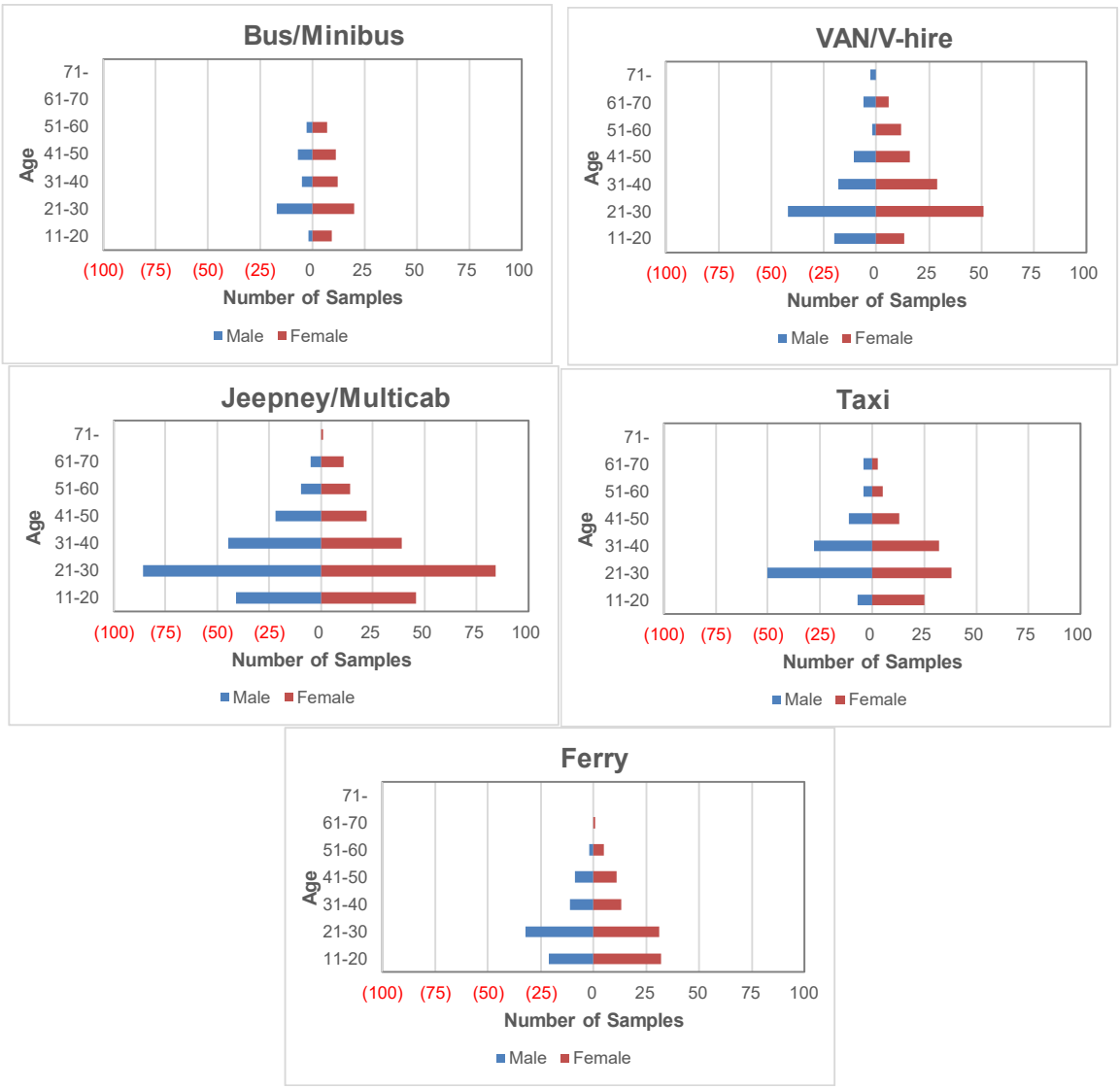
(i) Bus: age of users is averagely distributed, but uncommon for students;

(ii) V-hire: young, business and work purpose passengers are major;

(iii) Jeepney: majority of passengers are young, and used for commuting frequently;

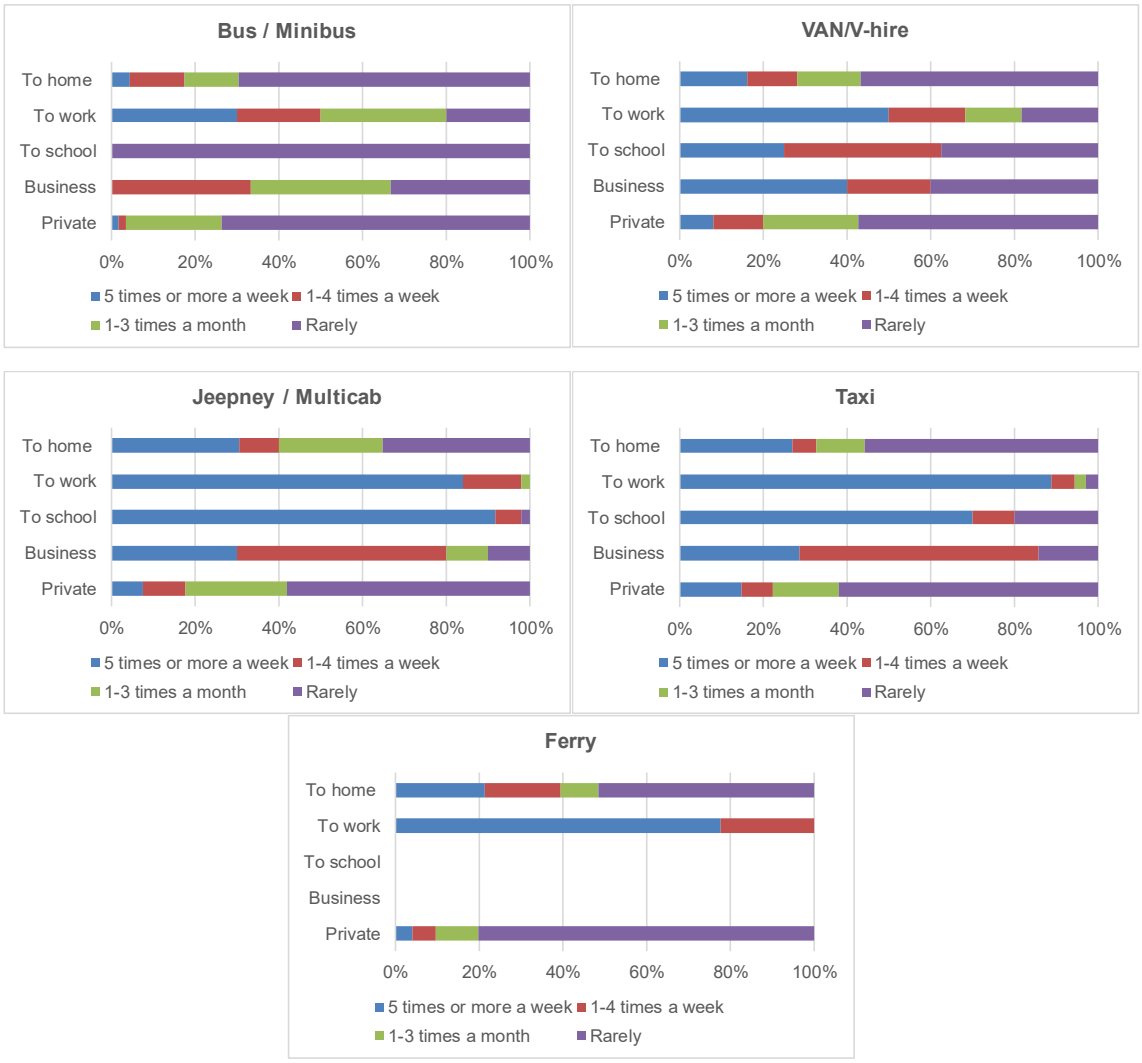
(iv) Taxi: taxi is also used for workers' and students' commuting; and

(v) Ferry: for work purpose passengers, over 70% use ferry 5 times or more weekly between Davao and Samal.



Source: IM4Davao Team

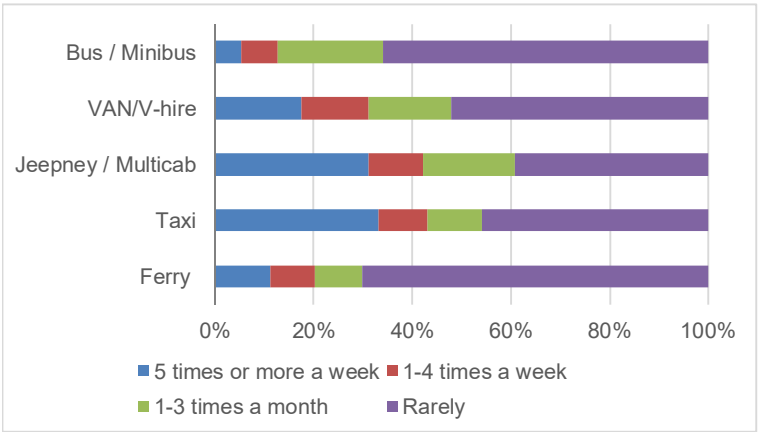
Figure 3.1 Number of Collected Samples by Respondent's Gender, Age, and Mode



Source: IM4Davao Team

Figure 3.2 Frequency of Use and Trip Purpose by Mode

12. Figure 3.3 shows the percentage of frequency of use by mode. Jeepneys and taxi are thought to be convenient traffic modes for daily use. Also, more than 30% of ferry, bus, v-hire passengers use the service regularly (i.e., at least once a week).



