APPENDICES

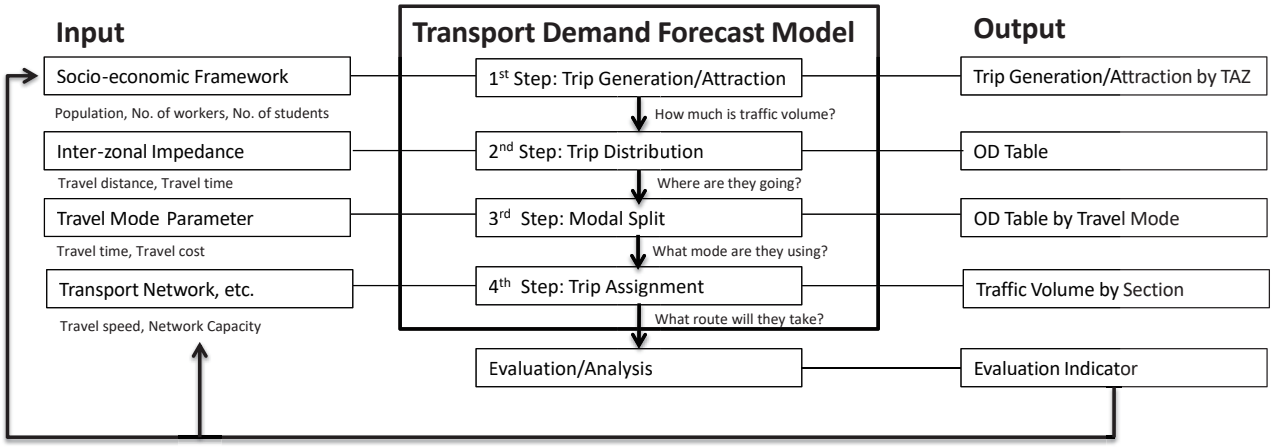
APPENDIX 1 TRANSPORT DEMAND FORECAST

Appendix 1: Transport Demand Forecast

1. METHODOLOGY

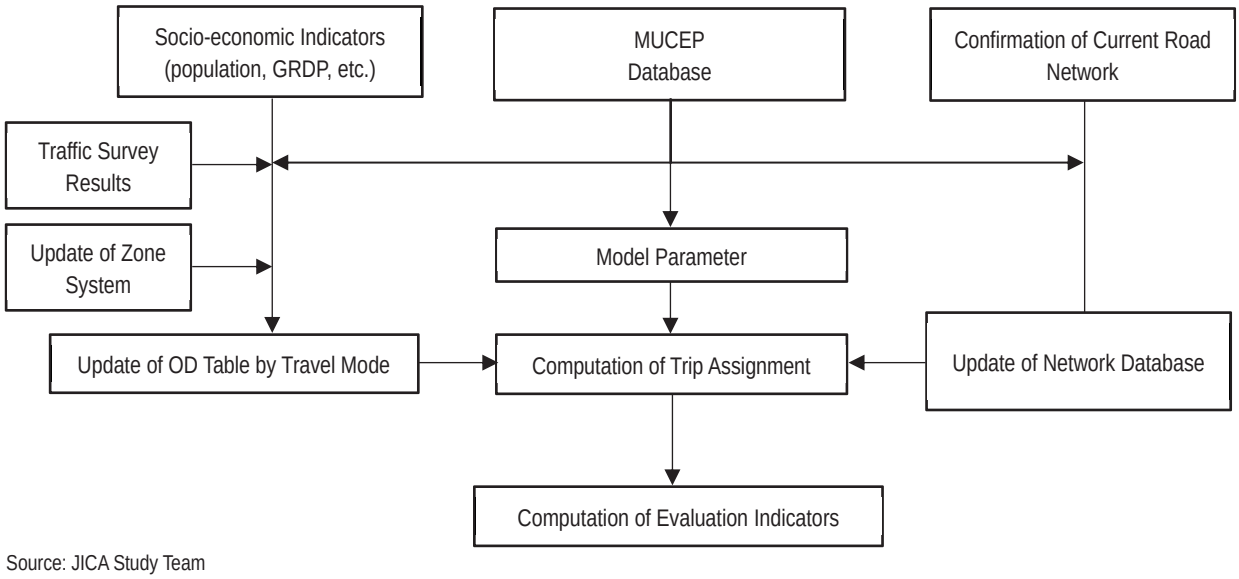
1.1. Methodology of Transport Demand Forecast

1.1 Transport projects, in general, are evaluated through transport demand forecast, and the Four-Step Model is widely used for transport demand forecast. The Four-Step Model is a sequential process to generate transport demand forecast with the following steps: (i) trip generation/attraction, (ii) trip distribution, (iii) modal split, and (iv) trip assignment (Figure 1.1). The required data for the fourth step "trip assignment" is calculated under the first to third steps. When the current transport demand is forecasted using MUCEP database, the trip assignment can be computed with the updated OD table using the travel mode and current transport network (Figure 1.2).



Source: JICA Study Team

Figure 1.1 Four-Step Model



Source: JICA Study Team

Figure 1.2 Forecast Process of Current Transport Demand

1.2. Update of Traffic Database

1.2 The projects that need evaluation in the Transport Roadmap are comprehensive, including urban roads, expressways, railways, and traffic management among others. In March 2017, when this Study started, the latest database of transport demand forecast was that prepared during MUCEP. However, there are several problems to evaluate the projects

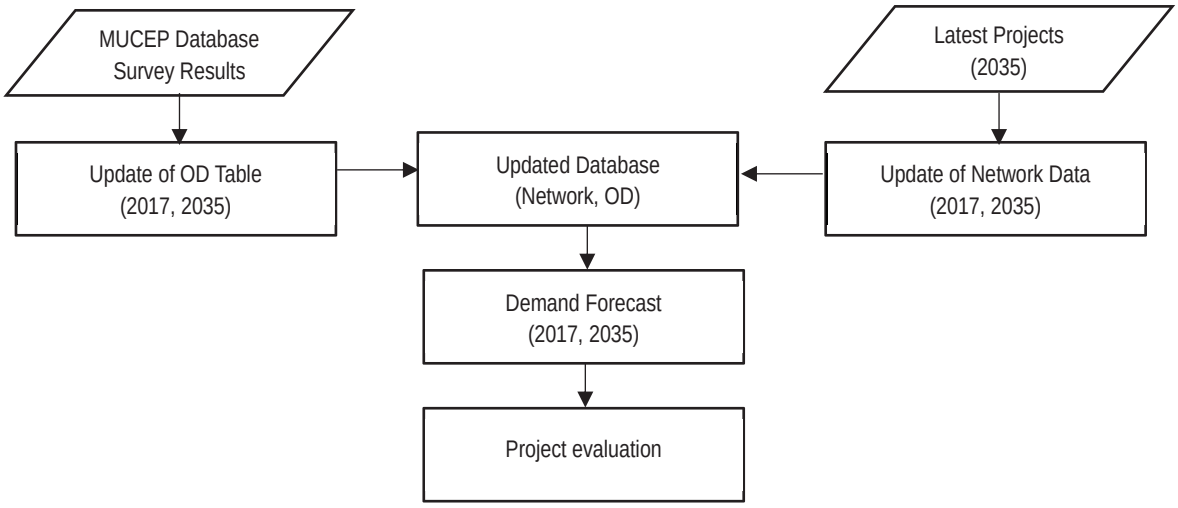
proposed for the updated Transport Roadmap using the MUCEP database as follows.

(i) Since the MUCEP database was developed in 2014, it is becoming old data. For this, The MUCEP database was updated by the traffic survey result of this project, and the project evaluation needs to be carried out based on the latest database.

(ii) Updating the database is useful not only for traffic surveys carried out in this Study, but also for other traffic data, if they are also utilized to improve accuracy. The database needs to be also updated using also MMDA's observable traffic volume on main road.

(iii) The MUCEP database evaluates large-scale projects considering the traffic volume at the macro level and does not explicitly deal with short-distance trips such as para transit. Especially, the tricycle has a big influence on the traffic situation in the Study area because it is caused by the size of the occupied area and low speed despite the small number of trips. For this reason, the tricycle also needs to be included in the updated OD database.

1.3 The MUCEP traffic database was updated with the latest data to solve the above problem. The traffic database needed to be updated is composed of OD table and transport network. The updated database can be updated continuously with available traffic data. The process of database update is shown below in Figure 1.3.



Source: JICA Study Team

Figure 1.3 Demand Forecast Process with Database Update

2. UPDATE OF ORIGIN AND DESTINATION (OD) TABLE

2.1. Zone System

2.1 Evaluating projects include not only large-scale traffic behavior like expressways but also microscopic traffic behavior like urban railway users. In this Study, traffic analysis zone system of MUCEP was applied.

Table 2.1 Comparison of Traffic Analysis Zone System

Area	Roadmap2 (2017)	MUCEP (2014)	Roadmap 1 (2012)
Metro Manila	266	266	94
Bulacan	23	23	26
Laguna	12	12	14
Rizal	22	22	15
Cavite	25	25	23
Rest of Region III	13	13	37
Rest of Region IV-A	35	35	18
Special Zones (Airport & Ports)	6	6	8
Other Area in Luzon (External)	30	30	10
Total	432	432	245

Source: JICA Study Team

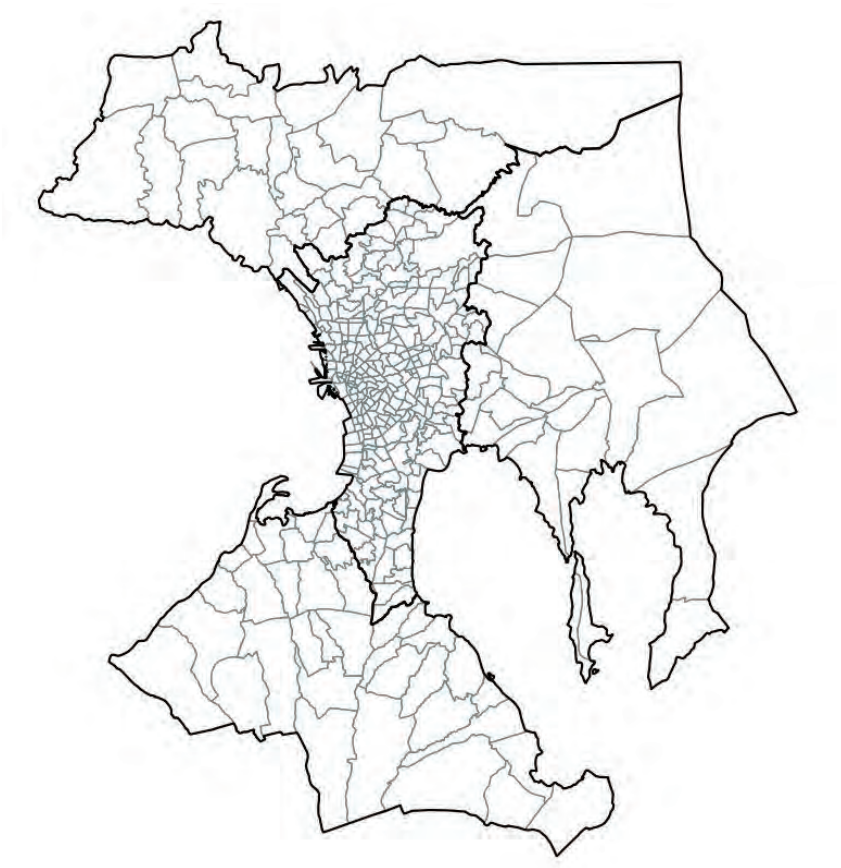
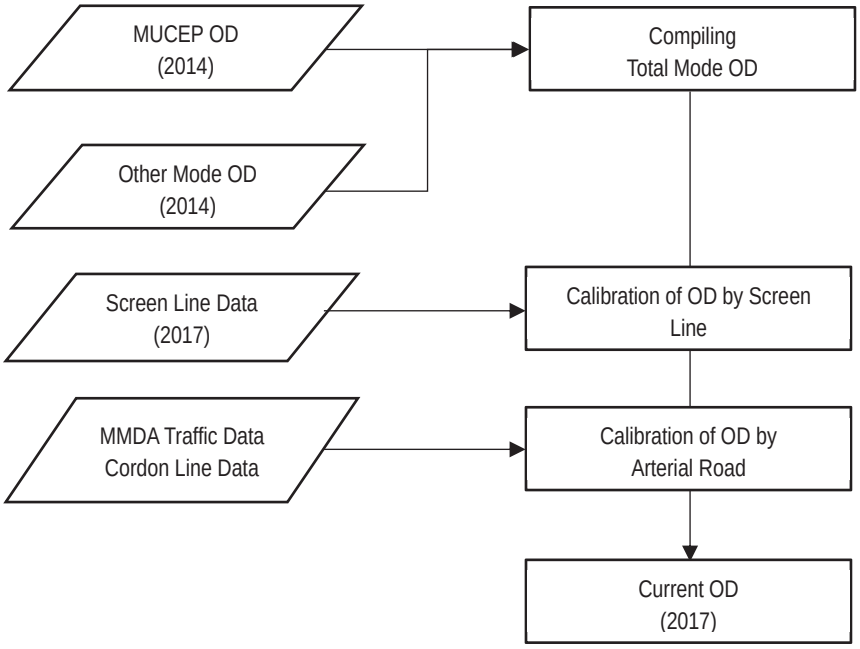


Figure 2.1 Zone system based on MUCEP (Red line shows divided zones in this project)

2.2. Update of O/D Table

1) Update Method using Traffic Count Data

2.2 Since paratransit such as tricycles affects to other transport modes significantly, OD data was updated including tricycle trips. On the other hand, the conduct of household interview survey (or person trip survey) is costly and time-consuming. Considering this fact, the OD data was updated using the available survey data in this Study. The data used to update OD data was the result of screen line survey conducted in this Study and Metro Manila Development Authority's (MMDA) traffic count data (Figure 2.2).



Source: JICA Study Team

Figure 2.2 O/D Calibration Method with MMDA Traffic Data

2) Vehicle Type

2.3 In order to consider the traffic behavior of other vehicle types such as tricyles, vehicle types to be included for demand forecast were re-examined (Table 2.2). The change from the previous studies is the inclusion of motorcycle and tricycle.

Table 2.2 Categorization of Vehicle Types included in Demand Forecast

Vehicle Types	Category in Demand Forecast		
	Roadmap 2 (2017)	MUCEP (2014)	Roadmap 1 (2013)
Motorcycle	Private	Private	Not included
Private car	Private	Private	Private
Taxi	Private	Private	Private
Jeepney	Public	Public	Public
Bus	Public	Public	Public
Truck	Private	Private	Private
Tricycle	Private	Not included	Not included

Source: JICA Study Team

3) Calibration by Screen Line

2.4 The OD table was updated based on the growth rate of the number of trips crossing the Pasig River (Screen Line). The traffic volume of almost all modes has increased in the period of 2012–2017 (Table 2.3).

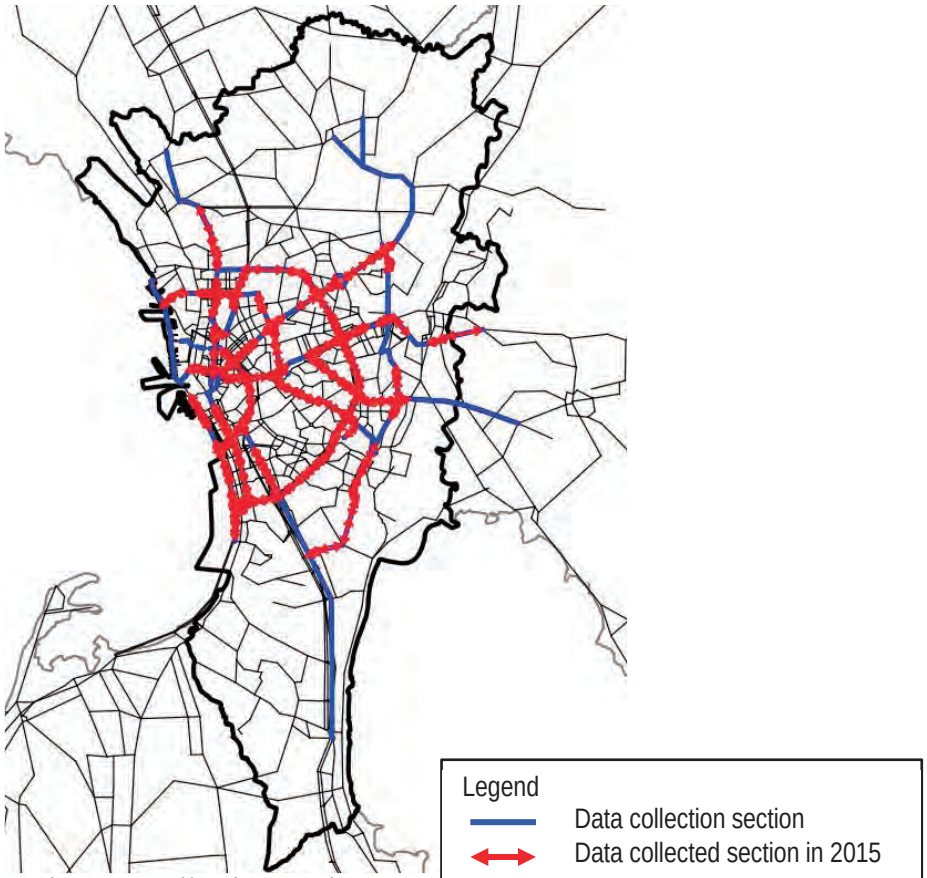
Table 2.3 Results of Screen Line Survey

Mode	MUCEP (2012)	Roadmap2 (2017) (trips/day)	Roadmap 2 OD Adjustment Factor
	(a)	(b)	(c)=(b)/(a)
Non-Motorized vehicle	20,970	17,851	0.851
Private	1,057,727	1,360,308	1.286
Public	1,041,860	1,620,882	1.556
Railway	741,971	473,156	0.638

Source: JICA Study Team

4) Calibration by MMDA Traffic Count Survey

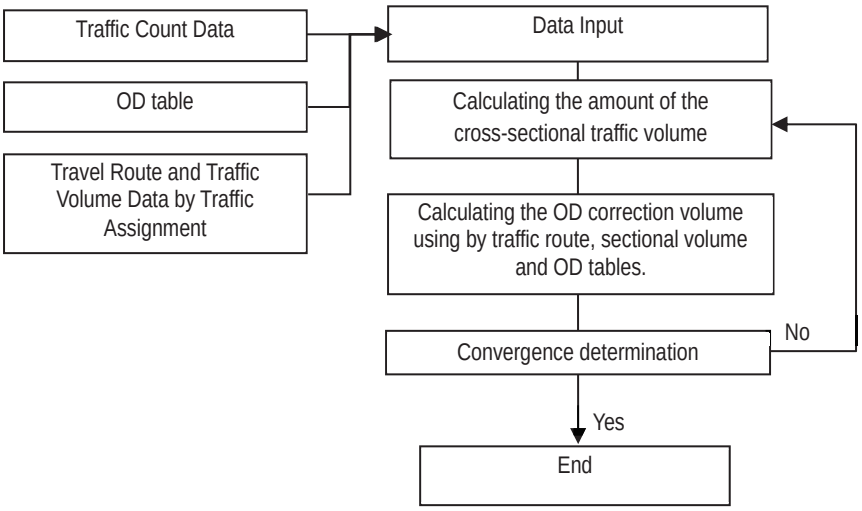
2.5 MMDA has been collecting traffic count data at many stations (Figure 2.3). The survey areas are the main roads in Metro Manila. In 2015, the surveyed sections are inside and outside of EDSA. Targeted modes were motorcycle, car, jeepney, bus, truck, and tricycle. This data is usually used to compute the annual average daily traffic (AADT) for road facility design.



Source: JICA Study Team prepared based on MMDA data

Figure 2.3 Road Sections of MMDA Traffic Count

2.6 An OD database correction method using traffic count data was developed. This method changes OD traffic to match the road section traffic volume using the traffic assignment route information. The flowchart of OD database correction method is shown below.



Source: JICA Study Team

Figure 2.4 Methodology of OD Calibration

2.7 MMDA traffic count data in 2015 is shown in Table 2.4. The total AADT was 2.6 million vehicles in a day. EDSA had the most traffic with 368,000 vehicles in a day.

Table 2.4 MMDA Traffic Counted Result in 2015

Road Name		Metro Manila Annual Average Daily Traffic (AADT) in 2015 (000 vehicle/day)					
		CAR	Jeepney	Bus	Truck	MC	TOTAL
C:1	Recto	30	16	1	1	23	71
C:2	Mendoza	63	0	0	4	24	92
	Pres. Quirino	76	5	0	6	29	120
C:3	Araneta Ave.	55	2	0	4	28	90
C:4	EDSA (Buendia Ave.)	284	3	14	5	60	368
C:5	Katipunan/ C.P. Garcia	135	1	1	10	46	194
R:1	Roxas Blvd.	138	0	0	1	34	173
R:2	Taft Ave.	56	16	3	1	15	91
R:3	SSH	87	0	1	7	28	127
R:4	Shaw Blvd.	59	10	0	2	25	95
R:5	Ortigas Ave.	73	10	1	5	32	121
R:6	Magsaysay Blvd.	57	13	1	2	26	100
	Aurora Blvd.	56	17	0	2	19	94
R:7	Quezon Ave.	136	8	1	4	35	186
	Commonwealth Ave.	169	17	6	6	60	259
R:8	A. Bonifacio	26	5	2	7	16	58
R:9	Rizal Ave.	29	13	0	2	26	70
R:10	Del Pan	0	0	0	0	0	0
Marcos Hwy.		112	17	0	6	37	173
McArthur Hwy.		37	10	3	4	28	82
Total		1,679	163	34	81	592	2,564

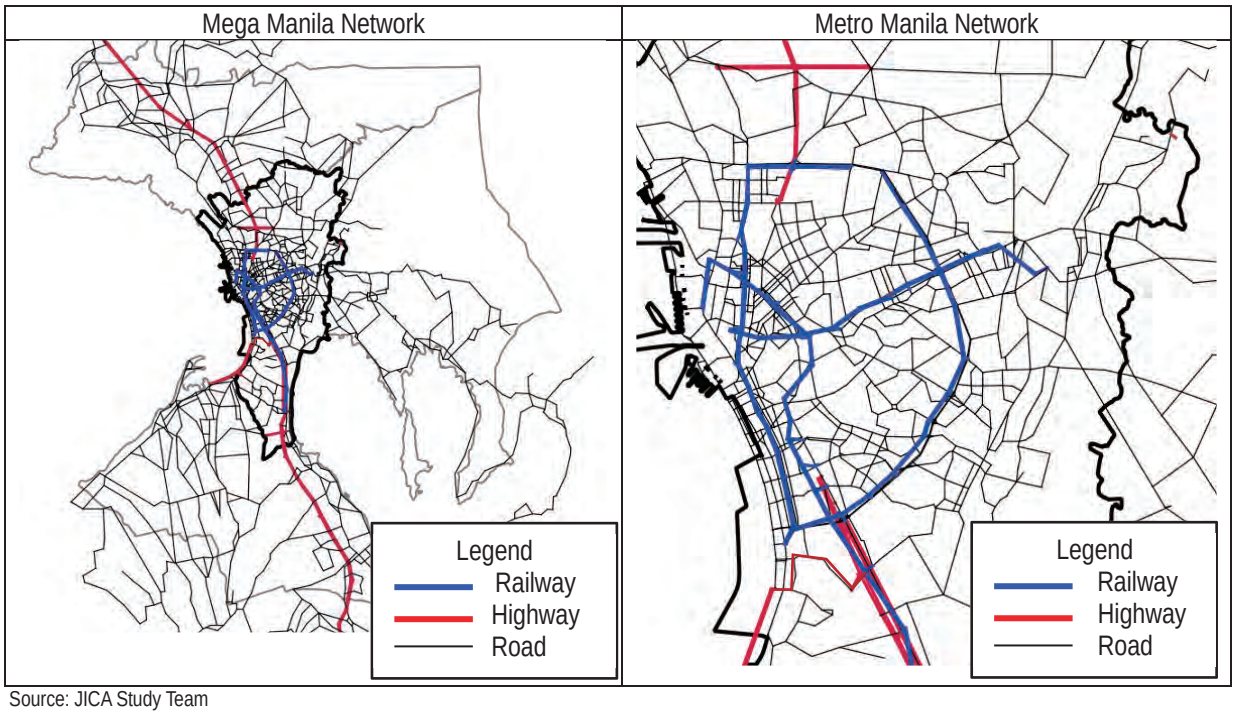
Source: JICA Study Team

3. UPDATE OF TRANSPORT NETWORK DATABASE

3.1. Update of Transport Network Data

3.1 The traffic model network of the base year was developed with consideration on the existing road and railway network, which covers the MUCEP study area. Both highway and rail networks are shown in Figure 3.1. The level of detail of the network model depends on the area. In the inner area of Metro Manila, the network includes all expressways, primary roads (R1-R10 and C1-C5), and most of the secondary roads. In some small zones, local roads are also included. For areas outside Metro Manila but within the Greater Capital Region, all expressways, primary roads, and strategically important secondary roads (those link key conurbations to primary/ national roads) are included.

3.2 The rail network includes the three urban railway lines LRT1, LRT2, and MRT3 and the Tutuban–Calamba section of the PNR. The three mass transit lines run frequent services for about 18 hours per day. PNR operates from 5PM to 9PM between Tutuban and Alabang. A few trains in the morning peak run to Calamba, but the operation is so limited that it was not included in the traffic model.



Source: JICA Study Team

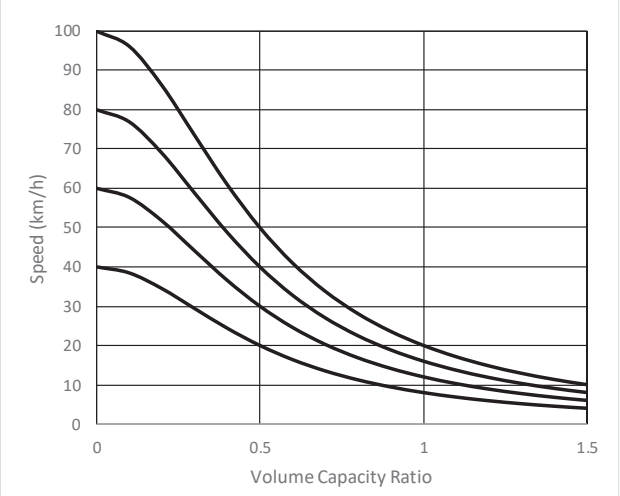
Figure 3.1 Update of Network Data

3.2. Network Performance Function

3.3 The traffic model combined road/ rail network was used to assign O/D table. The assignment process used is based on well-known 'equilibrium' method, where the traffic from each O/D pair is assigned iteratively to the network until no cheaper/ quicker route could be found. The shortest path building was based on the generalized cots of travel for private mode and public transport fares / wait & walk times were represented for the public modes according to the service on each line. The equilibrium method re-calculates the new travel time based on the road capacity and assigned traffic volume after each assignment iteration. As the travel speed slows down with the addition of more traffic after each successive iteration of assignment adds more traffic to the network. The speed/ flow i.e., volume delay function was calibrated according to the network, and is based on the USA BPR adopted formula.

$$Tx = T0\left\{1 + \alpha\left(\frac{V}{C}\right)^{\beta}\right\}$$

Where: *Tx= Travel Time at a Volume/Capacity Ratio x,T0= Travel Time at Maximum Speed, V=Traffic Volume in PCU, C=Road Capacity in PCU; and α and β are Calibrated Parameters with values:* EDSA $\alpha = 3.0$, $\beta = 2.0$, Other $\alpha = 4.0$, $\beta = 2.0$



Source: JICA Study Team

Figure 3.2 Volume Delay Function (α = 4.0, β = 2.0)

3.4 The road capacities and maximum link speed were adopted from the MMUTIS/MUCEP demand model, however, where necessary the road capacity and maximum speed coded in the network were updated according to the current (2017) conditions. The 'base' road capacities and maximum speeds adopted for the study are summarized in Table 3.1.

Table 3.1 Road Capacity and Maximum Speed by Road Category

Area	Road Category	Carriageway Type	Capacity 1-way pcu/day/lane	Maximum Speed (km/h)
Inside EDSA	Local Road	Single	2,200	30
	Secondary	Single	4,400	40
	Primary	Single	6,600	45
Outside EDSA Inside MM (including EDSA)	Secondary	Single	7,700	50
	Primary	Single	8,250	60
	Secondary	Divided	14,000	70
	Primary	Divided	16,500	80
Outside MM	Local road	Single	8,000	30
	Secondary	Single	11,000	55
	Primary	Single	15,400	60
Urban / Intercity	Access / egress	Single	15,000	80
	Expressway	Single	17,000	80
	Expressway	Divided	20,000	100

Note: Based on MMUTIS and MUCEP updated by JICA Project Team where appropriate

3.3. Key Parameters

1) Transport Fare

3.5 The public transport fare and expressway fee were set as follows, considering the current level of fare and toll fee.

Table 3.2 Fare Level

	2017 (PHP)
MMSP	22.0+2.0/km
LRT1	11.0+1.0/km
LRT2	11.0+1.0/km
MRT3	11.0+1.0/km
Line 6	11.0+1.0/km
Line 7	11.0+1.0/km
NSCR	22.0+2.0/km
Jeepney	8(<4km) + 1.5/km
Bus	10(<4km) + 1.8/km
Expressway	4.0/km

Source: JICA Study Team

2) PCU and Load Factor

3.6 Parameters for forecasting is based on MUCEP as below. User equilibrium model is applied for the transportation model.

Table 3.3 Parameter of PCU and Average No. of Passenger by Vehicle Type

	PCU Conversion (pcu/vehicle)	Load Factor (Pax/vehicle)	Value of Time (PHP/hour)
Motor Cycle	0.3	1.2	255
Private Car	1	1.6	413
Jeepney	1.5	8.8	211
Bus	2.5	34.2	271
Truck	2.5	2.2	271

Source: MUCEP

3) VOC Calculation Unit

3.7 Unit cost of vehicle operating cost (VOC) is applied same as MUCEP. The unit cost was set by speed and vehicle type (Table 3.4.).

Table 3.4 VOC Parameter (PHP/1000km)

Speed(km/h)	Motor Cycle	Private Car	Jeepney	Bus	Truck
5	11,122	59,068	40,761	105,050	171,735
10	6,420	33,291	23,382	60,616	95,330
20	3,980	19,945	14,499	37,681	56,576
30	3,145	15,353	11,605	29,800	41,281
40	2,689	13,010	9,958	25,885	33,960
50	2,476	11,626	9,734	24,661	30,730
60	2,443	11,280	10,218	25,080	29,034
70	2,481	11,282	11,085	26,190	28,598
80	2,572	11,492	12,172	27,725	29,734
90	2,726	11,960	13,148	29,272	31,834

Source: MUCEP

4) Emission Factors

3.8 The emission factors for calculating CO2, NOx and PM emissions was calculated from fuel consumption rate by speed level of MUCEP and the calculation method 1 of “EMEP / EEA emission inventory guidebook 2013 update September 2014”. The emission factor is shown below.

Table 3.5 Emission Factors of CO2, NOx and PM (g/km/vehicle)

	Speed (km/h)	Motor Cycle	Private Car	Jeepney	Bus	Truck
CO2	5	2.7357	1.4095	2.6545	1.4524	2.6133
	10	1.7835	0.9189	1.6983	0.9292	1.6721
	20	1.2912	0.6643	1.2281	0.6719	1.2090
	30	1.1177	0.5768	1.1213	0.6136	0.8895
	40	1.0330	0.5317	1.0439	0.5711	0.7384
	50	1.0088	0.5198	1.1213	0.6136	0.6779
	60	1.0410	0.5370	1.2869	0.7041	0.6542
	70	1.1016	0.5682	1.5032	0.8224	0.6779
	80	1.1944	0.6146	1.7288	0.9459	0.7341
	90	1.3194	0.6789	1.9097	1.0447	0.8109
NOx	5	0.3376	1.3920	6.1745	19.0808	34.3324
	10	0.2201	0.9075	3.9503	12.2081	21.9683
	20	0.1594	0.6561	2.8566	8.8270	15.8841
	30	0.1379	0.5696	2.6082	8.0612	11.6862
	40	0.1275	0.5251	2.4282	7.5024	9.7007
	50	0.1245	0.5133	2.6082	8.0612	8.9065
	60	0.1285	0.5303	2.9935	9.2497	8.5944
	70	0.1360	0.5611	3.4966	10.8040	8.9065
	80	0.1474	0.6070	4.0213	12.4265	9.6439
	90	0.1628	0.6705	4.4421	13.7256	10.6537
PM	5	0.1119	0.0048	0.6295	0.5375	0.9671
	10	0.0729	0.0031	0.4027	0.3439	0.6188
	20	0.0528	0.0023	0.2912	0.2486	0.4474

	Speed (km/h)	Motor Cycle	Private Car	Jeepney	Bus	Truck
	30	0.0457	0.0020	0.2659	0.2271	0.3292
	40	0.0422	0.0018	0.2475	0.2113	0.2733
	50	0.0413	0.0018	0.2659	0.2271	0.2509
	60	0.0426	0.0018	0.3052	0.2606	0.2421
	70	0.0450	0.0019	0.3565	0.3043	0.2509
	80	0.0488	0.0021	0.4100	0.3500	0.2717
	90	0.0540	0.0023	0.4528	0.3866	0.3001

Source: JICA Study Team based on EMEP/EEA emission inventory guidebook 2013 update Sept 2014 and MUCEP

4. VALIDATION FOR TRAFFIC MODEL IN BASE YEAR (2017)

4.1. Methodology

4.1 The number of trips on railways and roads were validated by comparing the actual and forecasted total daily ridership and traffic volume. The results are summarized in the tables below. The difference between the actual number of trips and forecasted is within 10 percent of the average daily volume. The forecasted number of trips at the screen line is 9 percent lower than survey results. The forecasted number of trips at the cordon line is 4 percent higher than survey results. The forecasted number of trips at the survey stations of MMDA traffic count is 4 percent higher than survey results. The total railway user is 3 percent difference.

4.2 In general, plus or minus 10 percent difference is within acceptable range. Therefore, the calibrated traffic database is valid.

Table 4.1 Validation with Screen Line

	Motorcycle	Car	Jeepney	Bus	Truck	Total
Survey (000pax)	354	955	429	1,367	69	3,174
Forecast (000pax)	333	1,048	416	1,446	75	3,318
Forecast/Survey	0.94	1.10	0.97	1.06	1.09	1.05

Source: JICA Study Team

Table 4.2 Validation with Cordon Line

		Motorcycle	Car	Jeepney	Bus	Truck	Total	Forecast/ Survey
North Part	Survey (000pax)	157	87	196	65	20	526	
	Forecast (000pax)	168	106	256	30	19	579	1.10
East Part	Survey (000pax)	317	550	532	31	47	1,477	
	Forecast (000pax)	207	524	512	56	45	1,344	0.91
South Part	Survey (000pax)	118	174	210	85	16	603	
	Forecast (000pax)	119	178	281	97	17	693	1.05
Total	Survey (000pax)	593	811	938	181	83	2,606	1.04
	Forecast (000pax)	494	808	1,049	184	81	2,616	
	Forecast/Survey	0.83	1.00	1.12	1.02	0.98	1.00	

Source: JICA Study Team

Table 4.3 Validation with MMDA Count Survey

	000 Volume/day					
	CAR	Jeepney	Bus	Truck	MC	Total
MMDA traffic counted[1/]	1,770	172	36	85	624	2,702
Forecast	1,791	183	60	115	655	2,804
Forecast/Survey	1.01	1.06	1.69	1.34	1.05	1.04

1/ Corrected by growth rate of population from 2014 to 2017. (1.7% in annum was assumed. 1.7 is sourced from Philippine Statistic Authority)
Source: JICA Study Team

Table 4.4 Validation with Railway User

Line	LRT1	LRT2	MRT3	PNR	Total
Ridership data in 2014 (000pax/day)	468	200	460	68	1,195
Forecast (000pax/day)	511	154	508	57	1,229
Forecast/Survey	1.09	0.77	1.10	0.84	1.03

Source: JICA Study Team

4.3 Comparing the results of traffic demand forecast, the forecast results was confirmed. As shown in Table 4.5, the trip rate is similar to the previous Roadmap Study and trip generation has grown due to population increase.

Table 4.5 Comparison of Updated Result[1/]

		Roadmap 2 (2017)		MUCEP (2014)	Roadmap1 (2012)
		With Tricycle[2/]	Without Tricycle[3/]		
Generation Trips	MetroManila	13.4	12.4	11.4	12.8
	BRLC[4/]	5.1	3.7	3.6	6.0
	Mega Manila	18.6	17.3	15.0	18.8
Population	MetroManila	13.0	13.0	12.5	12.1
	BRLC[4/]	11.0	11.0	10.0	9.7
	Mega Manila	24.0	24.0	22.5	21.8
Trip Rate	MetroManila	1.03	0.96	0.91	1.06
	BRLC[4/]	0.46	0.34	0.36	0.62
	Mega Manila	0.78	0.72	0.67	0.86

1/ Excluding walk and intra-zonal trip.
2/ Generation of Roadmap 2 considered tricycles.
3/ Using correction coefficiency, trip generation was calculated.
4/ Bulacan Rizal,Laguna and Cavite Provinces.
Source: JICA Study Team

4.2. Traffic Demand in Base Year (2017)

4.4 The traffic demand in the study area was evaluated using the assignment model with updated database. The results of road and railway traffic are as follows.

1) Road

4.5 Table 4.6 shows the traffic volumes on expressways and primary roads in Mega Manila as well as traffic volumes by areas, i.e. Metro Manila, Bulacan, Laguna, Rizal and Cavite. In Mega Manila, the traffic volume of most of roads are nearly or more than their road capacity. When the traffic volume of the road exceeds 50% of its capacity, the travel speed decreases dramatically and those roads are considered as having heavy traffic.

4.6 In terms of travel speed, the ratio of road sections with less than 10 kph varies while the travel speed of 60% or more of road sections are less than 20kph. This means that the traffic volume of the most of the roads have been reaching their capacity. The traffic volume/capacity ratio of each road section in Mega Manila and Metro Manila are shown in Figure 4.1. Orange and red color in the figures indicate road sections with 1.0 or more of a traffic volume/capacity ratio.

4.7 Among five circumferential roads (C1 to C5) in Metro Manila, C5 has the largest vehicle traffic with 3.4 million PCU-km/day (7.7 million person-km/day), followed by C4 (EDSA) with 2.0 million PCU-km/day (9.4 million person-km/day). The vehicles along more than 80% of C5 and C4 runs at a speed of 20 kph or less, which means that these roads reach its capacity in the whole day. Among the ten radial roads (R1 to R10), R7 has the largest traffic volumes with 3.2 million PCU-km/day (7.9 million person-km/day) Such large traffic concentration generates not only big economic loss, but also high air pollution and the poor quality of living environment.

4.8 The traffic situation along the expressways is better than the primary roads, particularly CAVITEX and NLEX. The volume/capacity ratio of CAVITEX, NLEX and SLEX is only 0.33, 0.07 and 0.31, respectively. Skyway marks relatively high at 0.82 of the

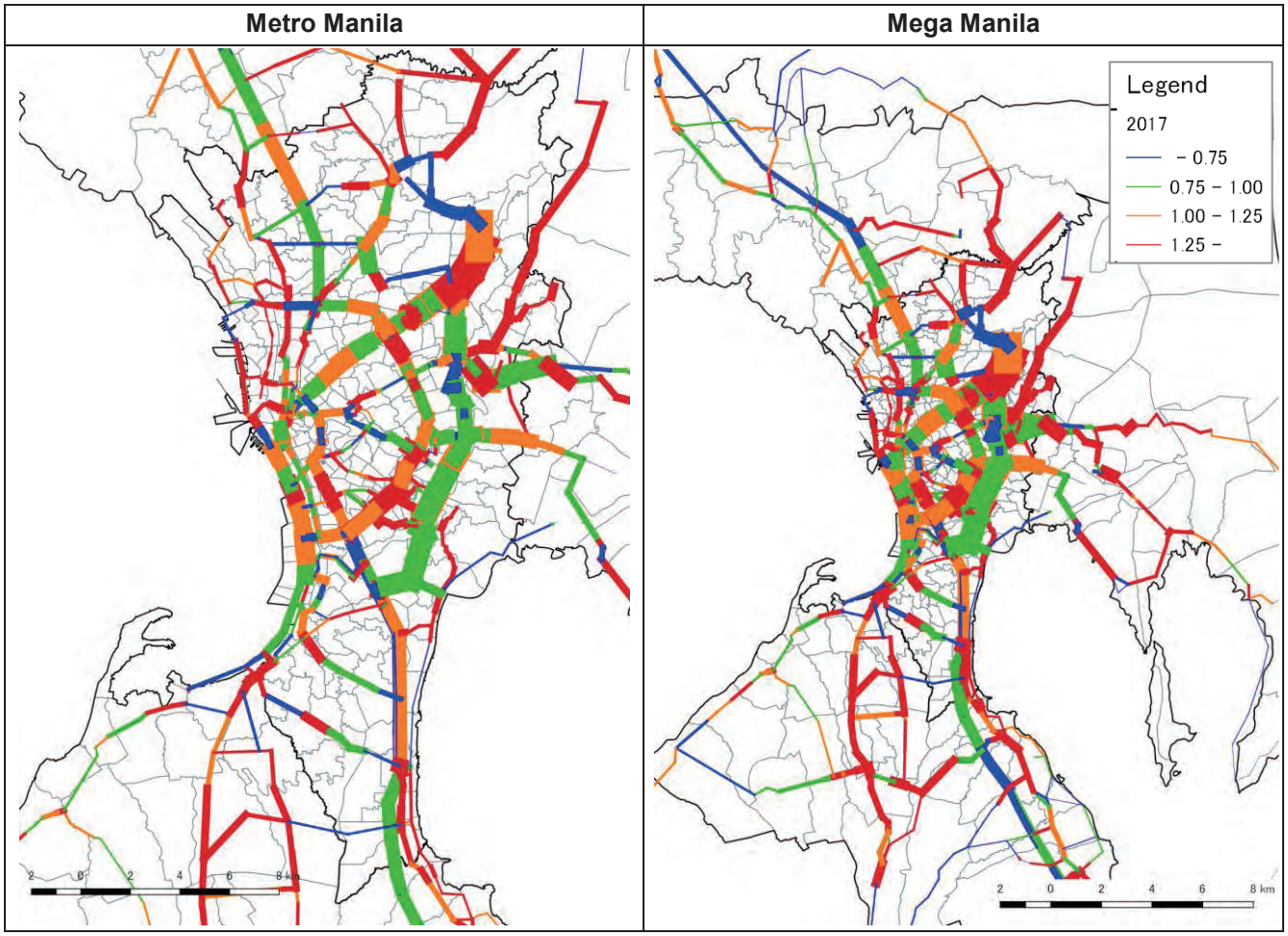
volume/capacity ratio, but still lower than most of the primary roads in Metro Manila.

4.9 In terms of area-wise result, the entire Mega Manila has been suffering from the serious traffic congestions. 44% of roads in Mega Manila shows its travel speed at or less than 10kph. The average traffic volume/capacity ratio is 0.93. Although the traffic management and new route improvement has been proposed since the previous Transport Roadmap was formulated, the traffic congestion has not been solved yet.