Source: IM4Davao Team

Figure 3.3 Frequency of Use by Mode

13. The survey asked passengers' opinions on the current level of public transport services based on 15 criteria using a five-point rating scale with 1 as the lowest and 5 as the highest. The average score by mode is shown in Figure 3.4. The results suggest the following points:

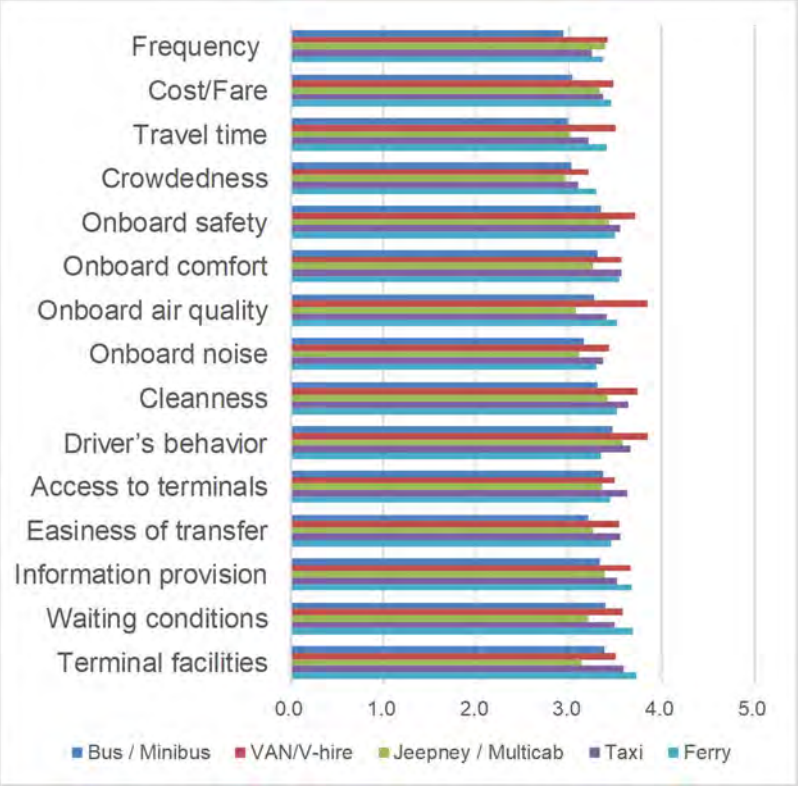
(i) Bus: travel time, in-vehicle crowdedness, cost, frequency and easiness to transfer need to be improved;

(ii) V-hire: on-vehicle crowdedness, and travel time need to be improved;

(iii) Jeepney: passengers are not satisfied with the current level of service in several aspects. It is particularly suggested to modernize vehicles because the worst points are in-vehicle crowdedness, air quality and noise. Long travel time, bad waiting condition and poor terminal facilities should be improved;

(iv) Taxi: on-board crowdedness, travel time and frequency are badly evaluated; and

(v) Ferry: general good assessment toward to all aspects.



Source: IM4Davao Team

Figure 3.4 Assessment on Current Level of Service

14. Alternative modes for interviewees to select for the trip include motorcycle, private car, pedicab, tricycle, taxi, VAN, jeepney, minibus, and bus, but there are reasons that hinder their choice:

(i) Travel time: pedicab, tricycle, VAN, jeepney and bus are time-consuming;

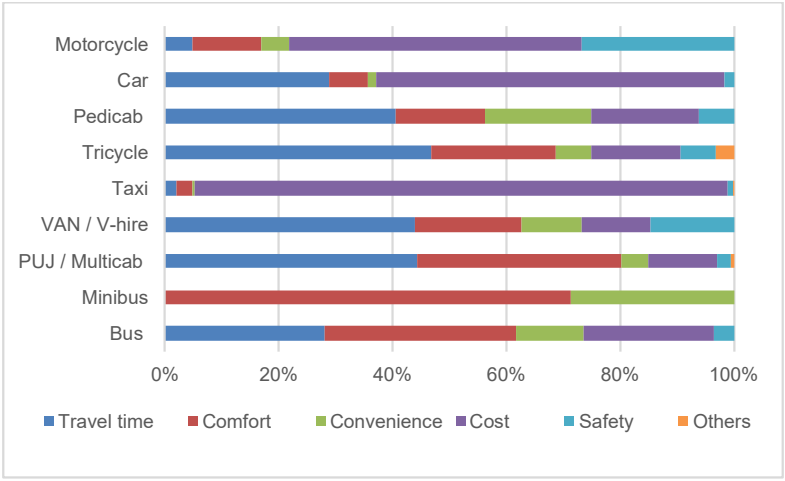
(ii) Comfort: jeepney, minibus and bus are not comfortable for passengers so they decide not to use;

(iii) Convenience: pedicab, bus, and minibus are inconvenience because limited location of terminals;

(iv) Cost: motorcycle, car and taxi are too expensive to afford; and

(v) Safety: about 25% of respondents who chose a motorcycle as the major alternative mode have safety concerns in driving a motorcycle, because motorcycles have the highest rate of traffic accident per passenger-kilometer.

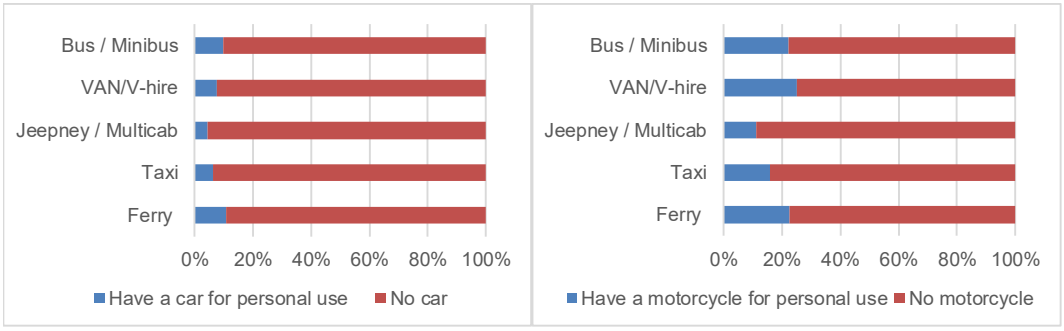
15. Therefore, it is necessary to develop more accessible public transport network, to modernize the public transport fleet, and to restrict motorcycle use for a safer and sustainable urban transportation environment.



Source: IM4Davao Team

Figure 3.5 Major Reason Not to Use Potential Alternative Mode

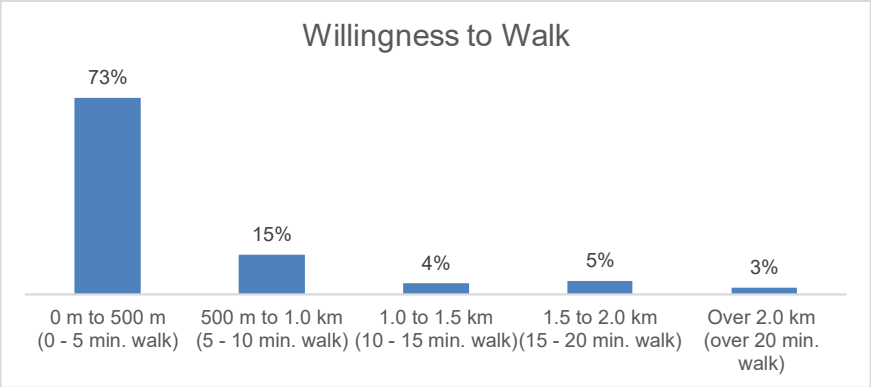
16. Figure 3.6 shows the patronage of the public transport system by car- and motorcycle-owning respondents. Around 6.8% and 17.6% of interviewees have a car and motorcycle for their own use, respectively. The passenger survey results show that people with their private vehicles still intend to use the public transport. It is recommended that the public transport system should provide more comfortable and quality services to attract these passengers.



Source: IM4Davao Team

Figure 3.6 Car / Motorcycle Ownership

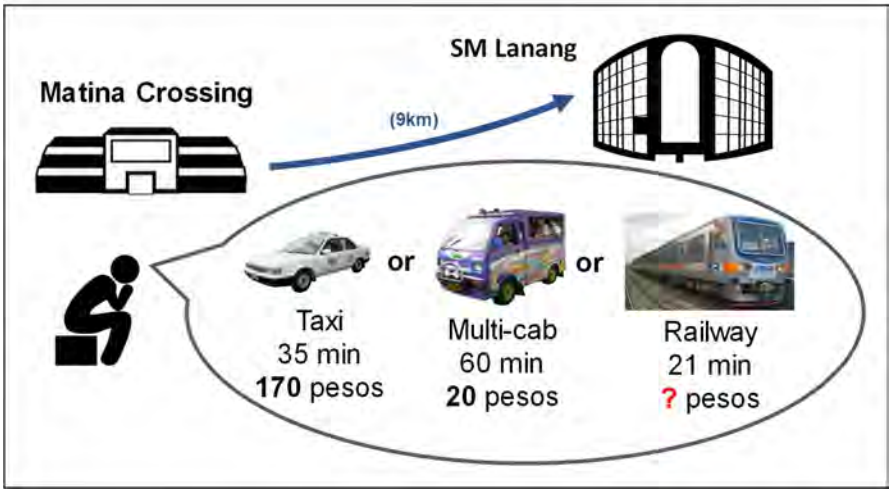
17. Figure 3.7 shows 73% of respondents are willing to walk maximum 5 minutes, which is around 500 meters. There are 15% that can walk within 1 kilometer, but only 12% can walk longer than 10 minutes. The results can be used for design of parking lot service area and location of public transport stops.