Table 4.6 Summary of Road Traffic Volume and Network Performance in 2017

Category	Road/Area	Road Length km	Av. V/C	% of Rd. Section with Speed		PCU (000)		Pax (000)	
				< 10 km/h	< 20 km/h	kms	Hrs.	Kms	Hrs.
Primary Roads	C-1	4.5	1.25	87%	100%	173	14.2	485	39.5
	C-2	10.7	1.04	75%	98%	475	30.6	982	62.9
	C-3	10.7	1.37	69%	100%	322	30.7	664	60.6
	C-4	21.9	0.57	31%	84%	1,983	176.1	9,420	289.1
	C-5	24.2	0.97	33%	89%	3,426	140.5	7,710	307.8
	R-1	8.6	1.03	52%	88%	988	45.7	1,979	89.7
	R-2	7.8	0.95	82%	95%	314	17.8	736	40.1
	R-3	18.7	1.04	28%	100%	1,268	67.1	3,224	169.3
	R-4	9.6	0.99	59%	85%	425	29.3	1,302	94.6
	R-5	17.6	0.94	16%	94%	1,296	52.2	3,035	120.7
	R-6	8.4	1.05	57%	93%	376	25.2	867	54.0
	R-7	30.4	0.80	26%	61%	3,189	132.1	7,924	303.3
	R-8	4.3	1.24	75%	100%	169	13.0	424	29.0
	R-9	10.9	1.19	90%	100%	456	30.7	1,204	79.6
	R-10	6.1	1.33	77%	95%	195	17.3	338	29.8
Expressway	CAVITEX	10.6	0.33	1%	1%	367	18.8	1,732	33.8
	Skyway	77.6	0.83	36%	61%	777	68.2	1,817	149.4
	SLEX	197.2	0.31	20%	36%	2,022	93.2	8,983	277.2
	NLEX	70.7	0.07	0%	14%	274	7.5	1,005	14.6
Area	Metro Manila	1,009	1.04	53%	77%	32,765	3,188	110,755	9,049
	Bulacan	443	0.76	39%	76%	7,740	847	24,280	2,451
	Laguna	208	0.54	23%	50%	3,700	173	14,836	493
	Rizal	294	1.11	48%	66%	5,817	856	14,843	2,158
	Cavite	389	0.88	33%	63%	6,790	412	18,785	1,104
	Mega Manila (Total)	2,343	0.93	44%	71%	56,812	5,475	183,498	15,256

Source: JICA Team.



Source: JICA Study Team

Figure 4.1 Traffic Model – Highway Network Traffic Volume and V/C Ratio (2017)

2) Railways

4.10 There are three mass transit urban railway lines in Metro Manila, and a commuter mainline railway (PNR). The key features of four railways are:

(1) PNR – a narrow gauge 29 km line from Tutuban to Alabang with 16 stations

(2) LRT Line-1 18km with 20 stations standard gauge grade-separated mass transit system from Baclaran in the south to Roosevelt on the northern section of EDSA;

(3) LRT Line-2 16.7 km with 11 stations standard gauge mass transit system from Recto in Manila city to Santolan in the east;

(4) MRT Line-3 16.5km with 13 stations standard gauge mass transit system along EDSA (C-4) from Taft to North Avenue.

5.1 The three mass transit lines and PNR commuter in Metro Manila carried about 305 million passengers in annum in 2015, which decreased from 395 million passengers in 2011. The demand and line capacity characteristics of each line are summarized in Table 4.7. Considering the possible expansion of platform and increase of rolling stocks, maximum future capacity of each line was also estimated. As a result, each line can accommodate almost double of the current demand of railway.

Table 4.7 Characteristics of Travel Demand by Railways in Mega Manila (2011 and 2015)

Description		PNR 1/	LRT Line-1 2/	LRT Line-2 2/	MRT Line-3 2/	Total Railways
Line Length (km)		28.0	18.1	12.6	16.5	75.2
Stations		16	20	11	13	60
2011 Annual Pax (million)		15.4	156.9	63.8	158.8	394.9
2015 Annual Pax (million)		19.2	105.0	62.2	118.2	304.6
AM-Peak Hour Boarding Pax/hr (2012)		2,000[2]	43,200	18,000	48,100	111,300
Peak Line Volume (Max: Pax/hr/direction=pphpd) (2012)		1,000[2]	20,100	11,500	20,300	20,300
Current Operational Headway (mins)		30	3	5	3	-
Current Rolling Stock Crush Capacity (Pax/Train)		~500[2]	1,350	1,600	1,180	-
Current Line Capacity (Pax/hr/direction=pphpd)		1,000[2]	27,100	19,500	23,600	-
Current Load Factor (Line Volume/Capacity)		~100%	74%	59%	86%	-
Maximum Future Capacity 3/: Assuming Extended Trains to Full Platform Length & Modern Connected Car Rolling Stock	Train Length (m)	200	110	110	130	-
	Pax/Train	1,800	1,630	1,630	1,930	-
	Headway	3	2.5	2.5	2.5	-
	Pax/hr/dir=pphpd	36,000	40,000	40,000	46,000	-
Available Capacity @ Current Load and Max-Cap:		97%	50%	71%	56%	-

Source: PNR/ LRTA/ MRT Data &JICA Study Team Analyses.
1/ PNR Data is for Tutuban to Alabang and peak period data is estimated by the study team.
2/ Lines 1&2 Data is for March 2012, Line-3 Data if for September 2012, and PNR for February 2012.
3/ Future Capacities are estimated based on possible capacity expansion program.

5. PREPARATION OF FUTURE OD TABLE

5.1. Workflow of Future Traffic Demand Forecast

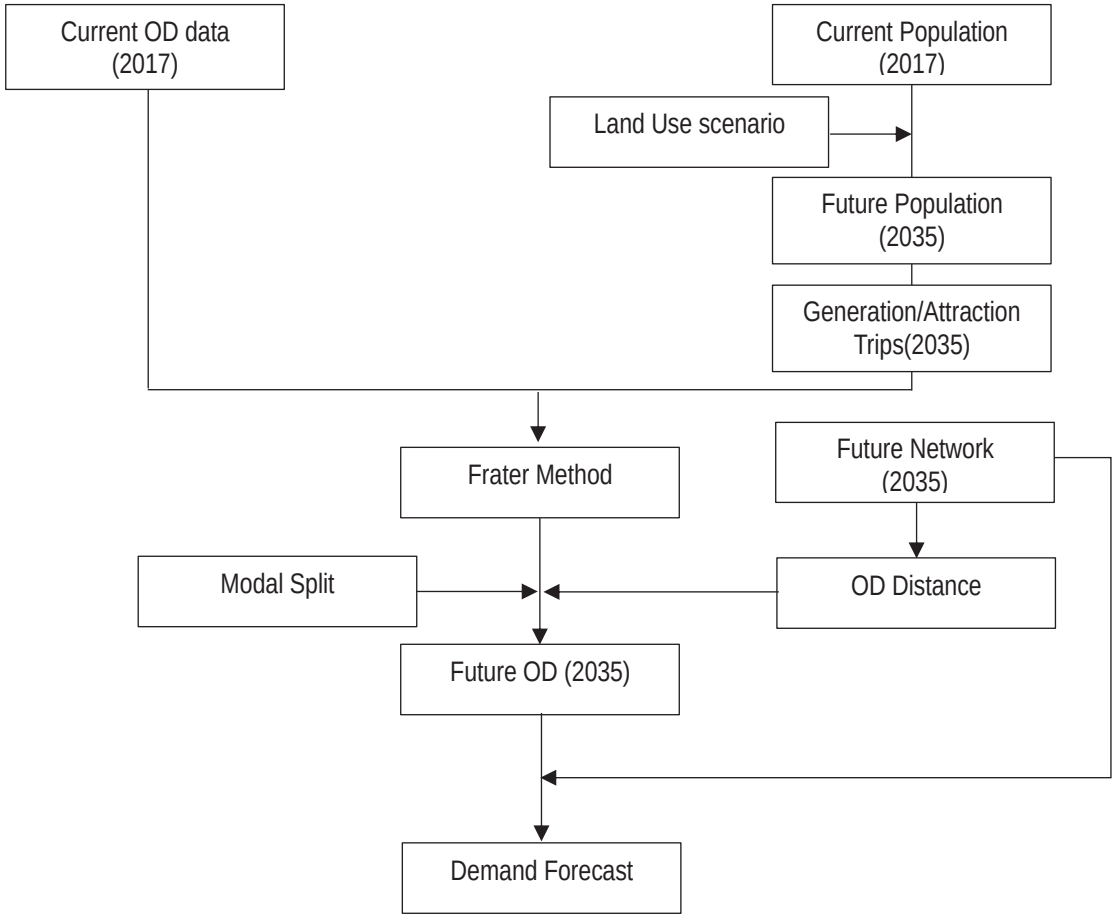
5.1 The work flow for the future demand forecast is as follows;

(i) **Future Generation/Attraction Trips:** The future traffic volume of generation and attraction was calculated from the current OD data reproducing the current traffic situation using the predicted future population

(ii) **Future OD Table:** The future OD table was prepared using the frater model to maintain the present OD pattern.

(iii) **Future OD Table by Travel Mode:** OD tables for each travel mode were prepared by modal split model based on the distance between future origin and destination.

(iv) **Traffic Demand Forecast:** Traffic demand was forecasted using the future transport network composed of the existing transport network and on-going/committed/planned transport projects of the government agencies.



Source: JICA Study Team

Figure 5.1 Workflow of Future Transport Demand Forecast

5.2. Future Traffic Demand in 2035 (Do-nothing Case)

5.2 The traffic volume of generation and attraction was calculated based on the population growth between 2017 and 2035. OD table of private and public travel modes were also prepared using the modal split model. The results of transport demand forecast for 2035 are shown in Table 5.1.

5.3 The number of trips in Mega Manila was estimated to increase by about 24% by 2035, which is similar to the population growth rate of 27% in the same period. While the number of trips in Metro Manila would increase by 20%, that of the adjoining areas would increase by 35%. Due to the densification of Metro Manila, it is expected that more people move to the adjoining areas, which resulted in farther increase in the traffic demand in the adjoining areas.

5.4 Comparing the private and public transport modes, the future public share is still high in the future and it is around 70% in Metro Manila. However, the trip generation of private modes would increase more than that of public transport in both Metro Manila and the adjoining areas. This is due to the insufficient public transport services and network.

Table 5.1 Growth of Trip Generation in the Period of 2017 - 2035

		2017		2035		2035/2017	
		PCU (mil. pcu/day)	Trips (mil. trips/day)	PCU (mil. pcu/day)	Trips (mil. trips/day)	PCU (mil. pcu/day)	Trips (mil. trips/day)
Metro Manila	Private	3.0	3.9	4.0	5.2	1.33	1.33
	Public	1.4	9.5	1.5	10.9	1.07	1.15
	Total	4.4	13.4	5.5	16.1	1.25	1.20
BRLC	Private	1.2	1.6	1.7	2.3	1.42	1.44
	Public	0.6	3.5	0.7	4.6	1.17	1.31
	Total	1.8	5.1	2.4	6.9	1.33	1.35
Mega Manila	Private	4.2	5.5	5.7	7.5	1.36	1.36
	Public	2.0	13.0	2.2	15.5	1.10	1.19
	Total	6.2	18.5	7.9	23.0	1.27	1.24
Population (million)		23.1		29.3		1.27	

Source: JICA Study Team.

5.5 The impact of traffic demand in 2035 without implementing new projects (Do-nothing Case) was evaluated using the current transport network and future OD table (Table 6.2 and Figure 6.2). As a result, the serious traffic congestions can be seen in the entire transport network in Mega Manila.

5.6 For the primary road of Metro Manila, C5 and C4 (EDSA) would have the large traffic with 3.3 million pcu-km (8.3 million person-km) and 2.0 million pcu-km (12.4 million person-km) among five circumferential roads while R7 would have the largest traffic concentration with 3.7 million pcu-km (11.7 million person-km). Thus, the tendency of traffic congestions would be the same as the current situation.

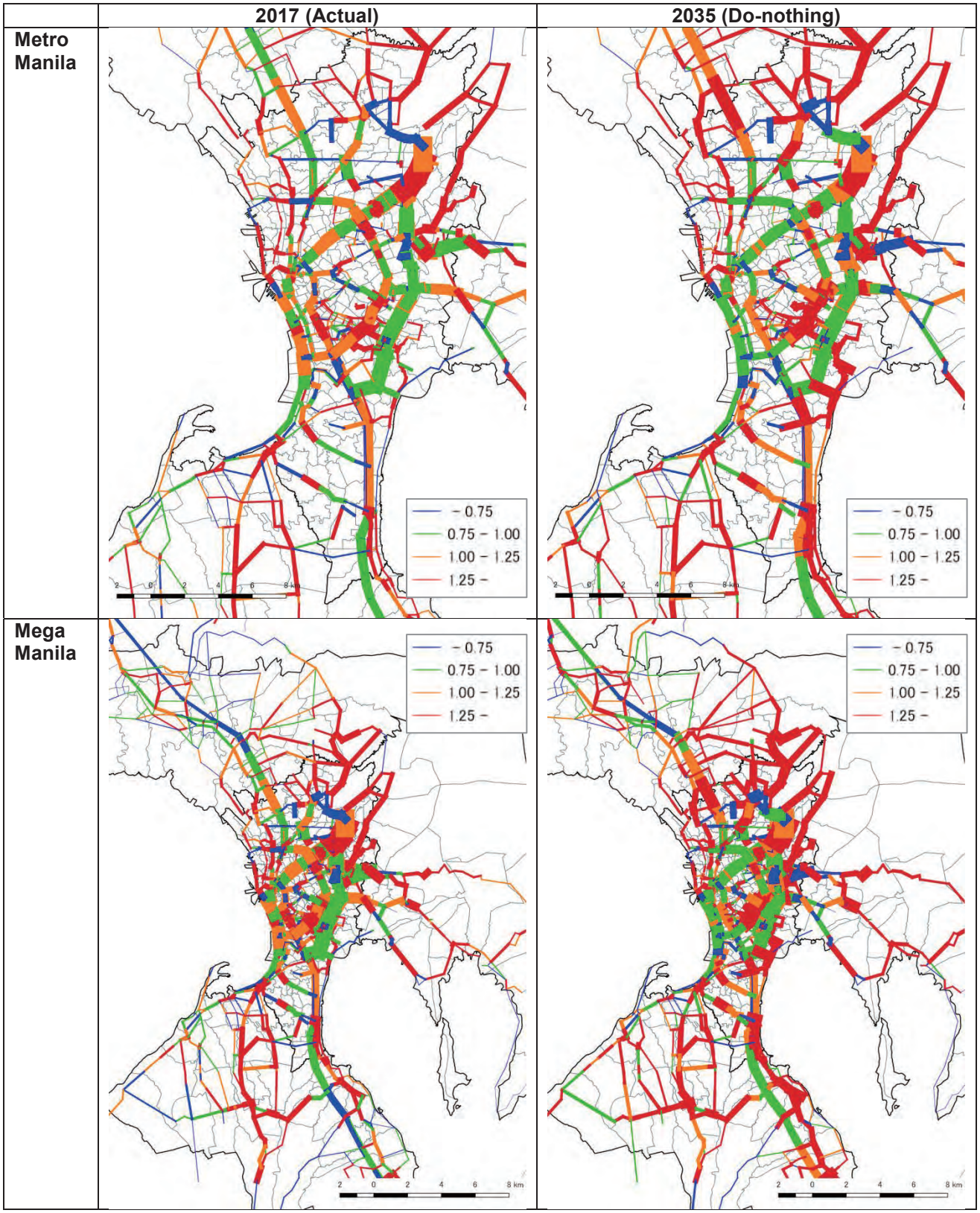
5.7 For the expressways, the traffic congestions along SLEx and Skyway would be even worse while the volume/capacity ratio of CAVITEX, NLEX and SLEX would be still low with 0.13 to 0.48.

5.8 At the area-based analysis, the volume/capacity ratio would reach 1.18 or more in the entire areas. The road sections with the travel speed of 10kph would exceed more than 60%.

Table 5.2 Summary of Road Traffic Volume and Network Performance in 2035

	Road Description	Road Length km	Av. V/C	% of Rd. Section with Speed		PCU (000)		Pax (000)	
				< 10 km/h	< 20 km/h	kms	Hrs.	Kms	Hrs.
Primary Road	C-1	4.5	1.43	86%	100%	199	22.5	598	59.1
	C-2	10.7	1.04	71%	98%	477	31.4	1,508	99.1
	C-3	10.7	1.33	75%	92%	312	27.8	780	70.6
	C-4	21.9	0.57	29%	87%	1,996	171.2	12,379	438.8
	C-5	24.2	0.94	21%	88%	3,319	128.3	8,264	317.5
	R-1	8.6	0.99	46%	88%	951	40.3	2,399	101.3
	R-2	7.8	0.93	60%	93%	307	17.7	1,060	62.4
	R-3	18.7	1.17	81%	100%	1,424	94.8	4,476	295.6
	R-4	9.6	1.14	61%	87%	491	49.6	1,836	166.3
	R-5	17.6	0.89	9%	92%	1,237	47.2	4,195	159.4
	R-6	8.4	0.99	51%	91%	357	20.3	1,076	59.8
	R-7	30.4	0.92	29%	78%	3,674	166.0	11,736	509.2
	R-8	4.3	1.33	78%	100%	181	15.5	545	43.1
	R-9	10.9	1.27	99%	100%	486	35.4	1,502	108.8
	R-10	6.1	1.34	77%	98%	197	17.8	419	37.9
Expressway	CAVITEX	10.6	0.42	1%	26%	457	30.5	2,455	65.0
	Skyway	77.6	1.29	55%	72%	1,201	220.9	3,097	502.9
	SLEX	197.2	0.48	37%	50%	3,128	194.4	12,869	570.2
	NLEX	70.7	0.13	1%	27%	508	15.6	1,802	31.6
Area	Metro Manila	1,009	1.21	61%	82%	38,062	5,039	142,811	15,728
	Bulacan	443	1.13	68%	86%	11,514	2,405	35,532	6,801
	Laguna	208	0.93	49%	81%	6,353	599	22,794	1,573
	Rizal	294	1.36	56%	71%	7,113	1,910	20,995	5,785
	Cavite	389	1.23	56%	81%	9,408	834	28,664	2,531
	Mega Manila (Total)	2,343	1.18	60%	81%	72,452	10,788	250,797	32,418

Source: JICA Team.



Source: JICA Study Team

Figure 5.2 Comparison of Volume/Capacity Ratio (2017 and 2035 (Do-nothing))

APPENDIX 2 PPP EXPERIENCE ON TRANSPORT PROJECTS IN THE GREATER CAPITAL REGION

Appendix 2: PPP Experience on Transport Projects in the Greater Capital Region

1. This section will review the experience of PPP arrangements for transport projects, particularly those in the Greater Capital Region, with the end-in-view of drawing lessons learned that can help shape future decisions on PPP arrangements for the Roadmap for Infrastructure Development for the Greater Capital Region.

1) Background on the Philippine PPP Program

2. The Philippine PPP Program was first conceptualized in the post martial law era, when the Philippine fiscal position was in dire straits and the new administration needed to mobilize additional funds for much needed infrastructure projects. The forerunner of the current BOT Law (Republic Act 6957) was passed in 1990. Only one project, the Metro Rail Transit 3 of MRT 3, went through the government approval process using this law. The law was found inadequate and was amended (Republic Act 7718) in 1994 to cover a broader range of PPP modalities, to allow unsolicited proposals and negotiated contracts subject to certain conditions, and to provide incentives to private investments. Even the MRT 3 contract was consummated only after the amendment of the law.

3. Since then the PPP Program has gone through peaks and troughs, which had largely been influenced by the policy of the administration and strong support of the sitting president. The PPP deal flow was prolific from 1990 to 2000; with investments peaking at 15.5% of the GDP in 1997[1]. Majority of these investments were for power projects, followed by transportation projects, such as MRT 3 and the Metro-Manila Tollway[2], and the Metro-Manila water supply concession.

4. The program virtually hibernated after 2000. Governance issues plagued the implementation of some projects and black marks were incurred with the failure of high profile projects such as the Manila International Airport Terminal 3 (see Box 1).

Box 1 Manila International Airport Terminal (BOT, unsolicited proposal)

The contract for NAIA Terminal 3 was awarded in 1995 to the challenger, which offered much higher lease payments to the government. The contract was however declared null and void by the Supreme Court (SC) because of the following reasons:

- Challenger was deemed not a qualified bidder because it did not satisfy the minimum financial requirement. Proof of required net worth included the entire net worth of a private bank, one of the consortium members. The SC ruled that the Bank's entire net worth should not have been accepted because banks are prohibited to invest more than 15% of their net worth in a single enterprise.
- The concession agreement offered from public bidding differed from the one signed and executed, on critical provisions—a) modification on the public utility revenues and non-public utility revenues that may be collected by the challenger; and b) assumption by the Government of the liabilities of the challenger in the event of the latter's default. These changes violated the condition of the government approving body on regulation of public utilities and the provision of the BOT law

[1] Asian Development Bank, Increasing Competitiveness for Inclusive Growth Program, Chapter on Sector Assessment (Summary): Public Private Partnerships in Infrastructure, 2013

[2] The ill-fated Ninoy Aquino International Airport Terminal 3 was also processed within this period but was later dropped from the PPP project listing when the contract was declared null and void by the Supreme Court.

against direct government guarantees for unsolicited proposals.

- The international equity investor was found to violate the Anti-Dummy Law as its investments in consortium members exceeded 60% or more than the investment of the Filipino consortium members. Under the Constitution (and as restated in the BOT Law) public utilities have to be owned by Filipinos or if a corporation at least 60% owned by Filipinos. The Philippine court ruled a buyout price to the Filipino consortium member amounting to US$176 million. The foreign consortium member is demanding a US$400 million.

Source: Supreme Court Ruling

5. The next peak was not until 2010 to 2016. The administration then identified critical reforms to stimulate the program, as follows:

- The incumbent President issued clear policy statements on the use of PPP as a development strategy and enjoined implementing agencies to rationalize PPP investments in their overall investment program.
- Government amended the Implementing Rules and Regulations of the legal bases for PPP arrangements (BOT Law and JV Guidelines for government corporations) to strengthen the integrity of the bidding guidelines and accountability of implementing agencies, streamline the approval process and improve the monitoring and evaluation of projects (see Box 2).

Box 2 PPP Project Development, Evaluation and Approval

The PPP project development is guided by the Philippine Development Plan (PDP) and sectoral master plans. The projects should support the objectives of the Plan, and should be screened using multi-criteria analysis to determine if suitable for PPP implementation. The implementing agency then proceeds with the preparation of priority projects, starting with business cases or pre-feasibility analyses. Projects that turn out to be viable, proceed to detailed feasibility studies. Agencies can opt to apply for funding from the PDMF or request budget appropriation for such studies.

The results of the feasibility study will determine the type and level of government support. For projects requiring viability gap funding, the implementing agency will include the amount required in its Annual Expenditure Plan, for consideration in the budget appropriation. Although there are no multi-year appropriations, major infrastructure agencies are required to submit a 3-year rolling plan to the Department of Budget and Management to inform the Department of core investments that need to be prioritized. Prior to the inclusion of the project in the agency's budget request, internal approvals are required, particularly the head of the national government agency (e.g., Department Secretary), Board of Directors of government corporations and Local Legislative Councils for Local Government Units.

The next step will be to get the approval of the designated government oversight body, summarized below:

Implementing Agencies	Approving Body	Approval Thresholds
National government agencies: line departments and government owned and controlled corporations	Investment Coordinating Committee of the NEDA Board NEDA Board (upon recommendation of ICC)	Up to PhP300 million ($6.8 M) Above PhP300 million; and all negotiated projects
Local Government Units: Provincial City	Municipal Development Council Provincial Development Council City Development Council	Up to PhP20 million Above PhP20, up to PhP50 million Up to PhP50 million

Municipal	Regional Development Council ICC	Above PhP50 million up to PhP200 million Above PhP200 million

The ICC has a composite technical working group consisting of representatives from NEDA, DOF and PPP Center that does the project appraisal based on formally constituted guidelines.

NEDA appraises the project in terms of its alignment and contribution to the Philippine Development Plan (PDP). In so doing, NEDA will undertake the assessment of the socio-economic aspects of the project through an economic cost-benefit analysis and ensures compliance with existing laws, rules and regulations.

PPP Center is responsible for the project's value for money analysis and financial analysis, particularly, commercial viability and soundness of financing structuring. It thus validates the appropriateness of the viability gap fund.

DOF appraises the risk structure and allocation of the project's fiscal requirements and government undertakings, the project's financial internal rate of return (FIRR) and its impact on fiscal sustainability through assessment of government's direct, contingent, and opportunity costs.

The approval of oversight bodies is a pre-requisite to budget approval of any government support required and project tender.

- Government revamped the PPP Center and its capacity strengthened to perform the following functions: oversight on policy implementation, capacity building of implementing agencies, including preparation of knowledge products and standard, program monitoring and evaluation.
- PPP Center established the Project Development and Monitoring Fund (PDMF), a revolving fund that implementing agencies can access to prepare bankable projects and avail of advisory services, to facilitate the deal flow of solicited projects. The PDMF was indeed instrumental in reversing the pre-dominance of unsolicited proposals.
- Parallel to efforts to encourage solicited projects, the unsolicited proposal process was also improved to make it more transparent (see Box 3).

Box 3 Unsolicited Proposals

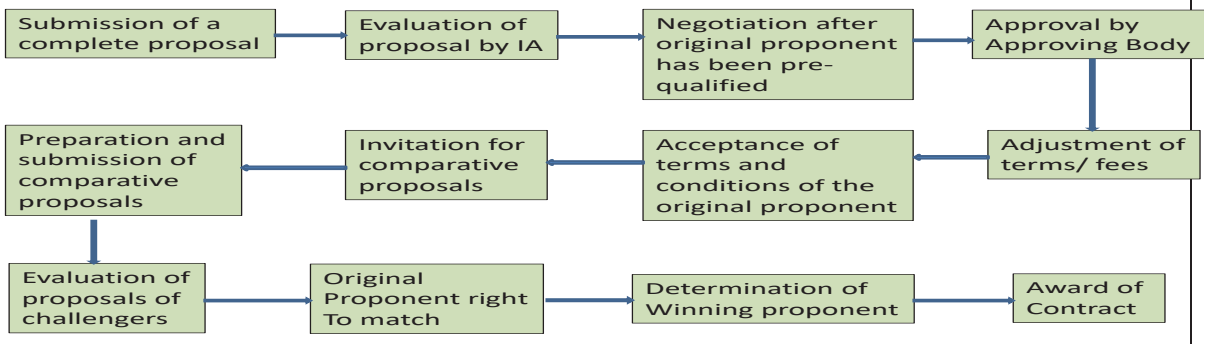
Before 2010, the unsolicited mode played a significant part in project development. About a third of awarded contracts were through unsolicited proposals, most of which were not challenged, hence awarded to the original proponent. Some of the reasons cited for the lack of interest to challenge are: perceived bias of the implementing agency in favor of the original proponent and the short time frame to prepare a comparative proposal. The unsolicited projects had mixed reviews in terms of effectiveness and value for money. Most distressed projects came from negotiated proposals, i.e., from unsolicited proposals or from a lone bid. Four contracts from unsolicited proposals were terminated, one major project (i.e., Manila International Airport Terminal 3) and three small infrastructure projects of local government units.

Unsolicited proponents took out the burden of preparing projects from government implementing agencies, however even with that, the agencies had to scrounge for resources to do quick technical and financial analyses to have meaningful negotiations with the private proponents. Most proposals did not really offer new technology and cost efficiency was either elicited in the competitive challenge or was not established since the government agencies did not use value analysis. The negotiations were also protracted, adding to the transaction cost. Moreover the challenge period of 60 days is

rather short for major infrastructure projects, to even attract credible competition.

Fortunately, the propensity for implementing agencies to rely on unsolicited proposals is reversing. Most projects since 2012 have been done through competitive bidding. Nonetheless, since the unsolicited continue is an allowed mode, government improved the process to make it more transparent.

Shown below is the rationalized process for unsolicited proposals.



6. The other reforms to improve the enabling environment for PPPs are works in progress. There is currently a pending bill to amend the BOT Law to, among others, include joint ventures among the PPP modalities, improve the challenge for unsolicited proposals, institutionalize the Project Development and Monitoring Facility, separate the regulatory and proprietary functions of government owned and controlled corporations to address conflict of interest, and create a list of "Projects of National Significance" that will "insulate" them from ordinances of local government units, local fees and taxes.

7. During this time 15 projects were awarded, of which 4 are already operational, 7 under construction, 4 at pre-construction stage, and 3 under procurement. These projects have a total value of PhP 361 billion[3]. There were also several projects ready for procurement (such as the secondary airports O&M), but some of these have been pulled out of the PPP pipeline and transferred to the public investment program.

8. An overall snapshot of the PPP Program from inception to 2015[4] is presented in Table 1.

Table 1 Status of PPP Projects in the Philippines, 1990-2016

Sectors	Number of Projects				Value of Projects			
	Concluded and Turned Over	At operation stage	Contract signed/ Notice of Award	Total	Concluded and Turned Over	At operation stage (US$ million)	Contract signed/ Notice of Award	Total US$ million)
Power	28	10		38	3582	5119		8701
Transport		10	6	16		2654	4391	7045
Information Technology	3	3		6	1.92	150		152
Water Supply		5	1	6		7839	543	8382
Property Development	1	8		9	4	450		454
Health		1	1	2		1	125	126

[3] Data Source: PPP Center of the Philippines
[4] These projects include: management, lease contracts, concessions and greenfield BOT projects

Sectors	Number of Projects				Value of Projects			
	Concluded and Turned Over	At operation stage	Contract signed/ Notice of Award	Total	Concluded and Turned Over	At operation stage (US$ million)	Contract signed/ Notice of Award	Total US$ million)
Education	1	1		2	295	397		692
Total	33	38	7	72	3883	16610	1939	25552

Source: PPP Center of the Philippines and 2015 Budget of Expenditures and Sources of Financing, Department of Budget and Management.

9. In the current administration (2016 to 2022), there are expressed tactical shifts in the role of PPP. The government targets to spend PhP8.4 trillion for its "Build, Build, Build" Program. This will raise the share of infrastructure spending to 5.4% of the GDP this year and 7.1% by 2022. Only 18% will be carried out through PPP arrangements, but mostly through "hybrid PPPs". In hybrid PPPs, government funds the construction of the projects and then will bid out the operation and maintenance to the private sector. The Secretary of Finance in an interview said the rationale is for government to have direct control so that it can speed up construction. [5] Financing will be sourced from loans and tax collections.

10. The new approach is yet to be tested and proven if it will result to greater value for money compared to previous BOT-type of arrangements, where the private sector finances, designs, operates and maintains the projects.

2) PPP Experience in the Transportation Sector

11. The transportation sector as seen in Figure 1 has a substantial share in the PPP Program. It has a 15% share in terms of the amount of investments and 26% in terms of number of projects. The Greater Capital Region gets the lion's share of these projects, as 90% of them are in this Region. Table 2 provides a list of awarded transportation projects in GCR from 2003 to 2015.[6]

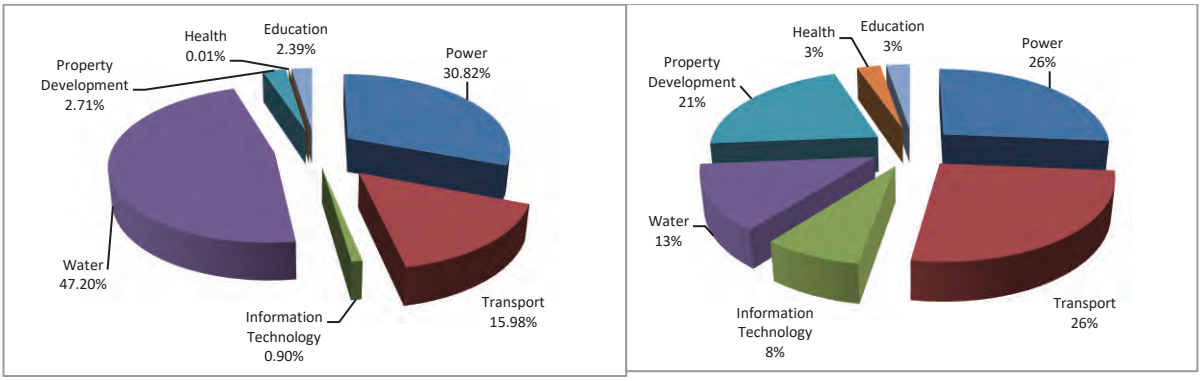


Figure 1 2015 Sectoral Composition of the PPP Program, based on Cost and No. of Projects

12. The PPP transportation projects in GCR consist of toll roads, mass transit systems and transport terminals. The implementing agencies are the Departments of Public Works and Highways, Department of Transportation and the Light Rail Transit Authority.

13. Due to limited access to information, the review will be based on cases in point, particularly toll roads and mass transit systems. It would have been ideal to see the value for money analysis that led to the decision to implement the projects through a PPP arrangement but none of the projects that are reviewed in this report were subjected to a VfM

[5] Philippine Daily Inquirer, June 21, 2017
[6] Data Source: PPP Center of the Philippines

analysis. The scope of the review will focus on the following aspects that most affect the performance of PPPs: i) project structure, ii) risk allocation and iii) institutional capacity.

14. The review is based on the following projects:

Table 2 Projects Reveiwed

Project Name	Description
1. Daang Hari and South Luzon Expressway Link Road	Now called the Muntinlupa-Cavite Expressway, the project is a 4-lane, 4-kilometerl road, including a new bridge crossing the South Luzon Expressway.
2. NAIA Expressway, Ph.2	The project is 4-lane, 7.75 km elevated expressway and 2.22 km at-grade feeder road that will provide access to NAIA Terminals 1, 2 and 3 and link the Skyway and the Manila-Cavite Toll Expressway.
3. Mass Rail Transit 3	Greenfield project; 17 kilometer urban rail system along EDSA
4. Light Rail Transit 1 Cavite Extension and Operation and Maintenance	11.7-kilometer extension of the existing line to the Cavite and operation and maintenance of the existing and extension line
5. Mass Rail Transit 7	Greenfield 23-kilometer urban rail linking San Jose Del Monte, Bulacan to Metro Manila; 22-kilometer road intended to decongest EDSA and an integrated transportation terminal in Tala Bulacan

Table 3 List of Awarded Transportation Projects in the Greater Capital Region

	Project Title	Contract signing date	Solicited/ Unsolicited	Estimated Project Cost (PhP million)	Estimated Project Cost (USD million equivalent)	PPP Structure	Implementing Agency	Government Financial Support	Government Revenue Share	Government Guarantees
A.	**AWARDED: COMPLETED AND OPERATIONAL**									
1	Tarlac-La Union Toll Expressway Project	28-Aug-08	Solicited	1,579	35	Build-Transfer-Operate	Department of Public Works and Highways	PhP328.3 million for ROW cost and ancillary infrastructure to connect to SLEX and PhP10.6 million for half of the cost of the independent consultant	PhP 531 million premium payment	Compensation due to government default and termination payments
2	Daang Hari and South Luzon Expressway (SLEX) Link Road Project	2-Apr-12	Solicited	2,001	44.67	Build-Transfer-Operate	Department of Public Works and Highways	PhP1.02 B for ROW cost and PhP40.10 million for half the cost of the independent consultant	PhP11 billion premium payment	Compensation due to government default and termination payments
4	NAIA Expressway Project	8-Jul-13	Solicited	15,520	344.89	Build-Transfer-Operate	Department of Public Works and Highways	PhP2.77 million for half the cost of the independent consultant	PhP1.088 billion premium payment	Compensation due to government default and termination payments
	Sub-total			**20,820**	**463**					
B.	**AWARDED: UNDER CONSTRUCTION**									
5	Mass Rail Transit 7	18-Jun-08	Unsolicited	55,744	1,236	Build-Transfer-Operate	Department of Transportation and Communication	PhP 1.9 billion for ROW cost; PhP3.3 billion, disbursed PhP100 million annually for the Annual Grantor Payment; and PhP8.8 million for half the cost of the independent consultant	None	Compensation due to government default and termination payments
6	Integrated Transport System-Southwest Terminal	For contract signing; Notice of Award issued in January 2015	Solicited	2,500	55.56	Build-Operate-Transfer	Department of Transportation and Communication			
7	Metro-Manila Skyway Stage 3		Joint Venture Agreement	37,430	829.93		Toll Regulatory Board			
	Sub-total			**95,674**	**2,121**					
C.	**AWARDED: PRE CONSTRUCTION**									
8	LRT Line 1 Cavite Extension and Operation and Maintenance Project	2-Oct-14	Solicited	64,900	1442.22	Build-Transfer-Operate	Department of Transportation and Communication	PhP5.3 billion for ROW cost, PhP417.25 million for half the cost of the independent consultant; and PhP 19.83 billion for light rail vehicles and depot works, funded through a JICA loan	PhP9.35 billion premium payment	Compensation due to government default and termination payments
9	Cavite Laguna Expressway		Solicited	35,430	785.59	Build-Transfer-Operate	Department of Public Works and Highways			
10	South Integrated Transport System Project		Solicited	5,200	115.30		Department of Transportation and Communication			
11	NLEX-SLEX Connector Road		Unsolicited	23,200	514.41		Department of Public Works and Highways			
	Subtotal			**128,730**	**2,858**					

Source: PPP Center

(1) Tollroad Projects

15. The tollroad projects are pretty much standardized in terms of structure and risk allocation. DPWH has also been pro-active in preparing projects, hence has had control in specifying the conditions of the contract upfront.

16. The tollroad projects used the Build-Transfer-Operate modality; that is, after the construction the ownership of the asset is turned over to the government. This is mostly in consideration of the taxes due on ownership of the asset by the private sector. The concession period is generally 30 years.

17. The vertically integrated approach of giving the private sector control in the design and construction will enable it to better plan and execute the operation and maintenance of the facility.

18. They key elements of the risk allocation, are:

(a) Government provides the right of way.

(b) The private sector will be responsible for the technical risks. It is required to meet minimum performance standards and specifications and key performance indicators.

(c) The private sector assumes the demand risk. Government will not guarantee the traffic volume.

(d) The base tariffs (based on willingness to pay surveys) and rate adjustment formula and conditions for extra-ordinary increases are specified in the bid documents. Government guarantees the application of the formula. The private sector will be compensated if the formula is not followed.

(e) The private sector is granted commercial development rights to augment the toll income. However, it is required to give government 5% share on gross revenues from the development within the basic right of way provided by the government.

19. The current deals have improved considerably from the past projects because of better structure and risk sharing, clarity of contractual provisions and forward planning in right of way acquisition, including budgeting early on for the acquisition cost. Box 4 shows an example of a tollroad project implemented in the early years of the program and what had gone wrong in the implementation that diminished the value of the project.

20. The DPWH has also institutionalized its PPP Unit into the equivalent of a bureau and is building its capacity to prepare and manage PPP projects. The unit head reports to an undersecretary.

Box 4 Southern Tagalog Arterial Road Project (STAR)

The STAR PPP Project is composed of two stages: Stage 1 involves the operation and maintenance of the segment built by the government (Sto. Tomas to Lipa in Batangas); and Stage 2 involves the construction and O&M of a new road from Lipa to Batangas City. Together, the toll road is a four-lane 42 kilometer highway. The agreement was signed in 1998 with a concession period of 30 years.

The government committed to provide the right of way and complete the link between STAR and South Luzon Expressway. The latter was crucial for ensuring the traffic demand forecast.

The project encountered construction delays. The private sector could not secure financing due to the government's delay in the completion of the expressway link, the private sector's low bid on tariff thus

compromising the financial viability of the project (the winning bidder offered tariffs 34% lower than the second-lowest bidder and 39% below the government's estimate); change in the proponent's ownership and no enforceable timetable in the agreement (the concession agreement was not categorical on the timeline).

ROW acquisition was also delayed because there was no clear plan from DPWH on the funding thereof when it committed to this obligation.

The road maintenance was also below standard but the Toll Regulatory Board did not enforce its regulations.

The base tariffs were set including the rate adjustment conditions and formula. Government does not receive toll revenue thus ended up paying for the construction of Stage 1 from its budget. The concessionaire was given commercial development rights but there is no provision for government share in revenues.

Because of the delay in project implementation the project is deemed marginally successful.

Source: AusAid-assisted Partnership for Economic Growth Reforms Project, Review of ODA and PPP Projects, 2009

(2) Urban Rail Projects

21. Unlike the tollroad projects, PPP urban rail projects are not that easy to standardize, considering that there are greenfield projects and existing facilities for refurbishment and operation and maintenance. There can be valuable lessons learned though that should be heeded to improve the next deals.

22. The MRT 3 project has unquestionably help reduce traffic congestion along EDSA. But this gain is overshadowed by public perception that it is a bad example of a PPP undertaking and that government is fumbling n how to deal with the issues and insensitive to the best interest of the commuters. The current performance or underperformance of the facility can be traced back to fundamental weaknesses on the project study, procurement, PPP structure, risk allocation and contract management. These are summarized below[7]:

(a) Project Study- When the project was evaluated, there were findings that ridership forecast was overly optimistic, as well as the assumption of 100% commercial development. In the desire of the government to implement the project, the approving authorities accepted these assumptions.

(b) Procurement - The project was tendered but there was only one pre-qualified bidder. Instead of re-tendering the project, DOTC decided to negotiate directly with the proponent, thereby foregoing the opportunity for competition and possibly offers of better value.

(c) Structure- The arrangement was “Build-Lease-Transfer” modality. The private proponent financed and built the facility; leased it to the government who operated it; but maintenance is done by the private proponent. The division of the responsibility between operation and maintenance siloed these functions, thus losing efficiency in the process. Moreover, the maintenance arrangement also vested on the proponent the right to supply new vehicles. As the maintenance cost is an absolute pass through, the proponent does not have the incentive to do it in a cost-efficient manner.

(d) Risk allocation- Government bore the brunt of the risks, notably:

[7] AusAid-assisted Partnership for Economic Growth Reforms Project, Review of ODA and PPP Projects, 2009

(i) Approval risks. Because of the delays in getting government approvals, the original cost of USD300 million increased to almost USD 700 million.

(ii) Provision of right of way for the tracks, depot and related facilities

(iii) Equity rental payments (ERP) denominated in dollars. The ERP consists of the following streams of payment: debt service, guaranteed 15% return on equity on an after tax basis, maintenance cost, salaries and administrative expenses and annual bonuses. In effect, there is a sovereign guarantee on debt payment and return on equity, and complete pass through of the maintenance cost.

(iv) Demand and tariff acceptability risks. At the time it started operations, ridership was lower than the forecasts—original ridership targets were achieved only on the 10th year of operation. Government decided to reduce the tariffs to encourage patronage. The ridership did increase but the increase in revenues was not commensurate. Fares were suppressed way below the cost recovery level thus increasing the subsidy than what was anticipated. In June 2008, subsidy was at USD3.3 million per month.

(v) Completion risk. While the private proponent bore the construction risk, government effectively assumed the completion risk as it guaranteed the debt portion of the project cost by agreeing to buy out the lenders in the event that the construction is not completed at a certain date.

(vi) As regards commercial development, government assumed 100% development of all commercial areas, yet the contract obligated the proponent to develop at least 60% only. Government was supposed to get a share from the commercial development revenues but the basis is not clearly spelled out in the contract.

Given that the proponent bore a disproportionately small amount of the risk, there was little incentive for it to invest in the growth of MRT 3 or make costs efficient, or to consider its rational integration in the public transport system.

(e) Contract management- The DOTC is ultimately responsible for the contract management. However the changes in administration brought about changes up to mid-level leadership. There does not seem to be a constant team and a continuing system for contract management. The system breakdown is an indication that maintenance may not have been monitored and certainly capacity expansion with additional light rail vehicles (or coaches) was not planned before getting to a critical point.

23. Moreover, DOTC seemingly did not anticipate the adverse effect of asset-backed bond issued by the private proponent, which securitized the equity rental payments of the government. The bond was issued by the proponent in 2003. There was no protection to ensure that part of the proceeds will actually be used for debt service. Also assets may be tied up with the bond, which may be an issue when assets are scheduled to be turned over to the government.

24. In 2008, government through the Development Bank of the Philippines and Land Bank a huge amount of the bonds allowing it to hold 80% economic interest in the company, securing 11 of 14 seats in the Board. This puts government in a rather awkward position, with one hand paying the other. In 2013, then President issued an executive order for the equity value buyout of the private corporation, at estimated price of PhP54 billion. The process is apparently complicated hence to date the buyout has not been effected yet.