Source: IM4Davao Team

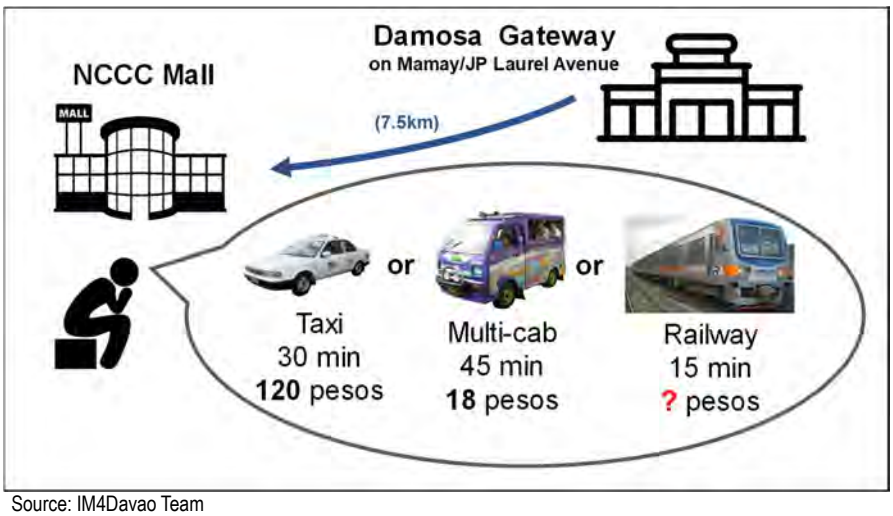
Figure 3.7 Willingness to Walk

18. There is a proposal for an elevated urban railway (LRT or Monorail) from Toril to the airport that passes through J.P. Laurel Avenue and MacArthur Highway. A willingness-to-pay survey was conducted to provide valuable information for investment planning for public services. Namely, it can provide the indicators for the most suitable technical options, the right size of facilities, the future consumer's willingness or ability to pay and long-term sources of funding for construction, O&M, expansion, and rehabilitation. Two scenarios were created as in Figure 3.8. Scenario 1 is suggesting passengers are going to SM Lanang from Matina Crossing (9 km) and they have three modal choices: taxi (35 min, PHP170), multi-cab (60 min, PHP20), and railway (21 min) for that trip with travel time and fare, but the rail fare is variable from PHP50 to PHP10. Another scenario assumes users are going to NCCC Mall (Ma-a) from Damosa Gateway on Mamay/J.P. Laurel Avenue (7.5 km) and also have three modal choices: taxi (30 min, PHP120), multi-cab (45 min, PHP18), and railway (15 min) for that trip, with fare ranging from PHP50 to PHP10 as well.



Source: IM4Davao Team

Figure 3.8 Willingness to Pay (Scenario 1)



Source: IM4Davao Team

Figure 3.9 Willingness to Pay (Scenario 2)

19. Both scenarios have similar results. About 80% of respondents are willing to pay PHP50 regardless of how cheap multi-cab fares are, implying that majority of passengers consider time saving as an important factor, and accept to pay more to reduce travel time. However, this result is considered to be higher than expected. Maximum MRT fare is Metro Manila is PHP40, but results in Davao show higher. This can contribute to the limitation of the survey. During questionnaire implementation, respondents were waiting for the public transport in peak hours, and this caused their stronger willingness for better public transport such as urban railway system. An actual willingness to pay relies on further study and discussion.

Table 3.2 Willingness to Pay for a Planned Mass Rapid Transit Service

	Scenario 1		Scenario 2	
	No.	%	No.	%
PHP50	916	80.56	908	79.86
PHP40	28	2.46	21	1.85
PHP30	76	6.68	77	6.77
PHP20	57	5.01	68	5.98
PHP10	47	4.13	51	4.49
None	13	1.14	12	1.06
Total	1137	100	1137	100

Source: IM4Davao Team

ANNEX 5: PERSON TRIP SURVEY FOR CAR-OWNED HOUSEHOLDS

1 Background and Objectives

1. The IM4Davao Project has developed the latest city traffic database including (i) traffic count, vehicle occupancy survey, and OD interview survey at the cordon line; and (ii) traffic count and vehicle occupancy survey at the screen line.

2. An existing data on origin–destination (OD) trip information of Davao City residents gathered in the early 2015 was acquired from a previous project conducted by the Cities Development Initiative for Asia (CDIA).[1] The IM4Davao Project, then, generated a 2017 data from its various surveys to update and supplement the earlier data.

3. The Person Trip Survey for Car-Owned Households (hereinafter referred as "Person Trip Survey") aims to update the 2015 OD matrix and to obtain daily trip data in aid of future traffic demand forecast. Survey results can be utilized as an essential database from which to cull existing travel behaviors of people and to forecast future traffic demand. The contents of the survey include household information, all household member information, one day trip information, and traffic accident-prone area.

2 Survey Methodology

1) Survey Process

(a) Preparation

4. Prior to the implementation of the survey, the subcontractor trained supervisors and surveyors and conducted two dry runs on 16 and 18 December 2017 to ensure a better understanding of the survey method by the survey staff. This time, the survey was conducted by the tablet (Magpi app), so the proper training and tablet setting were implemented.

(b) Field Survey

5. Person Trip Survey is a household interview survey by interviewers who visited target households and interviewed the respective household heads and every household member according to the survey forms.

6. Samples were selected by the subcontractor with close contact of barangay captains for support of sample selection and safety information.

(c) Encoding, Data Entry and Error Check

7. Guided by barangay code tables, encoders assigned a code to each barangay representing a respondent's residence, workplace, and trip origin and destination. Data were encoded during the survey by the tablet, which saved time for error check.

8. Magpi is the mobile phone application that served as the first level review of data. Its data were uploaded to the server and central data managers, in turn, prompted survey supervisors and interviewers when the data needed cross-checking.

[1] The CDIA-funded "Managing the Cities in Asia: Davao Sustainable Urban Transport Project" aimed to provide support to the local government of Davao City in developing its approach to the modernization and improvement of its transport system with a view to identifying specific interventions that could be the subjects of more detailed feasibility studies and subsequent investment.

2) Survey Items

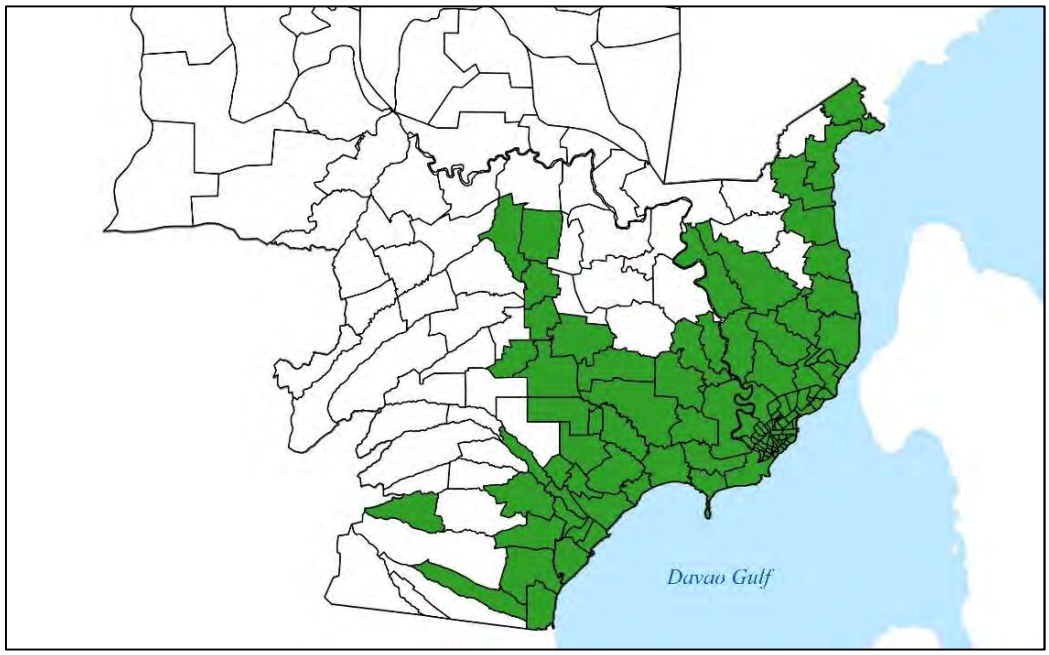
9. The survey forms shown include the items listed below.

(i) **Household Information:** This questionnaire covers the socio-economic characteristics of the households, their structure, income levels, location of residence, number of years in said residence, etc.

(ii) **Household Member Information:** This questionnaire covers the socio-economic characteristics of each household member. These include age, gender, education level, occupation, work or school address, income, and car ownership.

(iii) **Daily Trip Information:** This questionnaire covers all trips (origin, destination, time) made by of each household member 5 years old and above in the last 24 hours beginning at 3:00 a.m. of the previous day and ending at 3:00 a.m. of the survey day.

(iv) **Traffic Accident-Prone Area:** This questionnaire provides a map of Davao. Respondents have to mark top 5 traffic accident-prone area (intersection, roadside) from their past experience.



Source: IM4Davao Team

Figure 2.1 Surveyed 108 Barangays of Person Trip Survey

3) Survey Coverage

(a) Sample Size

10. The respondent households based on number of samples are listed in Table 3.1. The survey was conducted to determine the proper distribution of the total number of barangays across the 108 barangays.

(b) Target Households

11. Only car-owned households (includes SUV, pick-up, Innova as shown in Figure 2.2) were the survey target. Not included are the taxi, multi-cab, motorcycle, truck, tricycle, bicycle, etc.

Source: IM4Davao Team

Figure 2.2 Car (including SUV, pick-up, Innova)

(c) Survey Period

12. To get the daily trip of weekday (Tuesday to Thursday), the survey was mainly done from Wednesday to Friday. Data of daily trip on 26–28 December 2017 and 2 January 2018 were avoided.

(d) Survey Respondents

13. Household member and daily trip information were conducted among all household members over 5 years old in each respondent household, while household information and traffic accident-prone area were filled out only by the household head.

4) Implementation of Person Trip Survey

14. The subcontractor mobilized the survey team composed of 1 Survey Chief, 1 Survey Specialist and Programmer, 3 Survey Supervisors, and 15 Surveyors/Interviewers through an extensive orientation and training on the survey forms.

Source: IM4Davao Team

Figure 2.3 Person Trip Survey Photos

15. The survey respondents were selected with the assistance of the respective purok leaders. During the courtesy calls to barangay halls, they provided the names of the purok leaders who can assist in the identification of households with cars. There were instances when barangay councilors accompanied interviewers to the respective households. In some subdivisions, the survey team approached the homeowners' association president to assist in the identification of households with car. In the absence of the BLGU personnel or association president, the interviewers would make house-to-house visits to households with cars.

5) Survey Schedule

16. Table 2.1 shows the survey schedule of Person Trip Survey.

Table 2.1 Field Person Trip Survey Schedule

Activity	Schedule
Review of Survey Forms and Tablet Setting	12–16 December 2017
Training of Interviewers	16 and 19 December 2017
Dry-Run/Pilot Interviews	16–19 December 2017
Actual Fieldwork	20 December 2017–7 February 2018
Compiled Database	14 February 2018
Final Survey Report	22 February 2018

Source: IM4Davao Team

6) Survey Problems Encountered and Actions Taken

17. The Person Trip Survey encountered some problems, issues, and concerns during the course of its implementation to wit in Table 2.2.

Table 2.2 Survey Problems Encountered and Actions Taken

Problems Encountered	Actions Taken
Lack of cooperation of some barangays and the household respondents.	To counter this, the survey team secured the knowledge and imprimatur of the City Mayor who has the moral suasion with the barangay and household respondents.
There were a number of refusals to participate in the survey due to busy schedule and security concerns.	To counter this, the survey team secured Certificate of No Objection (CNO) from the city.
	The team also decided to move to middle class subdivisions where household owners are much easier to approach compared to guarded and secured high-end subdivisions.
	Looked for another respondent/s, requested assistance from the barangays, or explained again the project objectives.
The timing of the survey coincided with barangay's schedule of releasing clearances.	To address this and avoid delays, the survey team had to conduct the survey interview even without assistance from the barangay officials.
Tablet units do not really respond fast to Magpi application. Most of our interviewers were having problem during the uploading of the data completed.	Quick/Immediate feedback to programmer to immediately address the problem. Always gave feedback to the interviewers of the number of successfully uploaded surveys.
Errors on automatic GPS reading on Magpi form	The interviewers were advised to also note down original readings.

Source: IM4Davao Team

3 Person Trip Survey Results

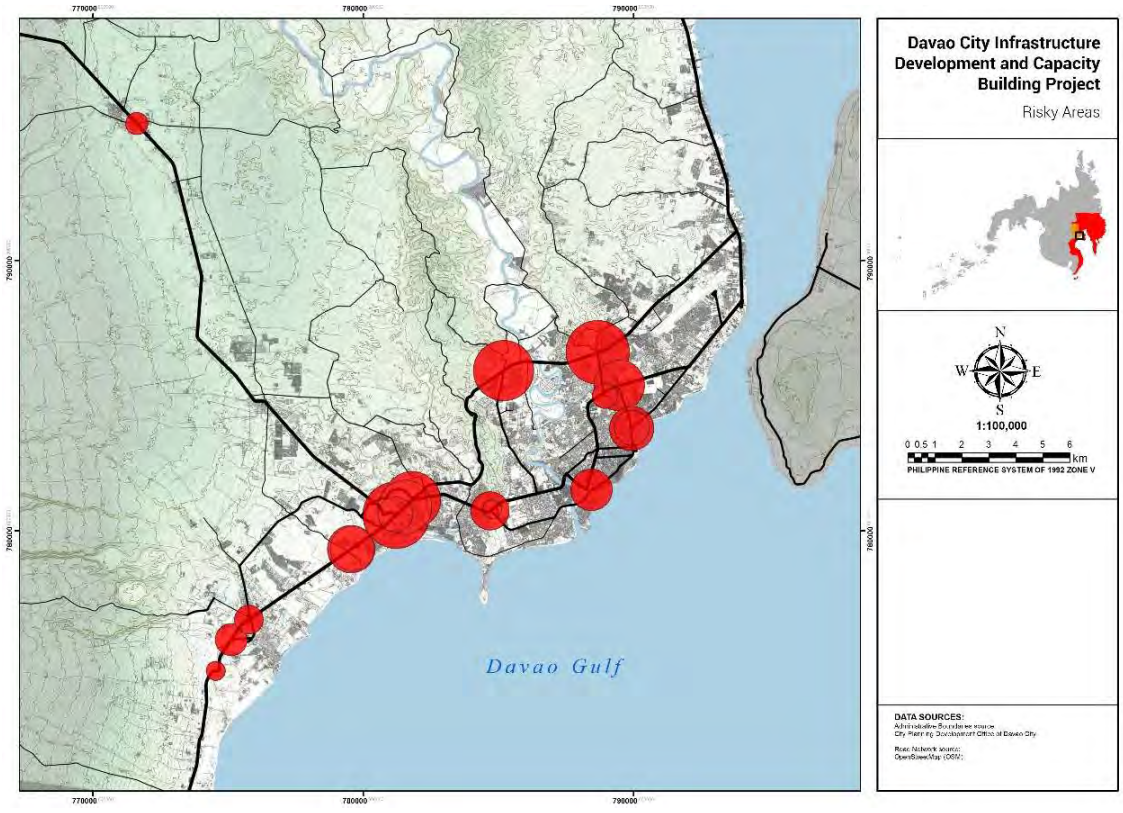
18. The Person Trip Survey covered 108 out of 182 barangays in Davao City with 1006 randomly selected household-respondents across barangays. Barangays with peace and order problems at the time of scanning were not included in the survey. Table 3.1 summarized the distribution of household respondents.

Table 3.1 Summary of Household Respondents by District

Congressional District	Administrative District	No. of Barangays		Household Samples
		Total	With Samples	
District 1	Poblacion	40	40	205
	Talomo	14	14	265
District 2	Agdao	11	11	101
	Buhangin	13	13	191
	Bunawan	9	6	88
	Paquibato	13	0	0
District 3	Baguio	8	0	0
	Calinan	19	3	26
	Marilog	12	0	0
	Toril	25	13	81
	Tugbok	18	8	49
Total		**182**	**108**	**1006**

Source: IM4Davao Team

1) Traffic Accident-Prone Area



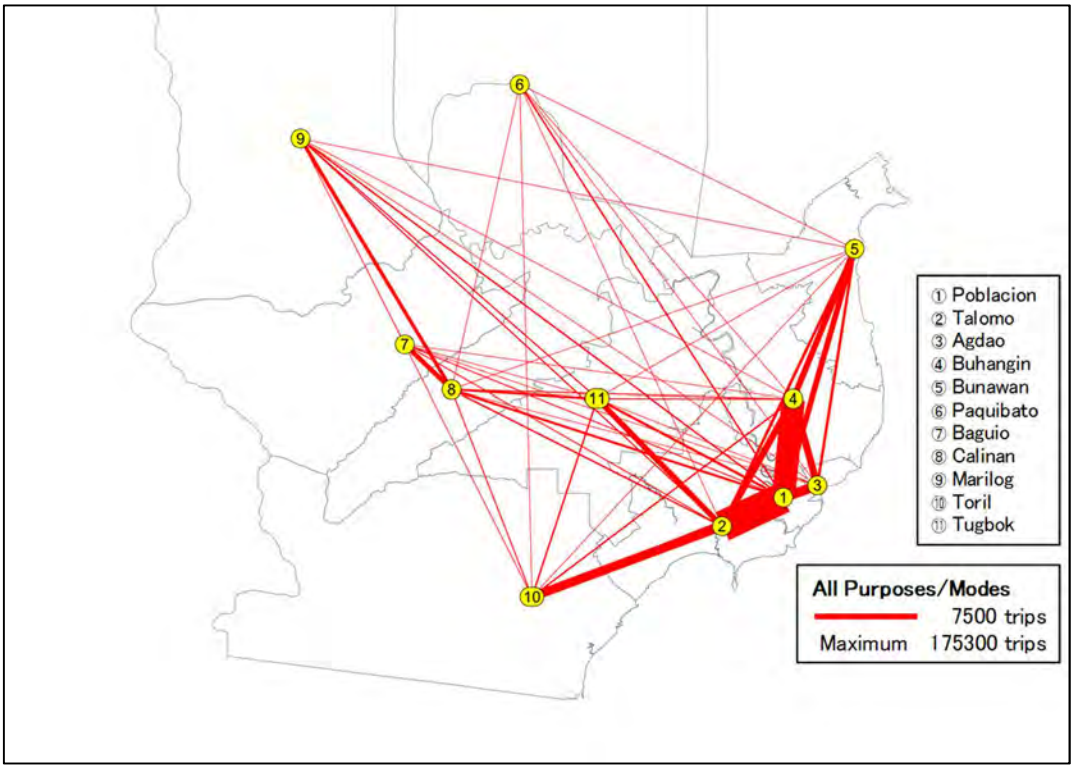
Source: IM4Davao Team

Figure 3.1 Traffic Accident-Prone Area

19. Figures 3.1 indicates interviewee's perceived top 20 traffic accident-prone areas within Davao. The results show traffic risky sections include (i) Buhangin underpass, (ii) Buhangin flyover, (iii) Agdao flyover, (iv) Andres Bonifacio Rotunda, (v) Ma-a, (vi) Matina, (vii) Bangkal, (viii) Ulas intersection, (ix) Bago Aplaya, and (x) Toril.