25. Eleven years after the implementation of MRT 3, an unsolicited proposal for the MRT 7 was signed by DOTC. The project scope includes:

- the Metro Rail Transit System (MRTS), a 22 km rail line with 14 stations running from North Avenue station in EDSA passing through Commonwealth, Regalado, Quirino up to San Jose del Monte in Bulacan, depot and rolling stock; the system shall have a capacity of 28,000 passengers per hour;
- an intermodal transport terminal to be build adjacent to the MRTS, with capacity to accommodate 60 buses at any given time, and
- a highway or a six-lane, 22 kilometers open road from Bocaue Interchange to North Luzon Expressway to the intermodal transportation terminal

26. Being an unsolicited proposal DOTr has no upfront cost share. However it will be responsible for right of way acquisition and relocation, albeit this will be paid for by the proponent. DOTr will also guarantee the application of the agreed base tariffs and the parametric rate adjustment formula spelled out in the contract. It will also be responsible for paying taxes.

27. The structure is a Build-Transfer- Operate arrangement, but the “transfer” is qualified as a “gradual transfer” scheme. The proponent undertakes to finance, design, construct and operate the facility. It has the right to charge and collect agreed fares and/or to receive fare differentials should the government decide not to follow the fare schedule stipulated in the contract. The proponent is also accorded commercial development rights. Based on an agreed schedule, the proponent will gradually transfer ownership of the asset to DOTr, for which the latter shall pay the proponent fixed amortization payments on a semi-annual basis. Each time a payment is made, the proponent will issue a certificate of transfer of ownership, which represents DOTr’s pro-indiviso interest in the assets of the Project proportional to the amortization payments. The amortization payments are subject to a rather complex adjustment formula, also stipulated in the contract.

28. DOTr will be entitled to share in project revenues. All passenger revenues will be deposited in an escrow account with a GFI depository bank. Sharing of net passenger revenues will be 30% for DOTr and 70% for the private proponent. DOTr is also entitled to 20% share on net income before tax actually realized from the exercise of development rights.

29. As of this writing, there is not enough information to see what the amortization payments cover. It is not also known what percentage of the amortization payment can be defrayed from the government’s revenue share.

30. While there is seemingly an improvement in the risk sharing, the government has to be vigilant in monitoring the factors or events that may lead to call on contingent liabilities, particularly: tariff levels, escalation factors for the tariffs and amortization payments, right of way acquisition and resettlement schedule to avoid delay penalties. On the revenue side, the government has to monitor the commercial development to ensure it gets its fair share of the revenues therefrom.

31. Finally, to see an example of a PPP arrangement for an existing facility, the Light Rail Transit 1 extension and O&M contract is reviewed too.

32. The Light Rail Transit 1 is the oldest of the three urban railway systems in Metro Manila. It was started operations in 1984 by the Light Rail Transit Authority (LRTA). In 2014,

the government decided to enter into a public-private partnership (PPP) arrangement for the extension of the line and the operation and maintenance thereof and that of the existing line.

33. The arrangement is a hybrid PPP; with project cost shared as follows:

Table 4 Cost Share in Hybrid PPP

Government using ODA/JICA and budget appropriation	Private proponent using 20% equity and 80% loan
• 120 new light rail vehicles (LRVs) • Refurbishment of existing 30 LRVs according to standards agreed with the proponent • Right-of-way for the 11.7 km line extension • Construction of a new satellite depot and expansion of the existing depot • Automated Fare Collection System (under a separate PPP agreement)	• Rehabilitation of the existing 20 km line and its 20 stations • 11.7 km extension line with eight (8) stations • Operate and maintain the existing and the extension line • Performance enhancement works throughout the concession period
Estimated Cost: PHP26 billion	Estimated Cost: PHP40 billion

Source: Complied several data sources

34. A number of options on the cost sharing schemes were analyzed and its effect simulated in a financial model. One option was to provide a viability gap fund to the proponent, who will be responsible for completing the entire system. The other option was to pay for the civil works of the extension and the other supply the LRVs. The cost efficiency was highest in the option to supply the LRVs funded out of a highly concessional tied loan from JICA. The trade-off however, is managing the timely completion or delivery of unbundled parts to integrate them in the system based on the agreed schedule. Delays have cost implications.

35. The structure is a Build-Transfer-Operate arrangement. As described previously, in this arrangement ownership is immediately vested on the government but the assets will not be handed over until after the end of the concession period. The condition of the assets at hand back is stipulated in the contract.

36. Apart from the risk allocation inherent in the assumption of the cost components, the following risks are allocated as follows:

(a) Market risk is borne by the proponent. The repayment to the proponent and equity returns will come from direct collection of tariffs as well as from revenues from commercial development.

(b) The tariff schedule is set in the contract including the rate adjustment conditions and formula. Government guarantees the application of the tariff schedule and adjustment formula; and if not it will compensate the proponent for the shortfall.

(c) The operating risks are borne by the proponent, who is subject to comply with key performance indicators.

37. Overall, the PPP arrangement appears advantageous to the government, as it benefits from:

- Private proponent is bearing financing and restoration risks to the existing system (both structural, tracks and train fleet). Without the PPP Project, government would have had to finance and implement this restoration to ensure safety and quality of service, taking on full risks for these activities.

- The bid for the Project yielded for the government direct fiscal benefits amounting to PhP14.35 billion from: premium payment (PHP9.35 billion in nominal terms and savings from the PhP5 billion maximum government subsidy offered in the bid.
- Php40.0 billion private investment is mobilized to extend the line to Bacoor, Cavite.

38. That said the value for money proposition of the PPP arrangement may be eroded if contract management is not done properly. DOTr and LRTA are joint grantors of the concession and are therefore also joint contract managers. However, with the change in administration, turn over and depletion of staff especially in DOTr, has put this function at risk. Because of delays in complying with contractual obligations or differences in the interpretation of contract provisions, claims for penalties or compensation have been submitted to DOTr by the proponent. Left unresolved these issues may result to bigger problems in the near future. It is imperative for DOTr and LRTA to immediately establish a functional contract management system and build its capacity for the different functions required, such as upgrading knowledge on technical standards, financial management and understanding legal obligations and recourses.

3) Conclusion

39. Undoubtedly PPP arrangements have a value to offer but they have to be planned and managed carefully. There is now more experience to draw insights from and more capacity in the government and the private sector to manage these deals. There is a project development facility that can be used for project preparation and transaction advisory so government can have better control in structuring the PPP arrangements and determining the optimum risk allocation.

40. It is hard to make generalizations of what should be implemented through PPP or public funding, except to go by proven analytics and due diligence activities.

(i) Identify projects from a thorough integrated transport systems review. By doing so, it also compels the implementing agencies to use competitive bid as the default mode, thereby engendering best value and efficiency.

(ii) Prepare robust feasibility studies, with in depth financial and risk analysis.

(iii) Conduct a value for money analysis comparing the PPP and public funding option. Value for money analysis is still at a nascent stage in the Philippines. Data is still limited to do an accurate comparison of the merits of a public or PPP implementation. It is worthwhile to develop the information base for reliable VfM analysis, especially in the light of the current policy for hybrid PPPs.

(iv) Build capacity within the implementing agencies to prepare and manage projects; institutionalize systems from project development and PPP structuring, procurement to contract management, keep records for traceability and review of past experiences and continually train staff.

41. There is a huge asymmetry in the capacity of private developers for big infrastructure projects (bidders revolve around a handful of big conglomerates the likes of Ayala, San Miguel, SM, Metro Pacific) who not only have the resources but the profit motivation as well to get the best minds and expertise in preparing and implementing projects. These companies have the basic in-house capacity as well as access to a battery of specialized consultants who can be tapped if necessary at every stage of the PPP arrangement.

42. Government counterparts on the other hand rely on staff that often does other tasks and on mostly ODA support to get the required expertise; but this is episodic and takes time to set up. The Project Development and Monitoring Fund has been a tremendous help in the project preparation and transaction advisory but is not necessarily designed as a technology transfer program, nor does it extend beyond award, particularly contract management. As discussed in previous sections, the agencies' capacity to do contract management threatens the full realization of the PPP value.

43. Capacity to implement PPP projects is not something learned overnight. Lessons are more ingrained if the structured, normative type of training is complemented by hands on experience; hence it is critical to have a stable PPP unit with deliberate plans for succession, training and mentoring of staff.

44. Between the two principal transport agencies, DPWH, in relative terms, is less affected by this issue as there is more stability in the tenure of its management and technical team. DOTr on the other hand, has had faster turnover of officials and staff. Hence any collective capacity built from past projects undertaken is either diminished or lost.

45. Both agencies should invest in structure and normative type of training for its staff offered by international and domestic providers (foremost PPP Center). They should also plan at project development stage what technical assistance or capacity building it needs and include the request or procurement in the timeline. Enjoin PPP Center to operationalize the reporting system for implementing agencies to complete the database of PPP contracts. This data base will provide useful information for the preparation of Fiscal Risk Management Program guidelines as well as contract management guidelines. Proponents should be required to submit current financial, legal and operating data to the centralized unit to improve the monitoring of project risks.

APPENDIX 3

PRESENTATION MATERIALS OF WORKSHOPS

Follow-up Survey on Roadmap for Transport Infrastructure Development for Greater Capital Region (GCR)

1st Technical Workshop

16 August 2017
Holiday Inn & Suites Makati

JICA Study Team

Main Points for Discussion/Consultation

- Workshops
- Review of Dream Plan
- Approach to Roadmap 2
- Key Performance Indicators
- Next Steps

Workshops

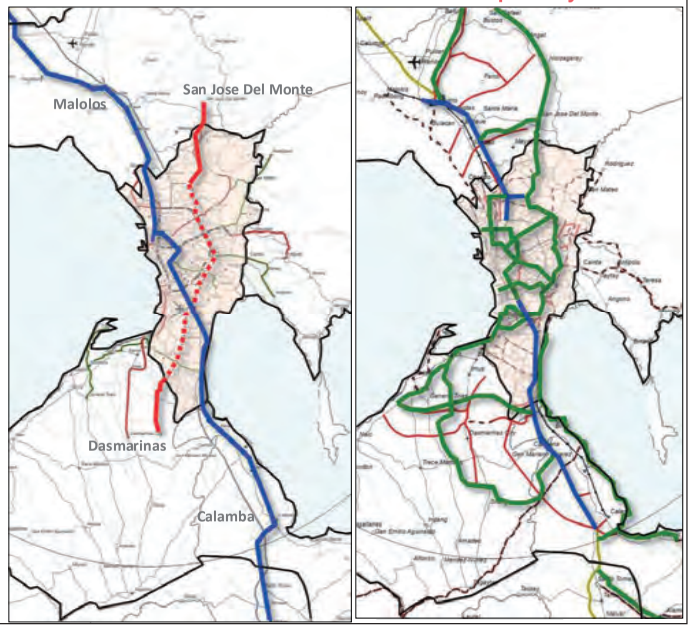
- **Objective of the Workshops**
  - Sharing the process of the implementation of the Build Build Build Program
- **Output of the Workshops**
  - Suggested broad implementation strategy of the program
- **Three Workshops**
  - 2nd workshop: September 2017
  - 3rd workshop: October 2017

Review of Dream Plan

5 Main components of Dream Plan

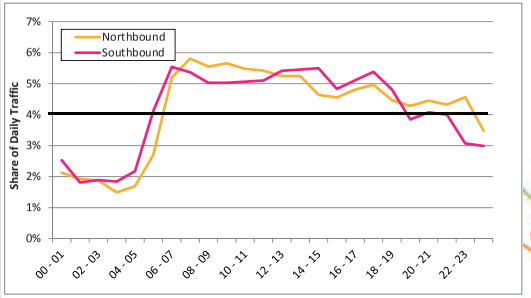
- **At-grade roads (urban roads)**
  - Missing links: C3, C5, bridges and others
  - New roads (137km)
  - Flyovers
  - Sidewalks and pedestrian facilities
  - Secondary roads in periurban areas
- **Expressways**
  - Intercity expressway (426 km)
  - Urban expressway (78 km)
- **Urban/Suburban rails**
  - Main line: 246 km (6 lines)
  - Secondary line: 72 km (5 lines)
  - Integrated lines and improved accessibility
- **Bus/Jeepneys**
  - Modern fleet and operation
  - Rationalized route structure
  - Improved terminals and interchange facilities
- **Traffic management**
  - Traffic signals
  - Traffic safety
  - Traffic enforcement and education
  - ITS

Urban/Suburban Rails Network | **Main Roads/Expressways Network**



Traffic congestions; everywhere throughout the day

Traffic Volume (PCU) at Screen Line (Pasig River) (2017)

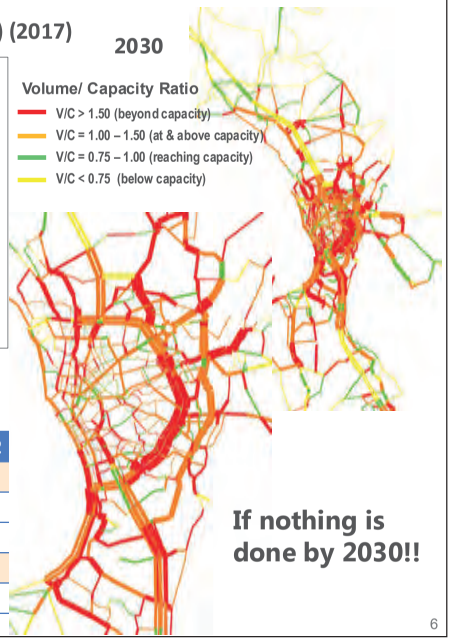


Traffic Demand and Impact (Metro Manila)

	2012	2030	'30/'12
Traffic demand (million trips/day)	12.8	14.5	1.13
Public transport share in total demand	69%	69%	1.00
Occupancy of road space by private vehicles	78%	78%	1.00
Transport cost (Php billion/day)	2.4	6.0	2.50
CO2 emission (million tons/year)	4.79	5.72	1.19

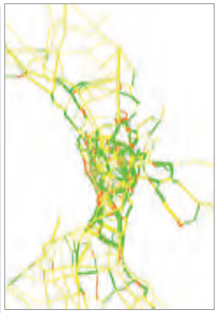
2030

Volume/ Capacity Ratio
- V/C > 1.50 (beyond capacity)
- V/C = 1.00 – 1.50 (at & above capacity)
- V/C = 0.75 – 1.00 (reaching capacity)
- V/C < 0.75 (below capacity)



If nothing is done by 2030!!

Impact of the Dream Plan on road traffic in 2030



Volume/ Capacity Ratio
- V/C > 1.50 (beyond capacity)
- V/C = 1.00 – 1.50 (at & above capacity)
- V/C = 0.75 – 1.00 (reaching capacity)
- V/C < 0.75 (below capacity)

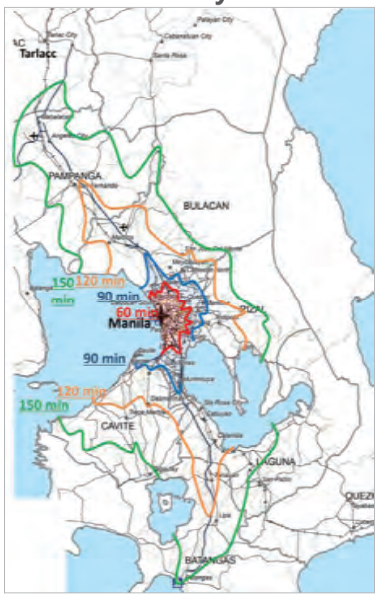
- Traffic situation will be significantly improved!
- Transport cost will be reduced much!
- Air quality will also be improved!

Impact of Dream Plan

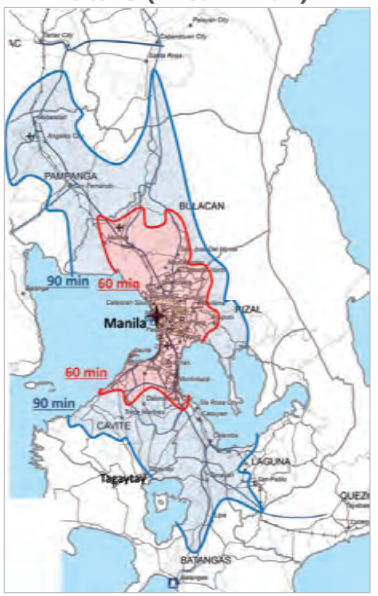
Indicators		2030	%Change from 2012
Metro Manila	Transport demand (mil. pax-km/day)	152.3	15.4%
	Transport Cost (Php bil./day)	1.4	-41.5%
	CO2 emission (mil. tons/year)	3.99	-16.7%
Bulacan, Rizal, Laguna, Cavite	Transport demand (mil. pax-km/day)	115.2	18.9%
	Transport Cost (Php bil./day)	0.84	-15.2%
	CO2 emission (mil. tons/year)	3.15	-1.60%

Impact of Dream Plan (estimated travel time from Manila)

Today | **Future (Dream Plan)**



60 min
90 min
120 min
150 min

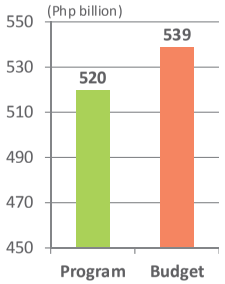


Budget envelop can cover the Dream Plan

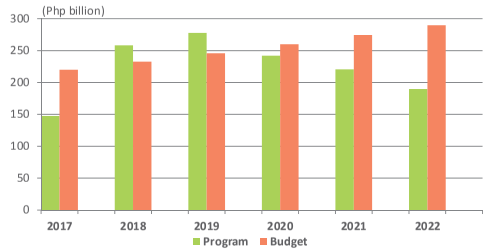
- Estimated budget envelop
- **Money is there!!**

			2014-16	2017-22	2023-30
GDP in 2012 (Constant Price)	Growth Rate (%/year)		6.0	7.5	5.0
	Php billion		38,545	105,936	195,904
Budget Envelop (Php billion)	Infra-structure	National (5% of GDP)	1,746	5,297	9,795
		Study Area (61% of National)	1,189	3,045	5,387
	Transport	**Study Area (50% of infra)**	**539**	**1,523**	**2,694**

- Short-term Plan



- Medium-term Plan



- Long-term Plan (2014 - 2030)
  - **Program: Php 2,610 billion**
  - **Budget: Php 4,756 billion**

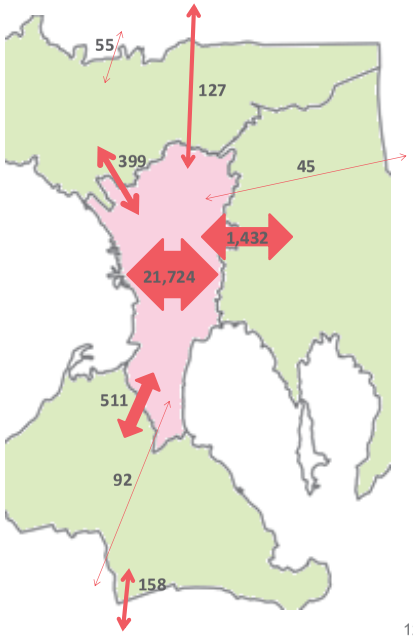
How to get there!?