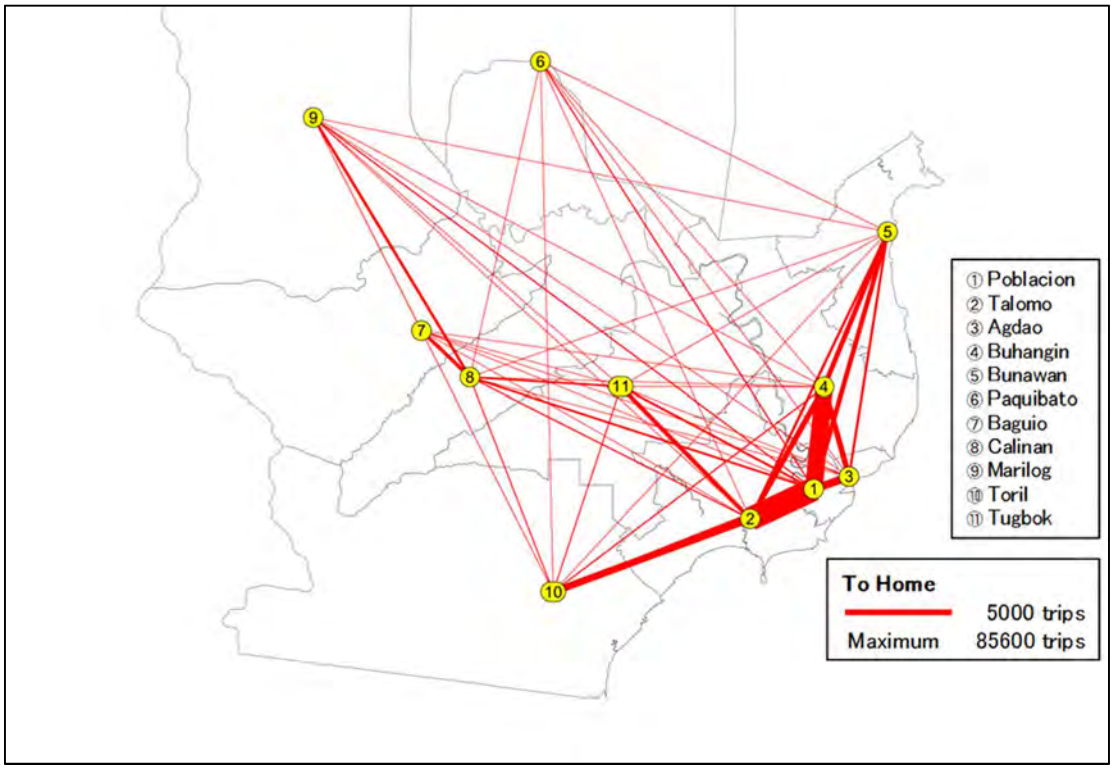
2) Trip Distribution

20. Trip distribution among 11 districts within Davao City by all (see Figure 3.2), purposes (see Figures 3.3 to 3.7) and modes (see Figures 3.8 to 3.15) are illustrated. Trips between Poblacion and Talomo and Poblacion and Buhangin account for a big portion of overall traffic demands in Davao City.



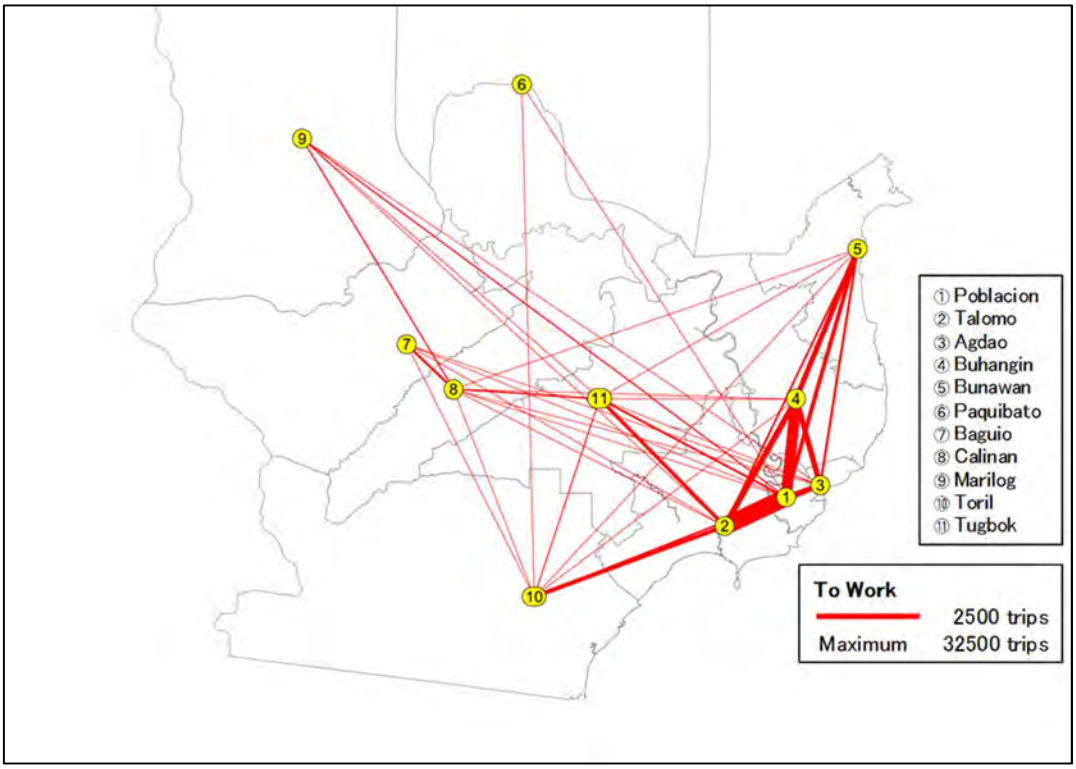
Source: IM4Davao Team

Figure 3.2 Trip Distribution by All Purposes and Modes



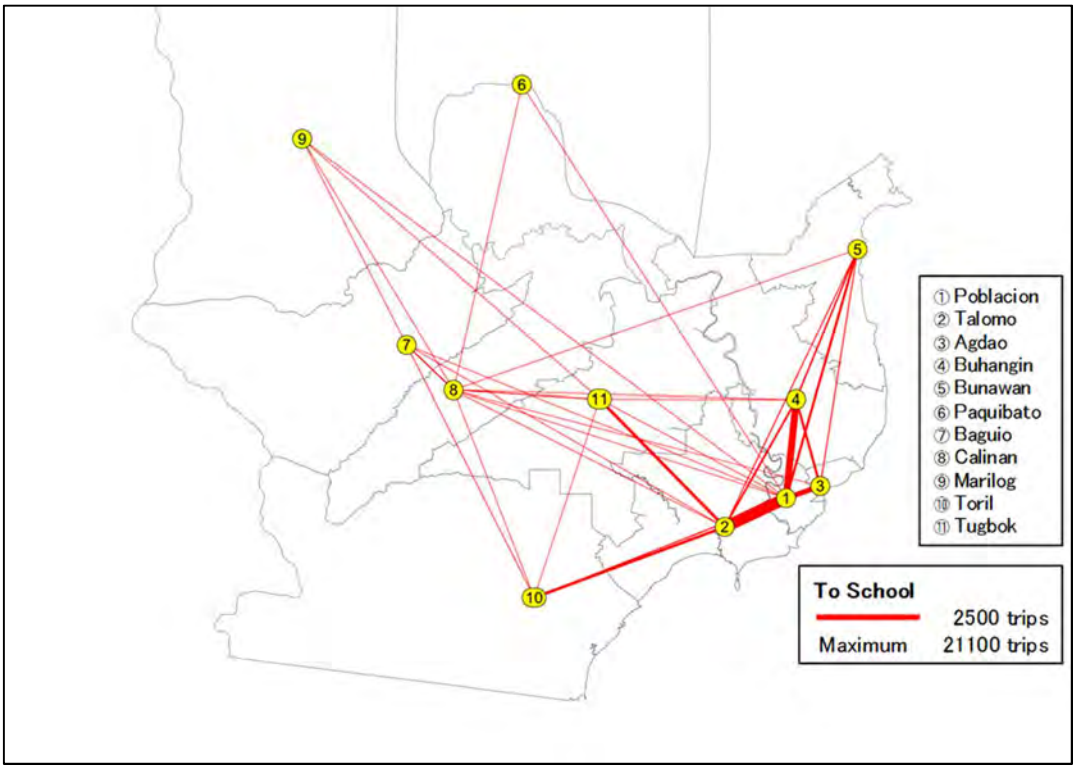
Source: IM4Davao Team

Figure 3.3 Trip Distribution by To-Home Purposes



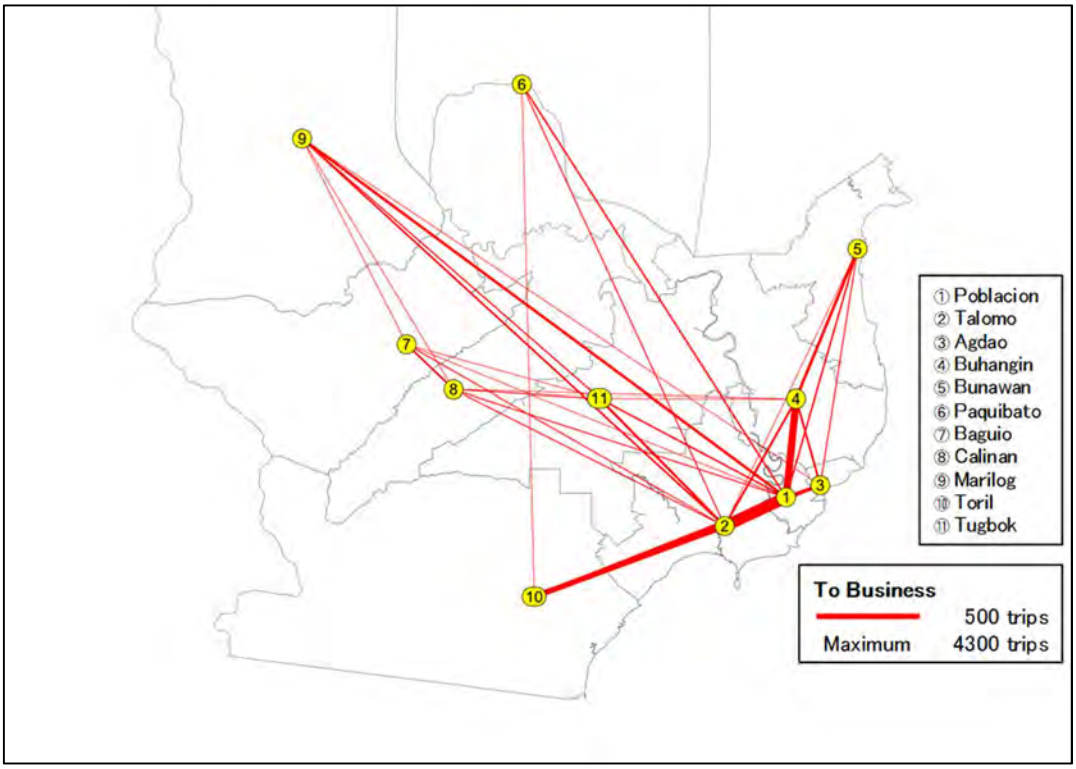
Source: IM4Davao Team

Figure 3.4 Trip Distribution by To-Work Purposes



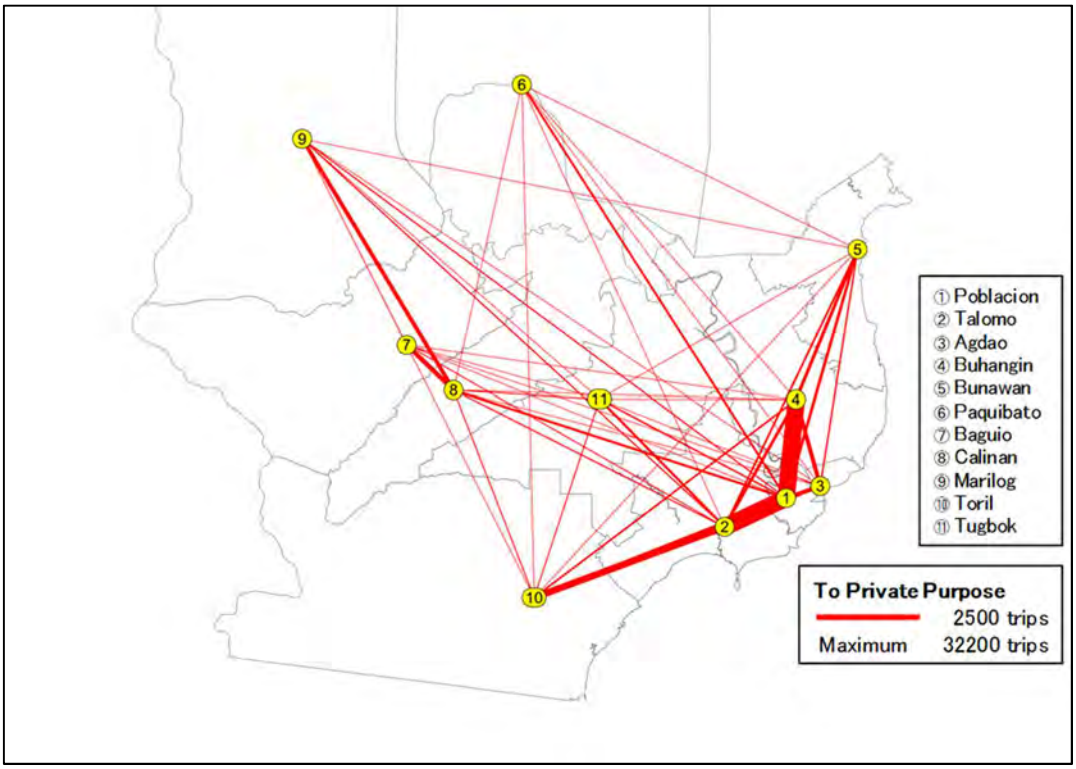
Source: IM4Davao Team

Figure 3.5 Trip Distribution by To-School Purposes



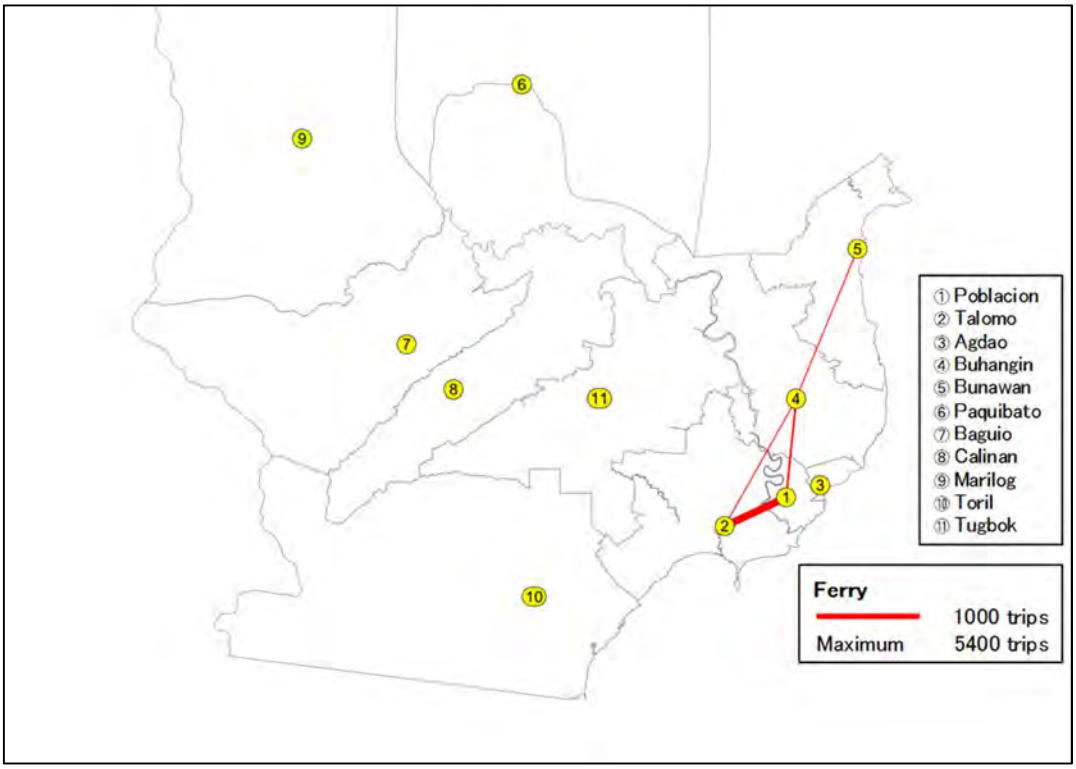