Action plan on institutions

- Clear backlogs of un-implemented projects (committed)
- Ramp up delivery capacity of transport agencies
- Improve management/control of unsolicited proposals for roads and railways to ensure network integrity
- Clear policy framework for privatization of rail lines to avoid direct government involvement in rail operation
- Harness resources of LGUs for many secondary roads and TOD
- Strengthen development control and guidance to private sector development to maximize benefits both by public and private sector

Traffic Increase in Mega Manila

- **Sharp increase between Metro Manila and Mega Manila.**



- Metro Manila Inner Cordon Traffic

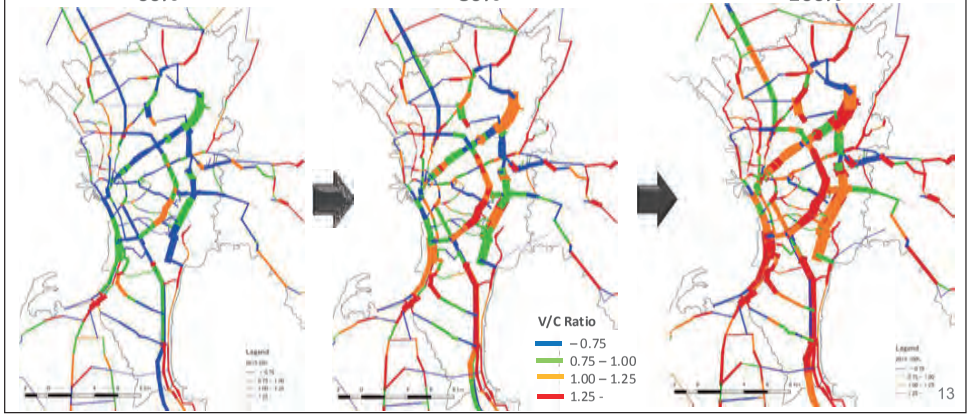
		MMUTIS (1996)	MUCEP (2013)	Roadmap (2017)	'17/'96
Pax (000/day)	North	423	335	526	1.24
	East	627	1,149	1,477	2.35
	South	348	421	603	1.73
	Total	1,399	1,904	2,606	1.86
PCU (000/day)	North	86	75	133	1.55
	East	163	284	440	2.69
	South	73	105	169	2.31
	Total	322	464	741	2.30

Identification of Bottlenecks

- Approach: Incremental assignment on existing transport network.
- **Main corridors are overcrowded.**

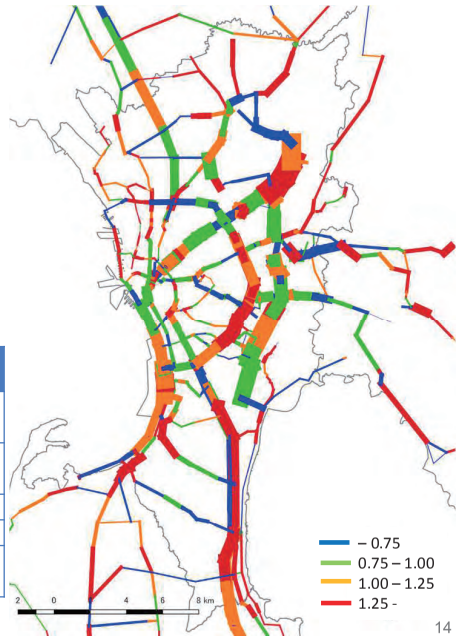
Indicators		60%	80%	100%
Traffic Demand	mil. trip/day	8.8	11.7	14.6
	mil. pcu/day	2.8	3.7	4.6
V/C Ratio		0.59	0.80	1.00

60% 80% 100%



Impact on Traffic Management Measures

- **Assumption**
  - Flyovers
  - Traffic management (-10%)
- **Significant improvement due to traffic management.**



- **Impact on Overall Network (2017)**

Indicators		Without	With	Improvement (%)
Volume Capacity Ratio		1.00	0.90	-10.3
Average Travel Speed (km/h)		15.9	18.3	+15.1
Transport Cost (Php mil./day)	VOC	1,153	1,065	-7.6
	TTC	1,175	1,022	-13.1
CO2 Emission (000 ton/day)		18.8	18.5	-1.5

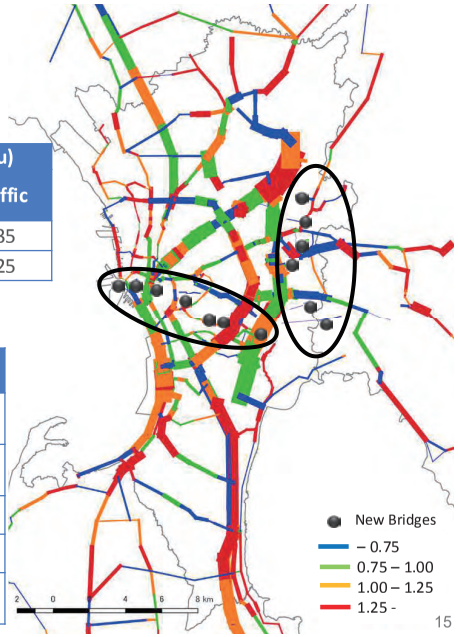
Impact on Pasig River Bridge

- **Farther improvement, but impact is not large.**
- **Traffic Volume**

	Without (000 pcu)		With (000 pcu)	
	Capacity	Traffic	Capacity	Traffic
Pasig River	820	816	1,097	835
Marikina River	375	285	664	325

- **Impact on Overall Network (2017)**

Indicators		Without	With	Improvement (%)	Accumulated (%)
Volume Capacity Ratio		0.90	0.89	-1.4	-11.7
Average Travel Speed (km/h)		18.3	18.4	+0.5	+15.6
Transport Cost (Php mil./day)	VOC	1,065	1,061	-0.4	-8.0
	TTC	1,022	1,013	-0.8	-13.9
CO2 Emission (000 ton/day)		18.5	18.5	-0.1	-1.5



Impact on North-South Expressways

- **Impact on existing major corridor (R1-R10, EDSA and C5 is notable)**
- **Traffic Volume of Expressway**

Traffic Volume (000 pcu)	Without	With
NLEx-SLEx Connector/Skyway Stage 3	-	221

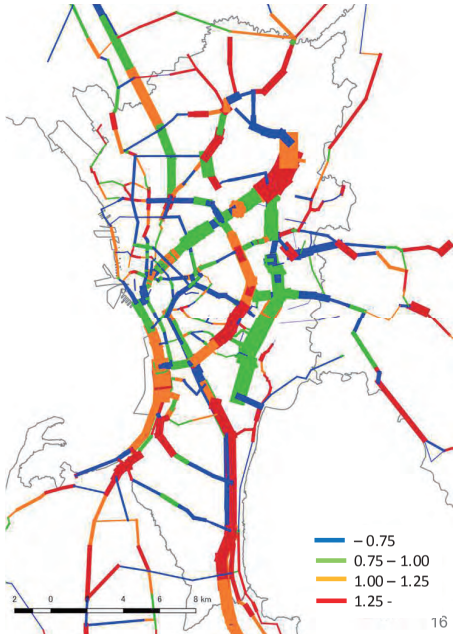
Note: assumed toll: Php4.0/km

- **Impact on Overall Network (2017)**

Indicators		Without	With	Improvement (%)	Accumulated (%)
Volume Capacity Ratio		0.89	0.85	-3.7	-15.5
Average Travel Speed (km/h)		18.4	19.1	+3.8	+19.4
Transport Cost (Php mil./day)	VOC	1,061	1,035	-2.4	-10.5
	TTC	1,013	982	-3.0	-16.9
CO2 Emission (000 ton/day)		18.5	18.4	-0.2	-1.8

- **Traffic Volume of Major Roads**

Traffic Volume (000 pcu)	Without	With	Decrease Rate
R1-R10	36	30	0.8
EDSA	247	230	0.9
C5	167	155	0.9



Impact on North-South Commuter Railway

- **Commuter rail will farther improve overall traffic situation.**

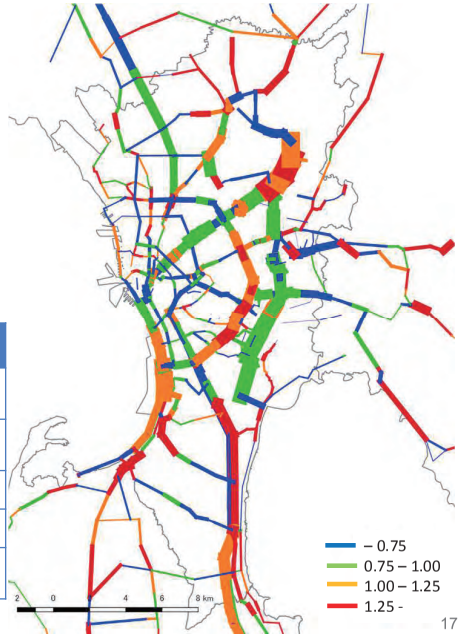
- **No. of Boarding**

Indicators	2017
No. of Passengers (000/day)	865

Note: assumed fare = Php22.0 + 2.0/km

- **Impact of Overall Network (2017)**

Indicators		Without	With	Improvement (%)	Accumulated (%)
Volume Capacity Ratio		0.85	0.83	-2.9	-18.4
Average Travel Speed (km/h)		19.1	19.5	+2.1	+21.5
Transport Cost (Php mil./day)	VOC	1,035	1,001	-3.3	-13.8
	TTC	982	918	-6.5	-23.5
CO2 Emission (000 ton/day)		18.4	17.8	-3.7	-5.4



Impact on MRT 7

- **MRT7 will improve the traffic situation along Commonwealth Avenue.**

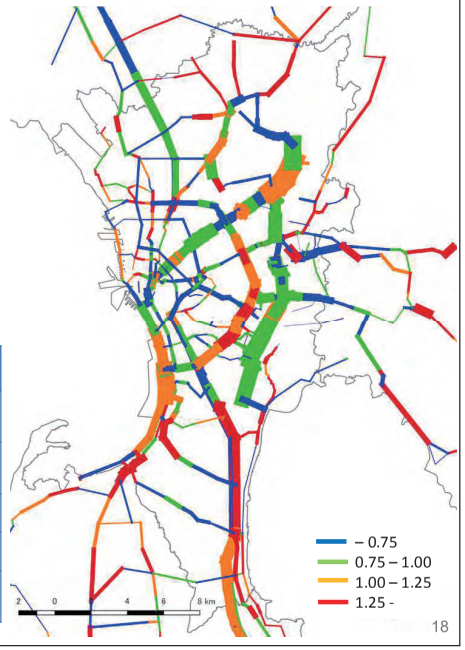
- **No. of Boarding**

Indicators	2017
No. of Passengers (000/day)	716

Note: assumed fare = 15 + 0.8/km

- **Impact of Overall Network (2017)**

Indicators		Without	With	Improvement (%)	Accumulated (%)
Volume Capacity Ratio		0.83	0.82	-1.5	-19.9
Average Travel Speed (km/h)		19.5	20.2	+3.6	+25.1
Transport Cost (Php mil./day)	VOC	1,001	976	-2.5	-16.2
	TTC	918	860	-6.3	-29.8
CO2 Emission (000 ton/day)		17.8	17.4	-1.8	-7.2



Impact on LRT 1 Extension (to Niyog)

- **LRT1 will not help to decongest roads, but effective.**

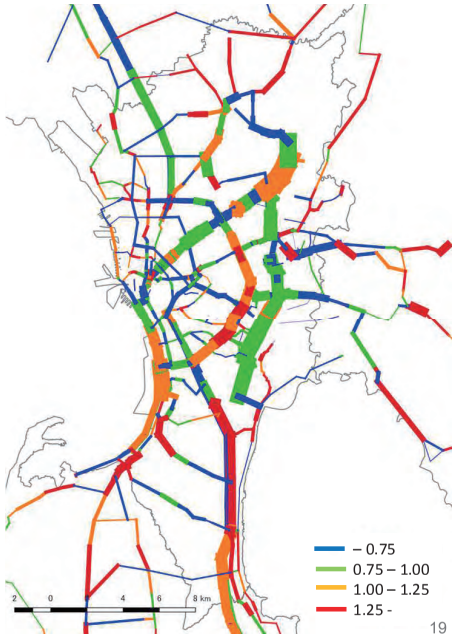
- **No. of Boarding**

Indicators	2017
No. of Passengers (000/day)	467

Note: assumed fare = 15 + 0.8/km

- **Impact of Overall Network (2017)**

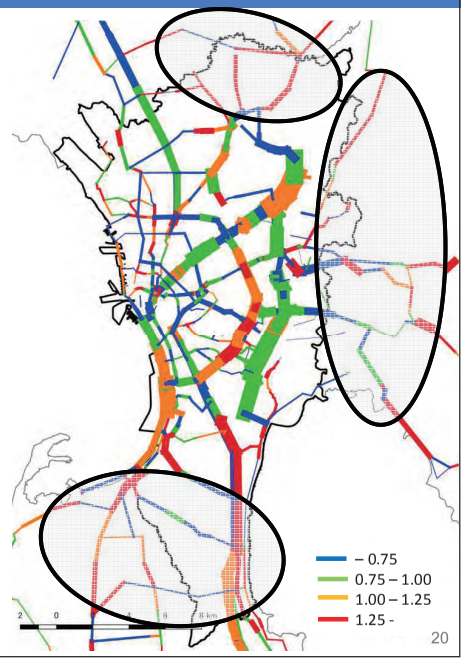
Indicators		Without	With	Improvement (%)	Accumulated
Volume Capacity Ratio		0.82	0.81	-0.5	-20.3
Average Travel Speed (km/h)		20.2	20.3	+0.5	+25.6
Transport Cost (Php mil./day)	VOC	976	970	-0.6	-16.8
	TTC	860	841	-2.2	-32.0
CO2 Emission (000 ton/day)		17.4	17.3	-0.7	-7.9



Attention to Outer Areas

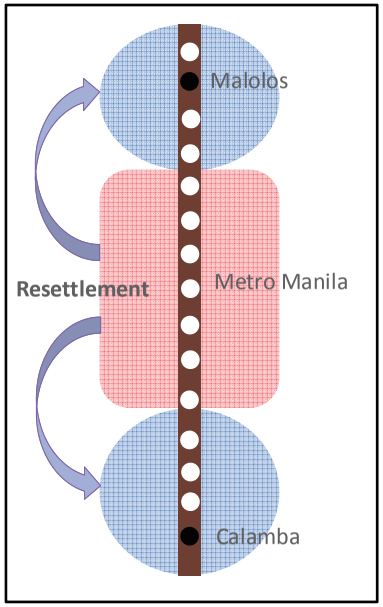
- Primary and secondary roads
- Sub Centers

➡ **It must be integrated in urban plans.**

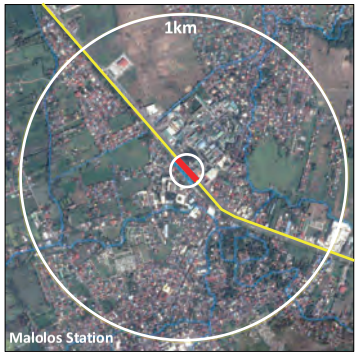


TOD Opportunities and Constraints

- Macro Scale



- Intermediate Scale



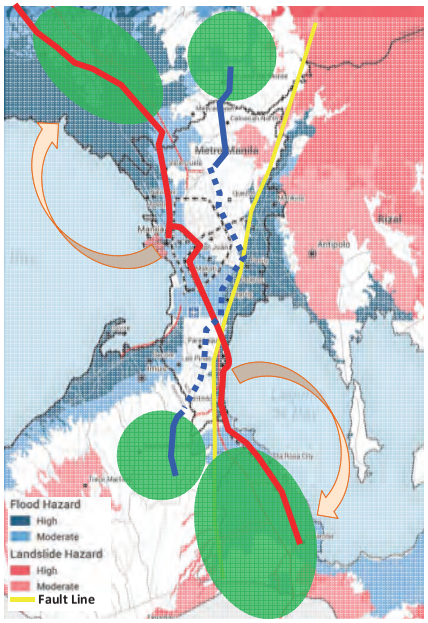
- Micro Scale

Key Performance Indicators

Spatial Development Scenario

- **Scenario 1:** relocate people in high hazard areas to areas outside Metro Manila along NSCR and Mega Manila Subway (1.9 mil. People)
- **Scenario 2:** Scenario 1 + develop the job opportunities outside Metro Manila along NSCR and Mega Manila Subway

Indicators		Benchmark	Scenario 1	Improvement (%)
Volume Capacity Ratio		1.00	1.00	+0.1
Average Travel Speed (km/h)		15.9	16.0	+0.6
Transport Cost (Php mil./day)	VOC	1,153	1,159	+0.6
	TTC	1,175	1,165	-0.9
CO2 Emission (000 ton/day)		18.8	18.8	+0.1



Key Performance Indicators: Assessment @ Master Plan Level

- **Transport Network (Road & Road-based)**
  - Travel demand
  - Volume capacity ratio
  - Average travel speed
- **Public Transport Service (Rail)**
  - Actual travel time
  - LRT/MRT on board congestions
- **Economic**
  - Vehicle operation cost
  - Travel time cost
- **Financial**
  - Toll and fare revenue
  - Vehicle operation cost
- **Social**
  - Transport fare in a day
- **Environment**
  - CO2

Next Steps

- Preliminarily roadmap to decongest Mega Manila.

Thank you for your kind attention.

Follow-up Survey on Roadmap for Transport Infrastructure Development for Greater Capital Region (GCR)

2nd Technical Workshop

22 September 2017
Venue: Makati Diamond Residences

JICA Study Team

Main Points for Discussion/Consultation

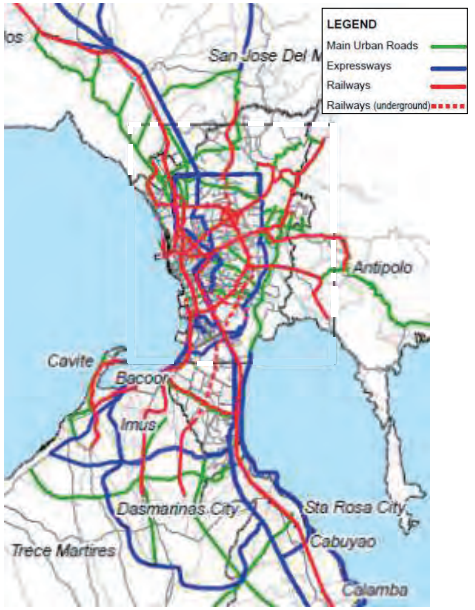
- Background and Summary of Workshop 1
- Identified Demand Supply Gaps of Metro Manila Transport Network
- Current Mega Manila Transport Network Development Strategy (Build!Build!Build!)
- Proposed Projects/Actions for Inclusion in Build!Build!Build!
- Next Steps

Summary of Workshop 1

- Outline of the National Transport Policy was presented by NEDA.
- Overview of pipe line project of transport sector and progress of the projects proposed in the previous Roadmap were presented by DPWH, DOTr and MMDA.
- Some indicators were requested to include in the key performance indicators (KPIs): e.g. fare box ratio, travel time speed and air pollution.
- Involvement of LGUs were highly recommended.
- In order to implement the projects/programs effectively and efficiently, the importance of close coordination among the agencies was mentioned.

Review of Roadmap 1 and Purpose of Roadmap 2

- **Review of Roadmap 1 (2014) by updating database and policy change**
  - expansion of Metro Manila to Mega Manila
  - backbone to promote North-South expansion through connecting NLEx-SLEx, NSCR and MMSP
  - hierarchical development of transport network
  - consideration of transport-and land use – hazard reduction
  - strengthen traffic management
- **Review of Transport Projects in Build!Build!Build!**
- **Identify the gaps and recommend the transport infrastructure development directions for Mega Manila**

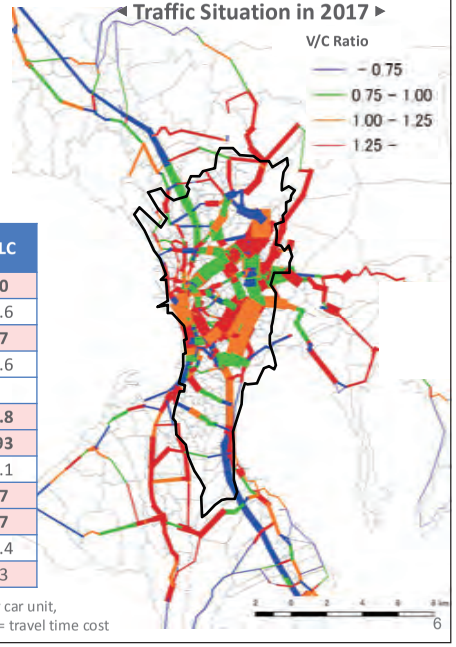


Identified Demand Supply Gaps of Metro Manila Transport Network

Performance of Existing Mega Manila Transport Network

- People in BRLC travels longer.
- Traffic situation is worse in BRLC.
- People living in BRLC pays more.
- Thus, externalities (socio-economic and environment) are high.

◂ Traffic Situation in 2017 ▸



◂ KPI of Existing Transport Network ▸

			Metro Manila	BRLC
Traffic Demand	No. of Trips	mil. trips/day	14.4	5.0
		Public Share (%)	51.3	51.6
	No. of PCU	mil. pcu/day	4.8	1.7
		Public Share (%)	21.1	23.6
	Rail (000pax/day)		1.2	
	Ave. Travel Distance (km/trip)		7.7	14.8
Network Performance	V/C Ratio		0.95	0.93
	Travel Speed (kph)		12.3	11.1
Transport Cost (PHP bil. /day)		VOC	0.9	0.7
		TTC	2.3	1.7
Ave. Fare (PHP/person/day)			13.6	20.4
Environment	CO2 (tons/day)		12.5	9.3

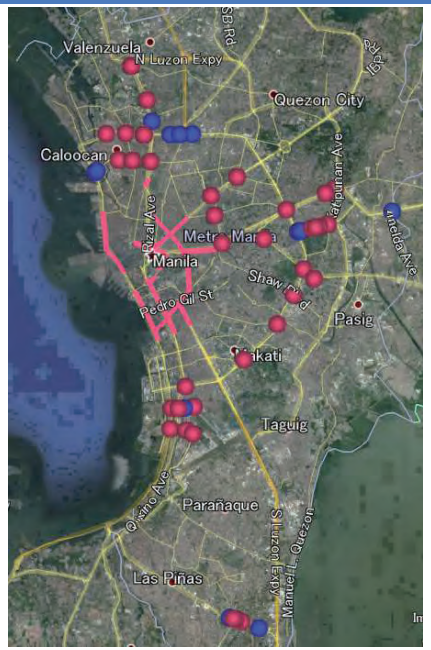
Note: BRLC = Bulacan, Rizal, Laguna and Cavite Provinces, pcu = passenger car unit, V/C Ratio = vehicle capacity ratio, VOC = vehicle operating cost, TTC = travel time cost

Existing Bottlenecks in Metro Manila Transport Network

- 70 intersections and 7 road sections were identified as bottlenecks by MMDA.
- Of 70 intersections, 10 are not signalized yet.

Immediate attention!