Source: IM4Davao Team

Figure 3.6 Trip Distribution by To-Business Purposes



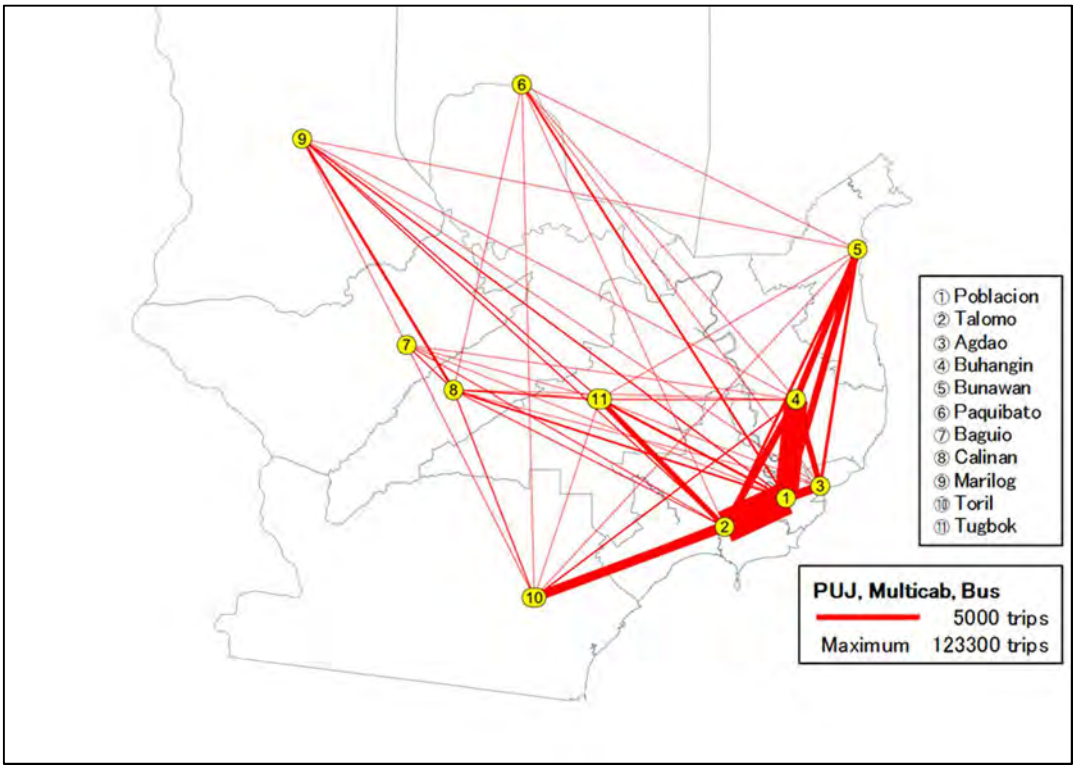
Source: IM4Davao Team

Figure 3.7 Trip Distribution by To-Private Purposes



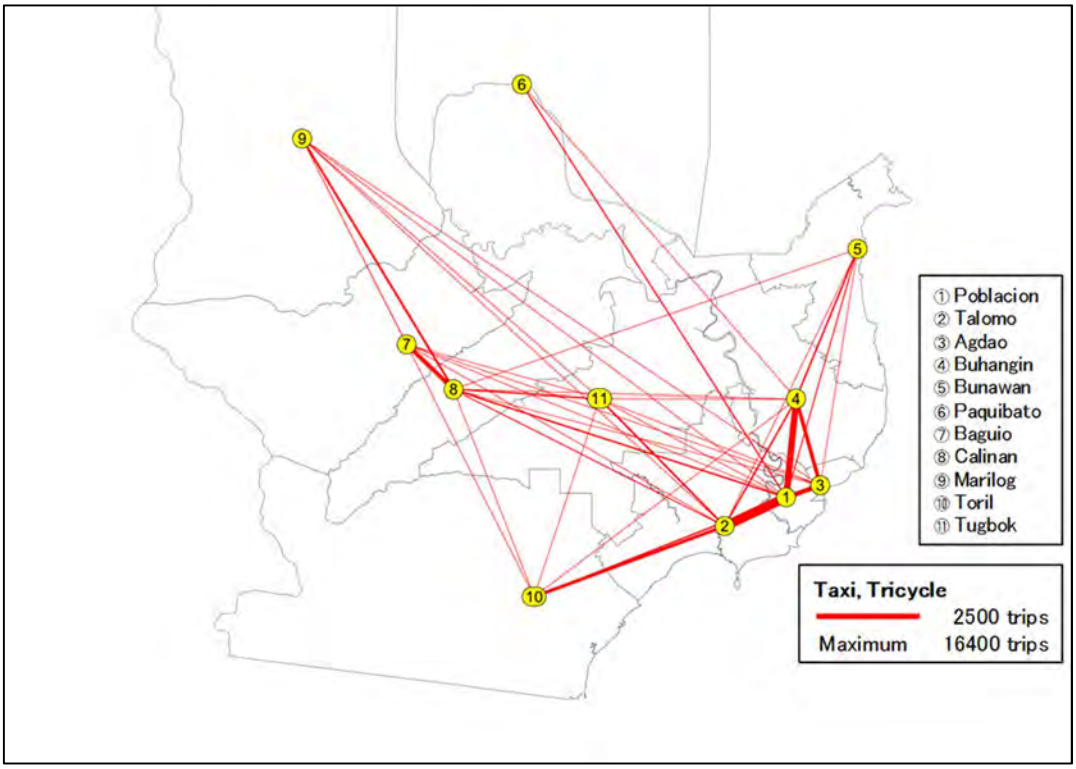
Source: IM4Davao Team

Figure 3.8 Trip Distribution by Ferry



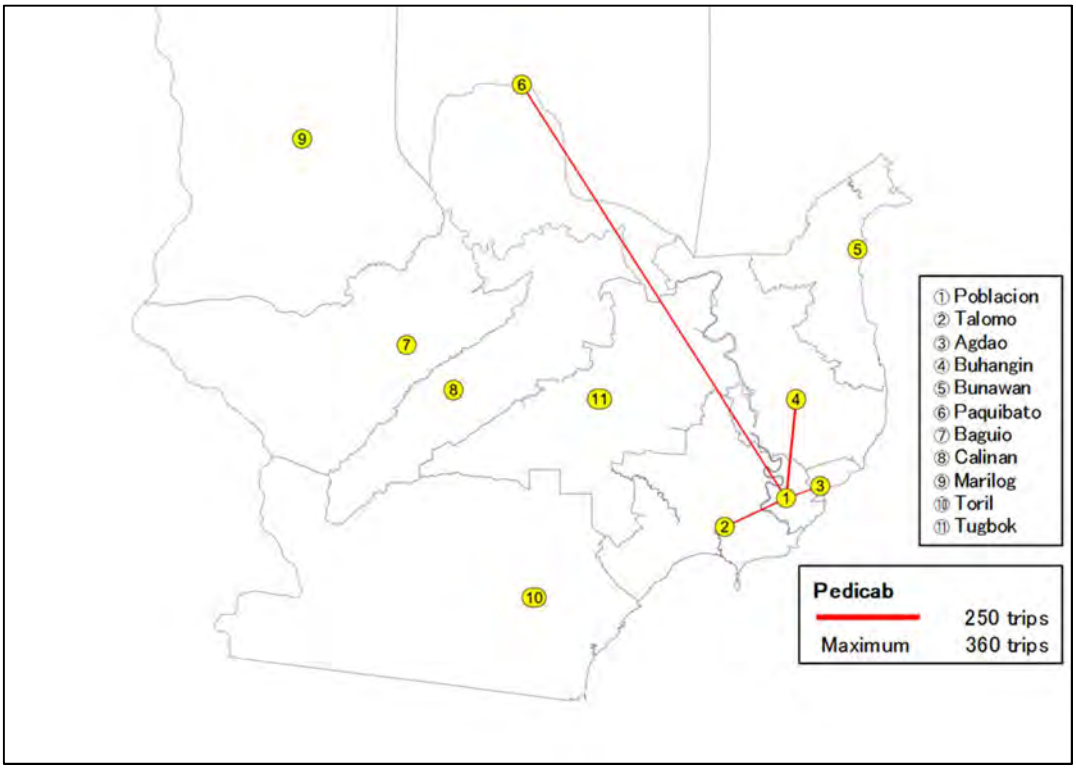
Source: IM4Davao Team

Figure 3.9 Trip Distribution by PUJ, Multicab, Bus



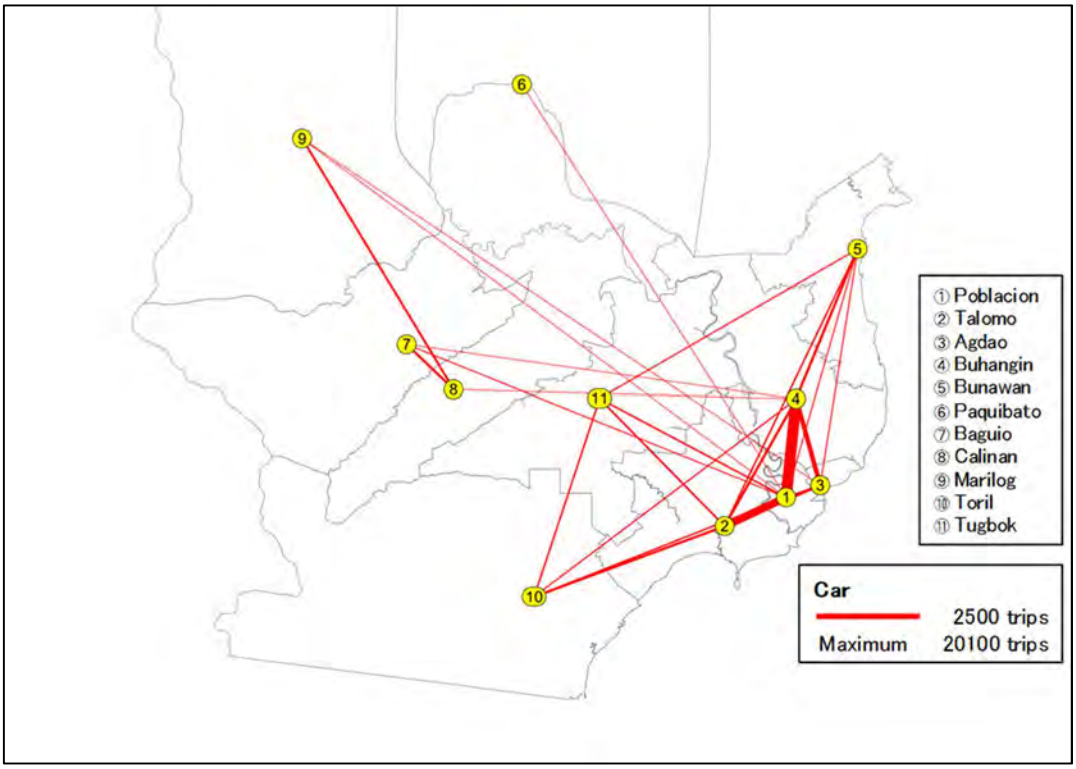
Source: IM4Davao Team