- Inefficient use of available infrastructure: traffic signals, driving attitude, roadside parking, jay walking, lack of enforcement capacity, etc.
- Bottlenecks/missing link in road network
- Inadequate road safety measures



Impact of Traffic Management on Existing Road Transport

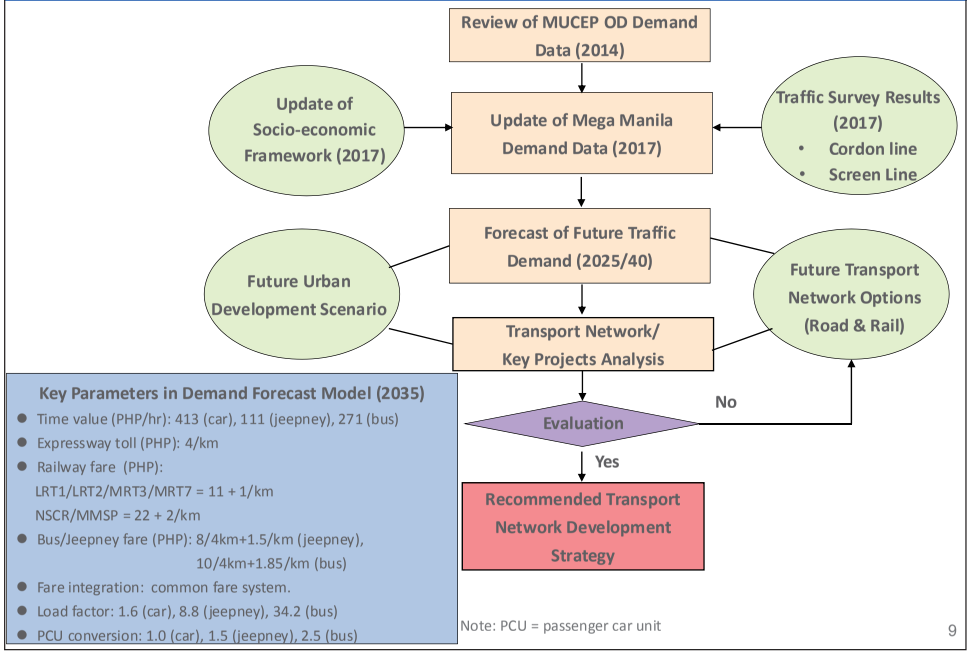
- **With road traffic management improvement, 10-20% of capacities be enhanced.**

◂ Impact of Road Traffic Management on Overall Network ▸

		Do-nothing		10% Improvement				20% Improvement			
				2017 Value		Contribution		2017 Value		Contribution	
		Metro Manila	BRLC	Metro Manila	BRLC	Metro Manila	BRLC	Metro Manila	BRLC	Metro Manila	BRLC
Network Performance	V/C Ratio	0.95	0.93	0.87	0.84	-8%	-10%	0.79	0.77	-17%	-17%
	Travel Speed (kph)	12.3	11.1	14.1	12.9	+15%	+16%	15.9	14.5	+29%	+31%
Transport Cost (PHP bil. /day)	VOC	0.94	0.72	0.87	0.68	-8%	-5.5%	0.81	0.64	-13%	-10.5%
	TTC	2.3	1.7	1.9	1.4	-17%	-15.6%	1.6	1.2	-29%	-28.0%
Environment	CO2 (tons/day)	12.5	9.3	12.3	9.1	-2%	-2%	12.1	8.9	-3%	-4%

- **When properly done, impact of road traffic management is significant. With 10% capacity increase, congestions will reduce to 8 – 10%, travel speed increase by 15-16%, and transport cost will reduce by 12 – 15%.**

Updated Database and Methodology and Forecast



Key Parameters in Demand Forecast Model (2035)

- Time value (PHP/hr): 413 (car), 111 (jeepney), 271 (bus)
- Expressway toll (PHP): 4/km
- Railway fare (PHP):
  LRT1/LRT2/MRT3/MRT7 = 11 + 1/km
  NSCR/MMSP = 22 + 2/km
- Bus/Jeepney fare (PHP): 8/4km+1.5/km (jeepney), 10/4km+1.85/km (bus)
- Fare integration: common fare system.
- Load factor: 1.6 (car), 8.8 (jeepney), 34.2 (bus)
- PCU conversion: 1.0 (car), 1.5 (jeepney), 2.5 (bus)

Note: PCU = passenger car unit

Estimated Future Demand

- **Overall demand: 19.5 million to 33.2 million person trips/day in Mega Manila. Vehicular traffic demand will increase 6.5 million to 8.6 million pcu/day.**
  - Demand will increase more in BRLC.
  - Traffic congestions amplifies in BRLC.
  - Transport cost in BRLC will exceeds that of Metro Manila.

◂Future Demand and KPI of Do-nothing Network in 2035▸

		2035 Value		2035/2017	
		Metro Manila	BRLC	Metro Manila	BRLC
Traffic Demand	No. of Trips (000 trips/day)	16.2	7.0	1.13	1.41
	No. of PCU (000 pcu/day)	5.6	3.0	1.16	1.31
	Rail (000pax/day)	1.4		1.19	
	Ave. Travel Distance (km/trip)	8.5	15.0	1.10	1.01
Network Performance	V/C Ratio	1.11	1.59	1.16	1.72
	Travel Speed (kph)	8.5	4.7	0.69	0.42
Transport Cost (PHP bil. /day)	VOC	1.2	1.7	1.29	2.33
	TTC	4.5	7.3	1.93	4.29
Environment	CO2 (tons/day)	15.0	17.5	1.19	1.89

Current Mega Manila Transport Network Development Strategy (Build!Build!Build!)

① Impact of Traffic Management

- **Improvement measures include Mega Manila wide improvement/ installation of traffic signals, flyovers at critical intersections, additional bridges across the Pasig River, regulated use of road space and enforcement.**

◂Impact of Road Traffic Management on Overall Network▸

		2035 Do-nothing (Baseline)		10% Improvement			
				Impact (2035 value with ①)		Impact against Baseline (ratio)	
		Metro Manila	BRLC	Metro Manila	BRLC	Metro Manila	BRLC
Network Performance	V/C Ratio	1.11	1.59	0.98	1.44	-12%	-9%
	Travel Speed (kph)	8.5	4.7	10.5	5.4	+24%	+15%
Transport Cost (PHP bil. /day)	VOC	1.2	1.7	1.1	1.6	-7.1%	-4.5%
	TTC	4.5	7.3	3.8	5.9	-15.3%	-18.4%
Environment	CO2 (tons/day)	15.0	17.5	14.6	17.2	-3%	-2%

- **10% improvement will improve traffic congestion significantly, reduction in transport cost and CO2 emission. This implies how important to improve as a network.**

② Impact of LRT1 + MRT3 Capacity Expansion

- **Capacity expansion of LRT1 and MRT3 will contribute to decongest carrying capacity of the systems. However it is apprehended weather or not it will improve access to trains. Impact on road traffic is limited to the corridors.**

◂ Capacity Expansion▸

		LRT1	MRT3
Capacity (pphpd)	Current	27,100	23,600
	Expanded	40,000	46,000

Note:
PPHPD = passenger per hour per direction

◂ Impact of LRT1 and MRT3 Capacity Expansion on Overall Road Network▸

		2035 Value with ①+②		Impact of the Program			
				Contribution		Against Baseline	
		Metro Manila	BRLC	Metro Manila	BRLC	Metro Manila	BRLC
Network Performance	V/C Ratio	1.06	1.29	Minimal	Minimal	0.95	0.81
	Travel Speed (kph)	9.4	6.7	Minimal	Minimal	1.11	1.43
Transport Cost (PHP bil. /day)	VOC	1.2	1.2	Minimal	Minimal	1.00	0.71
	TTC	4.1	4.0	Minimal	Minimal	0.91	0.55
Environment	CO2 (tons/day)	14.6	13.7	Minimal	Minimal	0.97	0.78

◂ Impact on LRT 1 and MRT 3 ▸

	No. of Passenger (000 pax)		With/Without Ratio
	Without	With	
LRT1	539	626	1.16
MRT3	454	848	1.87

Note: LRT1/MRT3 = PHP11+1/km

◂ Impact on EDSA ▸

	Traffic Volume (000 pcu)
Without	310
With	295

③ Impact of Skyaway Stage 3 + NLEx-SLEx Connector

- **Impact of Skyway Stage 3 and NLEx – SLEx connector on overall traffic is significant.**
  - Especially R1 and EDSA
  - Impact on Metro Manila is more significant than in BRLC.

◂ Estimated Traffic Volume▸

	Skyway 3	NS Connector
Traffic Volume (000 pcu)	123	145

◂ Impact of NLEx-SLEx Connector on Overall Road Network▸

		2035 Value with ① to ③		Impact of the Program			
				Contribution		Against Baseline	
		Metro Manila	BRLC	Metro Manila	BRLC	Metro Manila	BRLC
Network Performance	V/C Ratio	1.00	1.29	-5.9%	-0.2%	0.90	0.81
	Travel Speed (kph)	9.7	6.8	+3.2%	+1.5%	1.14	1.45
Transport Cost (PHP bil. /day)	VOC	1.1	1.2	-4.7%	-0.1%	0.92	0.71
	TTC	3.9	4.0	-3.6%	-0.8%	0.87	0.55
Environment	CO2 (tons/day)	14.5	13.7	-0.8%	-0.1%	0.97	0.78

◂ Impact on R1 and EDSA ▸

	Without		With	
	R1	EDSA	R1	EDSA
Traffic Volume (000 pcu)	30.9	292	25.5	279
V/C Ratio	0.8	0.98	0.74	0.89

Note: Expressway toll = PHP4/km

④ Impact of NSCR + MMSP

- **NSCR (North-South Commuter Railway) and MMSP (Mega Manila Subway Project) will reduce the congestion on LRT1 and LRT3.**
  - NSCR and MMSP contribute to improvement of public transport.

◂ No. of Passengers of NSCR and MMSP ▸

	NSCR	MMSP
No. of Passenger (000 pax/day)	753	1,369

◂ Impact of NSCR + MMSAP on Overall Network▸

		2035 Value with ① to ④		Impact of the Program			
				Contribution		Against Baseline	
		Metro Manila	BRLC	Metro Manila	BRLC	Metro Manila	BRLC
Network Performance	V/C Ratio	0.96	1.27	-3.2%	-1.7%	0.86	0.80
	Travel Speed (kph)	10.1	6.9	+4.1%	+1.5%	1.19	1.47
Transport Cost (PHP bil. /day)	VOC	1.1	1.2	-4.1%	-2.1%	0.92	0.71
	TTC	3.6	3.9	-8.2%	-2.9%	0.80	0.53
Environment	CO2 (tons/day)	13.9	13.4	-4.0%	-2.0%	0.93	0.77

◂ Impact on LRT 1 and MRT 3 ▸

	No. of Passenger (000 pax)		Increase /Decrease
	Without	With	
LRT1	386	272	0.71
MRT3	692	568	0.82

Note: LRT1/MRT3 = PHP11+1.0/km, NSCR/MMSP = PHP22+2/km

⑤ Impact of LRT 1 Extension + LRT 2 Extension + MRT 7

- **Impact of LRT1/LRT2 extension and MRT7 on road congestion is not big while No. of passengers of LRT1 increase more than 1.5 times.**

◂ Ridership of Line1, 2 and 7 ▸

	No. of Passenger (000 pax)		With/Without Ratio
	Without	With	
LRT1	276	450	1.63
LRT2	216	271	1.25
MRT7	-	526	-

Note: LRT1/LRT2 = PHP11+1.0/km, MRT7 = PHP11+1.0/km

◂ Impact of LRT 1 and LRT 2 Extension and MRT 7 on Overall Network ▸

		2035 Value with ① to ⑤		Impact of the Program			
				Contribution		Against Baseline	
		Metro Manila	BRLC	Metro Manila	BRLC	Metro Manila	BRLC
Network Performance	V/C Ratio	0.95	1.26	-1.1%	-0.4%	0.86	0.79
	Travel Speed (kph)	10.5	6.9	+4.0%	+0.0%	1.24	1.47
Transport Cost (PHP bil. /day)	VOC	1.0	1.2	-1.5%	-0.4%	0.83	0.71
	TTC	3.4	3.8	-5.2%	-1.2%	0.76	0.52
Environment	CO2 (tons/day)	13.7	13.3	-1.4%	-0.5%	0.91	0.76

⑥ Impact of NS-C5-Dike Road Expressway

- **NS-C5-Dike Road Expressway will influence more on traffic in BRLC. Traffic volume on NS Connector will depend on toll setting.**

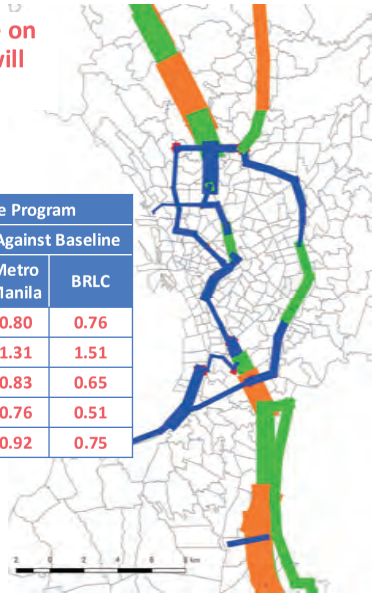
◂ Impact of NS-C5-Dike Road Expressway on Overall Network ▸

		2035 Value with ① to ⑥		Impact of the Program			
				Contribution		Against Baseline	
		Metro Manila	BRLC	Metro Manila	BRLC	Metro Manila	BRLC
Network Performance	V/C Ratio	0.89	1.21	-6.7%	-4.4%	0.80	0.76
	Travel Speed (kph)	11.1	7.1	+4.8%	+2.9%	1.31	1.51
Transport Cost (PHP bil. /day)	VOC	1.0	1.1	-3.4%	-3.5%	0.83	0.65
	TTC	3.4	3.7	-1.9%	-2.4%	0.76	0.51
Environment	CO2 (tons/day)	13.8	13.1	+0.9%	-1.7%	0.92	0.75

◂ Impact on EDSA ▸

	Traffic Volume (000 pcu)	V/C Ratio
Without	276	0.88
With	109	0.60

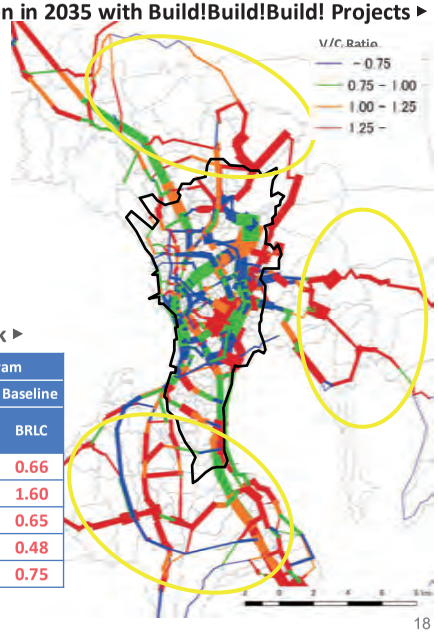
Note: Expressway toll = PHP4/km



⑦ Impact on Remaining Projects in Build!Build!Build!

◂ Traffic Situation in 2035 with Build!Build!Build! Projects ▸

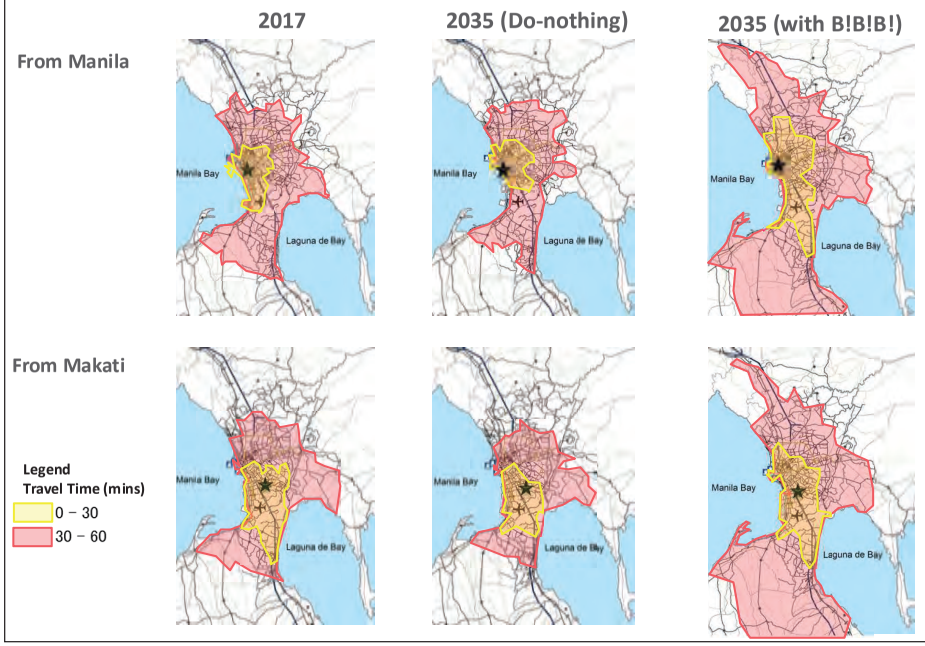
- Remaining projects include NAIA Expressway Phase II, NLEx Harbor Link, CALA Expressway, Unified Common Station, Metro Manila BRT Line 1 (Quezon Ave.), BGC-NAIA BRT and others.
- **Although impact is more significant in BRLC, more projects are needed for improvement.**



◂ Impact of Remaining Projects on Overall Network ▸

		2035 Value with ① to ⑦		Impact of the Program			
				Contribution		Against Baseline	
		Metro Manila	BRLC	Metro Manila	BRLC	Metro Manila	BRLC
Network Performance	V/C Ratio	0.88	1.05	-0.7%	-13.3	0.79	0.66
	Travel Speed (kph)	11.1	7.5	+0.9%	+5.6%	1.31	1.60
Transport Cost (PHP bil. /day)	VOC	0.99	1.1	-1.0%	-4.1%	0.83	0.65
	TTC	3.3	3.5	-0.8%	-5.3%	0.73	0.48
Environ	CO2 (tons/day)	13.8	13.1	-0.6%	-0.2%	0.92	0.75

Travel Time from City of Manila and Makati



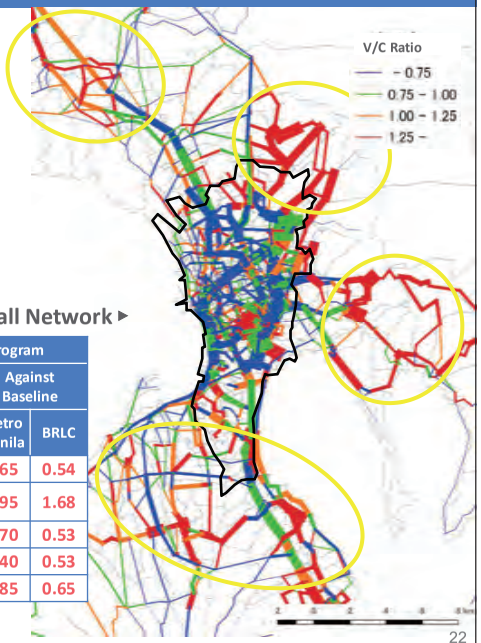
Proposed Strategy in Roadmap 2

Farther Identified Gaps to Build!Build!Build!

- **Three main areas;**
  - Transport infrastructure provision in sub-urban Area (secondary roads, secondary MRT) together with traffic management
  - CBD access provision: strengthening of connectivity with primary network
  - Land use reform: dedensification of Metro Manila, relocation of the households residing in hazard risk areas

Sub-urban Area Transport Development

- **Additional projects identified in the previous Roadmap.**
  - CBD secondary mass-transit access
  - Secondary roads
  - Others
- Traffic improvement in outer areas needs to be attended further.



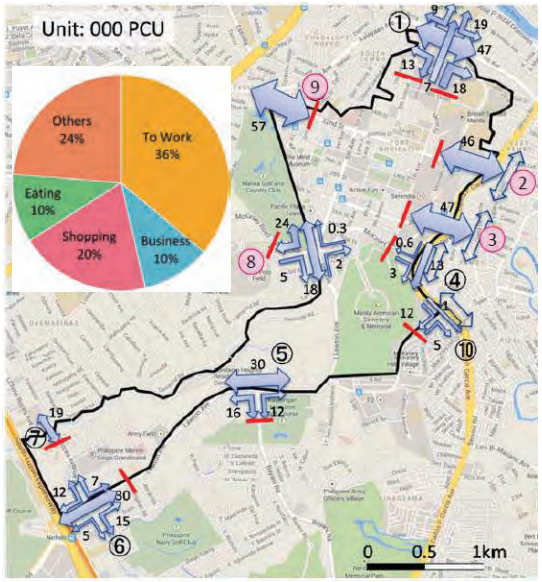
◂ Impact of Previous Roadmap Projects on Overall Network ▸

		2035 Value with ① to ⑦		Impact of the Program			
				Contribution		Against Baseline	
		Metro Manila	BRLC	Metro Manila	BRLC	Metro Manila	BRLC
Network Performance	V/C Ratio	0.72	0.86	-18.5%	-17.7%	0.65	0.54
	Travel Speed (kph)	16.6	7.9	+49.5%	+5.3%	1.95	1.68
Transport Cost (PHP bil. /day)	VOC	0.84	0.90	-16.0%	-17.9%	0.70	0.53
	TTC	1.8	3.9	-46.9%	-14.8%	0.40	0.53
Environ	CO2 (tons/day)	12.8	11.4	-7.0%	-13.1%	0.85	0.65

Current (2014) Traffic Volume vs Road Capacities in BGC

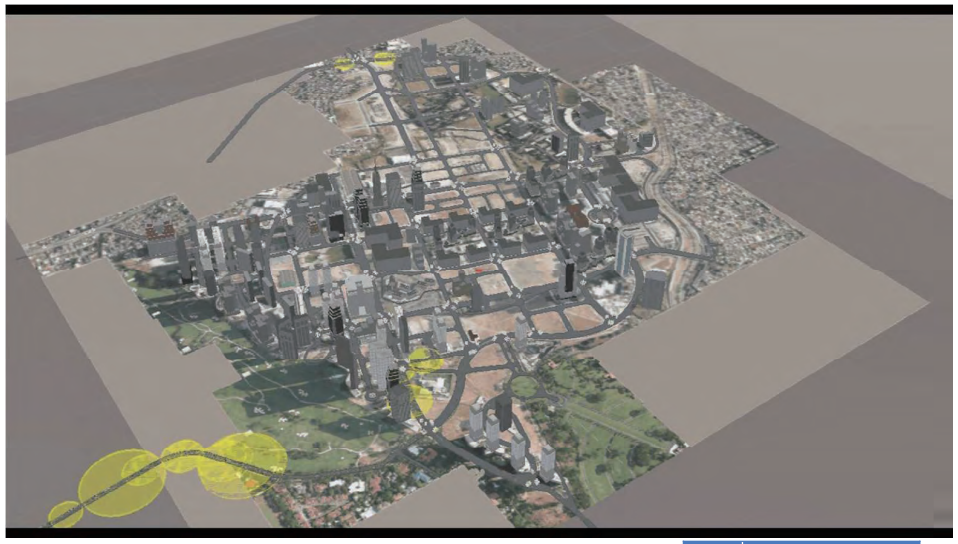
◂ Existing Access Roads of BGC ▸

	Road Section	No. of Lanes	000 pcu/day		V/C Ratio
			Volume	Capacity	
1	8th Ave.	4	11.6	43.1	0.3
	11th Ave.	4	3.6	34.8	0.1
2	32nd Str.	8	46.1	74.1	0.6
3	26th Str.	6	46.7	54.5	0.9
4	Upper McKinley Rd.	4	17.1	32.6	0.5
5	Bayani Rd.	4	28.7	39.1	0.7
6	Lawton Ave.	4	37.0	37.1	1.0
7	Chino Roces Ave.	4	18.7	37.1	0.5
8	McKinley Rd.	4	29.2	34.8	0.8
9	Kalayaan Ave.	8	56.6	78.1	0.7
10	SM Aura Dr.	2	3.9	20.1	0.2
	Total	52	299	485	0.6



- Roads traffic demand can be accommodated on daily capacity basis, but not in peak hours.
- Road traffic conditions in BGC will be greatly affected with:
  - **Capacities of external access**
  - **Efficiency of internal circulation**

CBD Access (BGC)

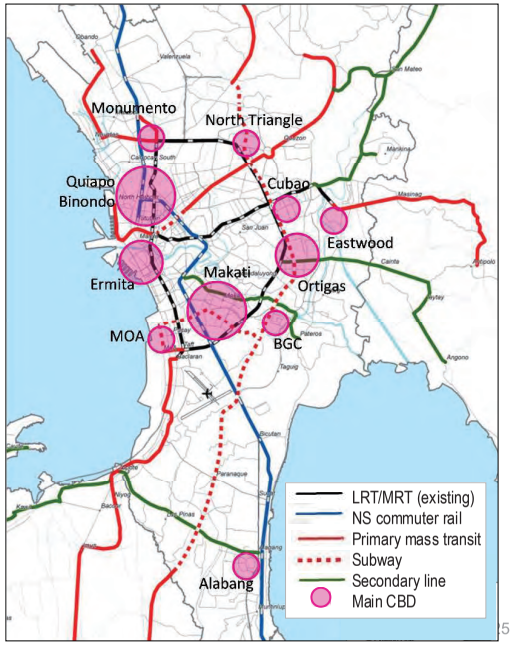


Expand the access or control the development!