Figure 3.10 Trip Distribution by Taxi and Tricycle



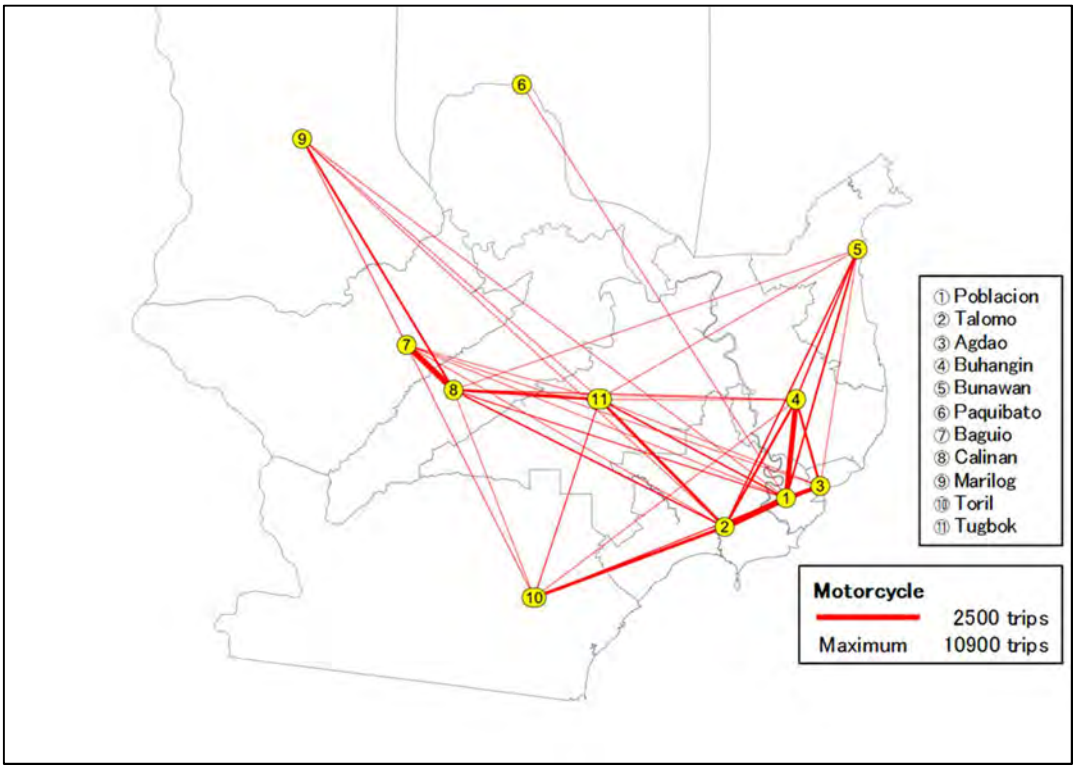
Source: IM4Davao Team

Figure 3.11 Trip Distribution by Pedicab



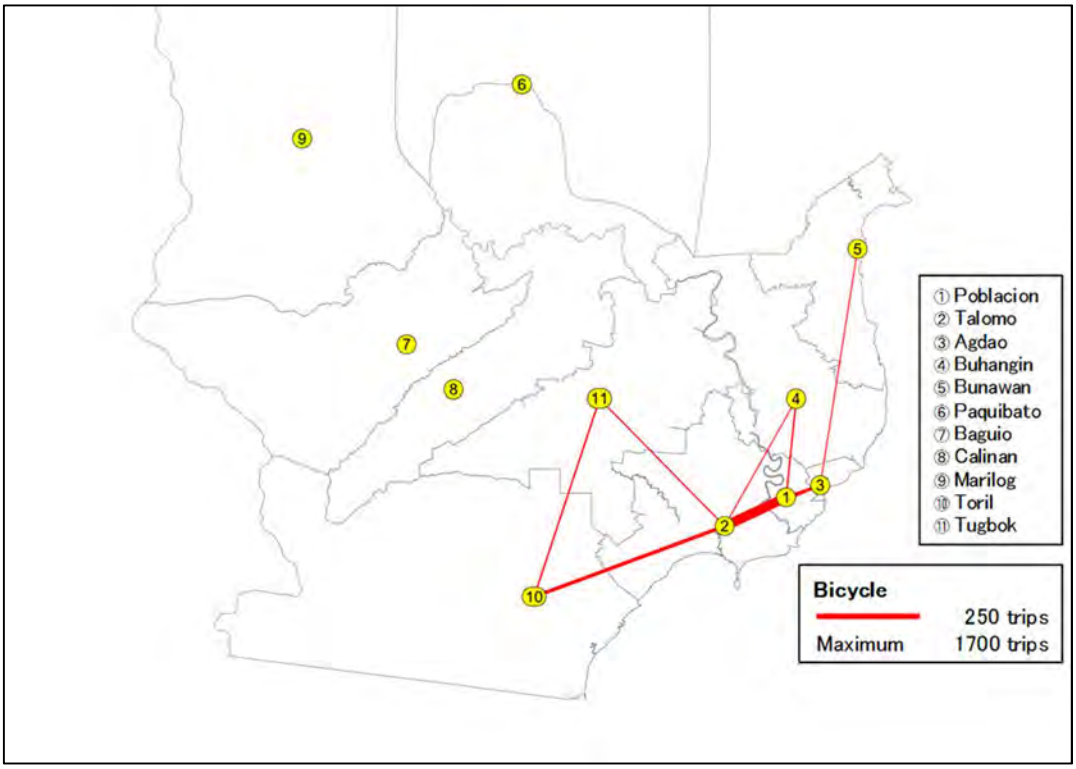
Source: IM4Davao Team

Figure 3.12 Trip Distribution by Car



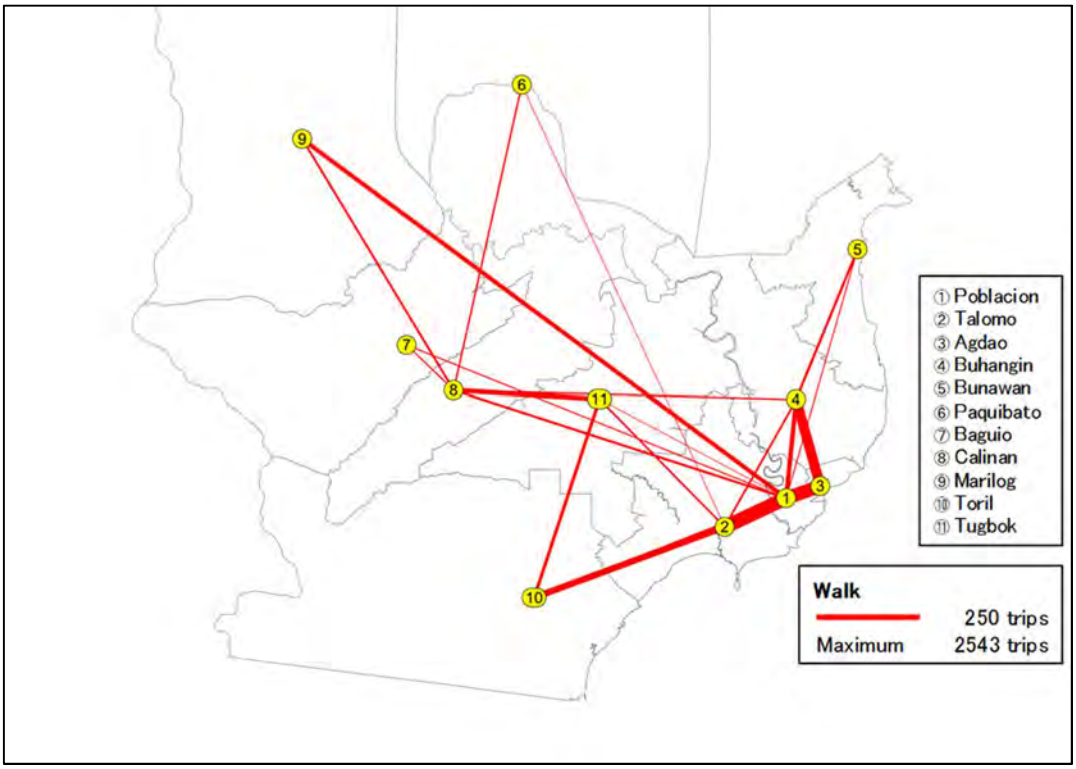
Source: IM4Davao Team

Figure 3.13 Trip Distribution by Motorcycle



Source: IM4Davao Team

Figure 3.14 Trip Distribution by Bicycle



Source: IM4Davao Team

Figure 3.15 Trip Distribution by Walk