	Gross Floor Area (ha)
2014	287
2030	818

Preliminarily Proposed Secondary Mass Transit Route in Roadmap 1

- **Development of mass-transit as hierarchical network**
  - NSCR and MMSP as a backbone lines
  - Existing three lines as primary lines to be expanded and new lines to be developed
  - Secondary lines (monorail, AGT, BRT) to be developed
- **Inter-line integration and TOD are the keys for success**



Opportunities for Jeepney/Tricycle Modernization Using EV and ICT

- Electrification as feeder service
- Modernize management system
- Support/Regulation of the Government
- ICT based public transport in CBD

For improved E-trike

For improved E-jeepney

Mobile App

Off-peak

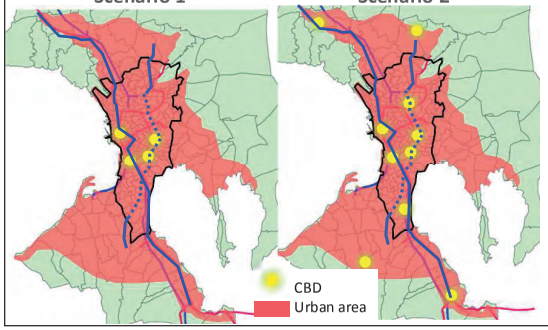
Peak hours

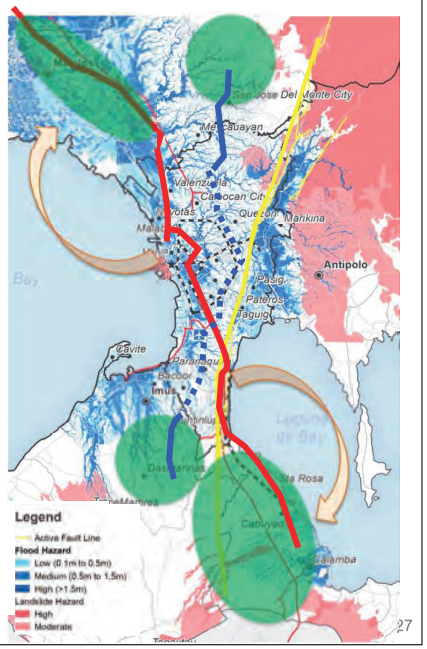
Source: NEDO-Softbank

Land Use Reform of Metro Manila

- **Scenario 1:** relocate people in high hazard areas to areas outside Metro Manila along NSCR and Mega Manila Subway. (approximately 1.4 mil. people)
- **Scenario 2:** Scenario 1 + develop the job opportunities outside Metro Manila along NSCR and Mega Manila Subway.

Scenario 1 / Scenario 2





Impact of Land Use Reform

- **Resettlement of the household residing in hazard areas is critical.**
- **Decongestion in Mega Manila is more effective if employment opportunities are provided outside Metro Manila.**

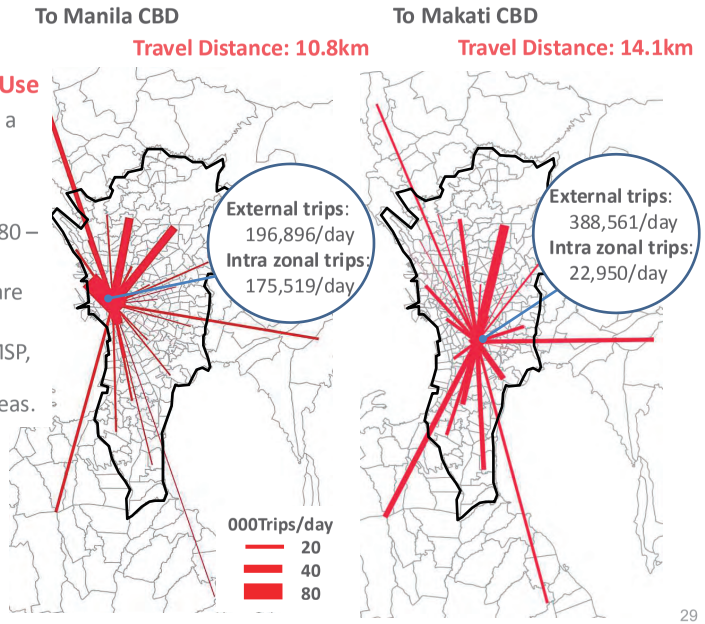
◂ Impact of Land Use Reform with Build!Build!Build!▸

KPI		Trend		Scenario 1		Scenario 2	
		Metro Manila	BRLC	Metro Manila	BRLC	Metro Manila	BRLC
No. of Population (mil.)	Night-time	15.2	14.2	14.1	15.3	14.1	15.3
	Day-time	15.5	13.7	14.7	14.5	14.0	15.2
Traffic Demand	mil.trips/day	16.2	7.0	16.2	7.0	15.6	6.5
	mil.pcu/day	5.6	3.0	5.6	3.0	5.3	2.7
	Rail (000trips/day)	4.0		4.0		3.8	
Network Perform.	VCR	0.83	1.19	0.84	1.25	0.80	1.16
	Ave. speed(km/h)	12.4	6.1	12.8	5.7	13.2	6.1
Environment	CO2 (ton/day)	13.8	16.5	14.0	17.3	13.2	15.9

Development of planned new urban areas in integration with NSCR and MMSP in outer areas will benefit both rail ridership and dedencification of Metro manila.

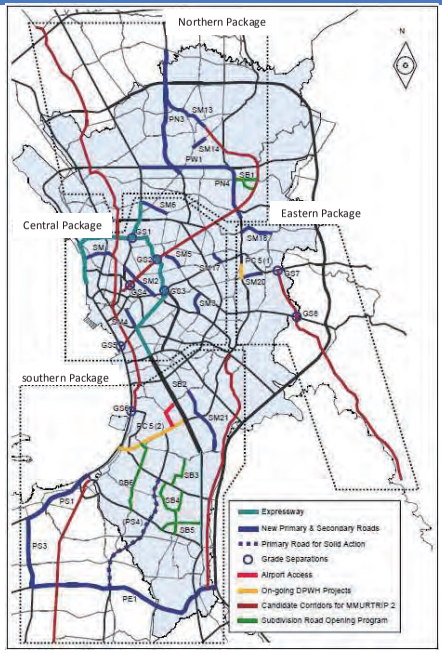
Transformation of Metro Manila

- **Transformation of Metro manila Land Use**
  - Up to 1970-'80 was a single CBD.
  - Makati areas and Ortigas emerged to new CBD during 1980 – today.
  - Other sub-centers are also emerging.
  - With NSCR and MMSP, new CBD to be developed outer areas.



Secondary Roads

- **Proposed packages in MTDP (1999 – 2004): MMUTIS**
  - Development of roads as network and packages
  - Expand the northern/southern /eastern packages to farther outer areas



Preliminarily Proposed Mega Manila Urban Transport Strategy

- Accelerate Transportation Projects in Build!Build!Build! (NOT Building) with priority
- Improve traffic management measures: 10% within 3 years and 10% within following 5 years and eventually more drastic measures on demand management.
- Attend to transport improvement in outer areas; secondary roads and secondary MRT.
- Start thinking land use strategy/control
- Improve institutional reform of transport sector management: single authority to manage Mega Manila transport issues, capacity building, modernization of bus/jeepney industries, etc.

Next Steps

- Roadmap 2 Program
- Recommended Institutional Reform

Thank you for your kind attention.

Follow-up Survey on Roadmap for Transport Infrastructure Development for Greater Capital Region (GCR)

Final Technical Workshop
~ Transport Roadmap for Mega Manila toward 2035~

8 November 2017
Venue: Joy~Nostalg Hotel & Suites Manila

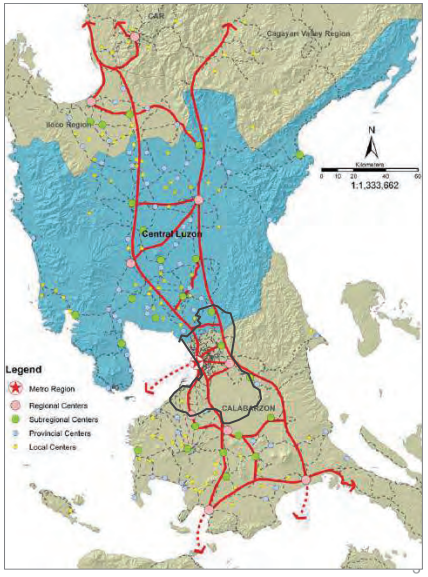
JICA Study Team

Contents

Study Background

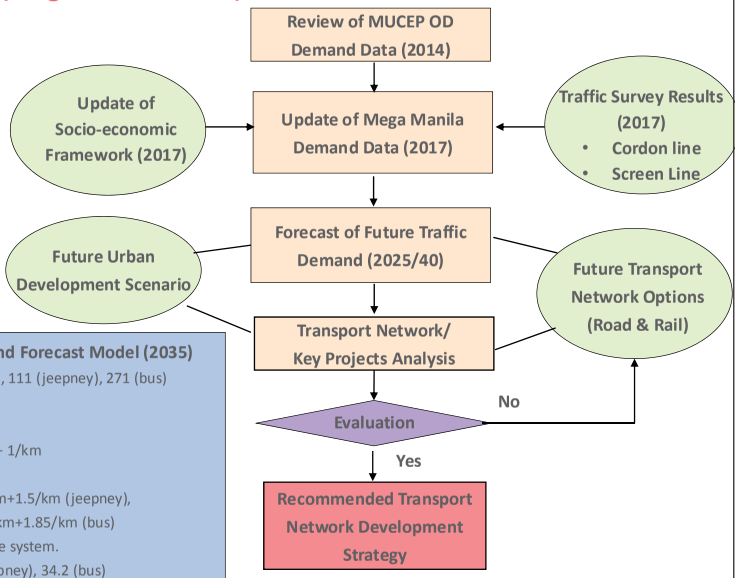
- **Background**
  - In June 2014, the NEDA Board approved the "Roadmap for Transport Infrastructure Development for Metro Manila and Its Surrounding Areas (Region III & Region IV-A)" (Transport Roadmap), which was considered as the Philippine government's long-term plan on transport infrastructure development.
- **Objectives**
  - To revise the 2014 Transport Development Strategies and Roadmap based on updated transport demand analysis and current government policy.
- **Expected Outputs**
  - Updated Transport Roadmap
  - Methods of plan update

Twin-spine Connectivity Framework Showing Linkage between Urban Centers



Updated Database and Methodology and Forecast

- **Updating OD (Origin-Destination) Table**



Key Parameters in Demand Forecast Model (2035)

- Time value (PHP/hr): 413 (car), 111 (jeepney), 271 (bus)
- Expressway toll (PHP): 4/km
- Railway fare (PHP):
  LRT1/LRT2/MRT3/MRT7 = 11 + 1/km
  NSCR/MMSP = 22 + 2/km
- Bus/Jeepney fare (PHP): 8/4km+1.5/km (jeepney), 10/4km+1.85/km (bus)
- Fare integration: common fare system.
- Load factor: 1.6 (car), 8.8 (jeepney), 34.2 (bus)
- PCU conversion: 1.0 (car), 1.5 (jeepney), 2.5 (bus)

Note: PCU = passenger car unit

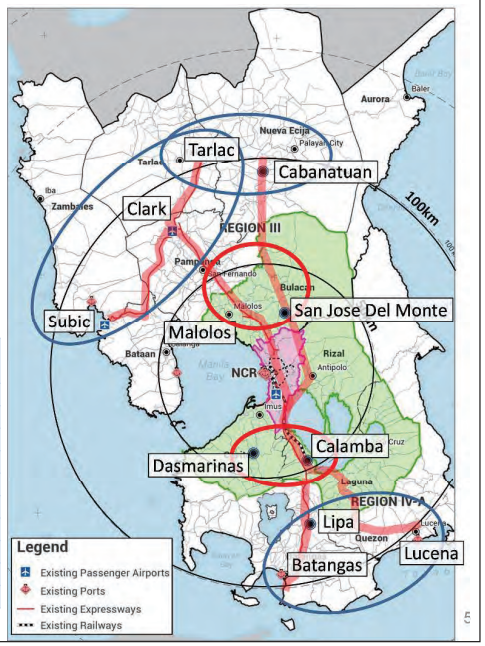
Study Area

- Mega Manila shares 25.5% of the total population.
- Metro Manila shares 12.8% of the total population but 41.5% of the total GRDP.
- Tertiary industry (82.1%) leads the economic sector.

Socio-Economic Profile of the Study Area (2015)

Item			GCR	Mega Manila	Metro Manila
Area	km²		39,508	20,289	620
	% of Total in RP		11.5	6.0	0.2
Population	In thousands		38,510	25,766	12,877
	% of Total in RP		38.1	25.5	12.8
	AGR ('10–'15: %/yr)		2.16	3.00	1.67
GDRP	PHP bil. ('15: current)		8,970	-	5,522
	% of Total in PR		67.3	-	41.5
	% by Sector	Primary	10.3	-	0.2
		Secondary	30.9	-	17.6
		Tertiary	58.8	-	82.1

AGR: annual growth rate



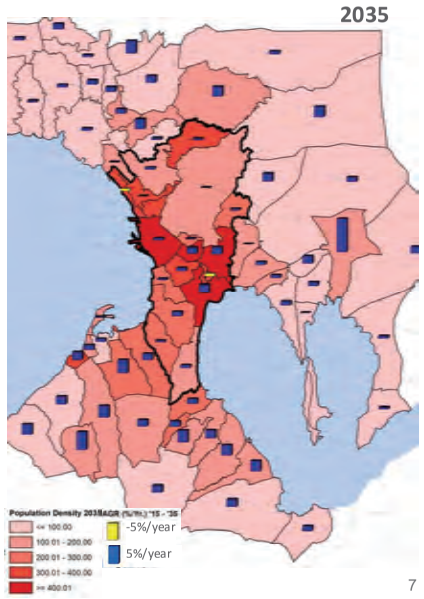
Impacts of Urbanization

Trend in Land Use Pattern

	LGU	2015 No. (000)	2015 Net Density (person/ha)	2015 AGR (%/yr): '10-'15	2015 Day/Night Ratio	2035 No. (000)	2035 Net Density (person/ha)
Metro Manila	Caloocan	1,584	303	1.2	0.90	1,812	347
	Las Pinas	589	187	1.3	0.96	679	215
	Makati	583	278	1.9	1.29	765	365
	Malabon	366	297	0.7	0.95	374	304
	Mandaluyong	386	357	3.3	1.23	658	609
	Manila	1,780	505	1.5	1.06	2,143	608
	Marikina	451	206	1.2	1.03	514	234
	Muntinlupa	505	133	1.9	1.07	652	172
	Navotas	249	425	0.0	0.94	224	381
	Paranaque	666	140	2.5	1.01	975	204
	Pasay	417	220	1.2	1.05	470	248
	Pasig	755	233	3.8	1.10	1,424	439
	Pateros	64	389	-0.1	0.96	56	341
	Quezon	2,936	175	0.7	1.04	3,036	181
	San Juan	122	215	0.9	0.99	130	229
	Taguig	805	236	4.5	1.02	1,750	512
	Valenzuela	620	161	1.5	1.00	750	194
	Sub-total	12,877	232	1.6	1.03	16,411	285
BRLC	Bulacan	2,640	29	2.7	0.96	4,624	51
	Rizal	2,884	23	3.0	0.92	5,803	47
	Laguna	1,888	55	3.3	0.99	3,936	114
	Cavite	3,315	49	3.7	0.97	7,509	111
	Sub-total	10,727	34	3.2	0.96	21,873	69
Mega Manila		23,604	63	2.3	1.00	38,284	102
				(PSA Estimation)		29,215	

Big difference!

Population Forecast (Trend)

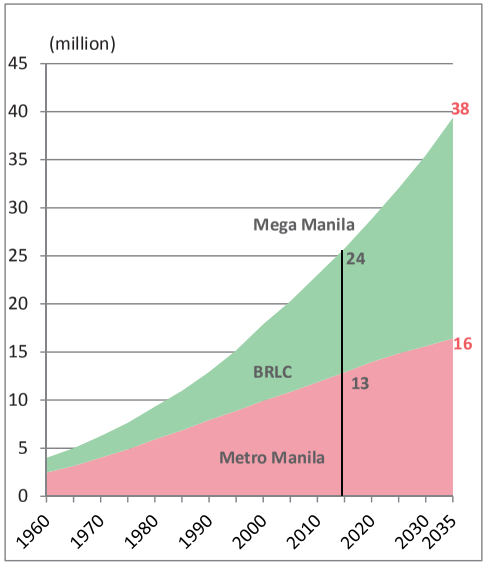


Expected Impact on Land Use

- Mega Manila will be one of the largest mega cities in the world.
- Makati, Ortigas, and BGC will become increasingly congested.
- New growth centers will emerge, because existing centers are congested and population increase in outer areas.

Impact on outer areas will be enormous.

Growing Urban Area



* BRLC = Bulacan, Rizal, Laguna and Cavite Provinces

Main Urban Issues

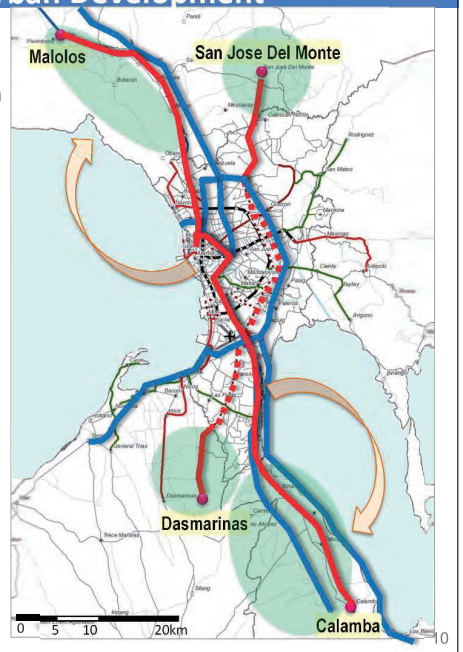
- **Traffic Congestions**
- **Hazard Risks (flood, landslide, earthquake)**
- **Affordable Housing**

➡ ***Three issues are closely interrelated.***

Three Issues must be attended through Integrated Transportation and Urban Development

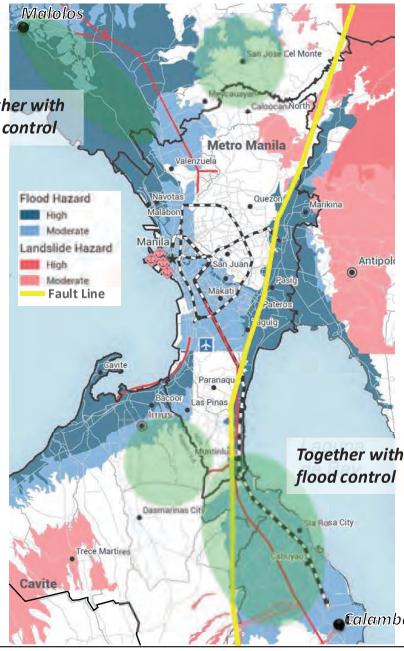
- **Reorganized Urban Structure**
  - From radial/circumferential to ladder form
  - Metro Manila to Mega Manila
  - Strengthen urban planning and development institutions
- **High-quality Mass Rapid Transit**
  - NSCR & MMSP as backbones
  - Hierarchical/Integrated rail system
  - Improved role of buses/jeepneys
- **Integrated Urban Development (TOD)**
  - Connectivity between CBDs and rail
  - Improved access to/from catchment areas
  - Large-scale new towns in outer areas connected to NSCR & MMSP
  - Required strong coordination among the relevant agencies.

* TOD = transit oriented development



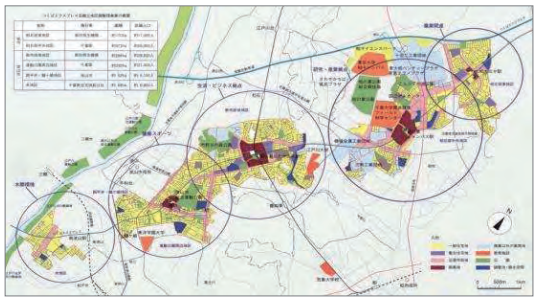
Hazard Avoidance

- **No. of households residing in hazard areas**
  - High: 1.6 million households
  - Moderate: 2.1 million households
- **Difficult to find relocation sites within Metro Manila**

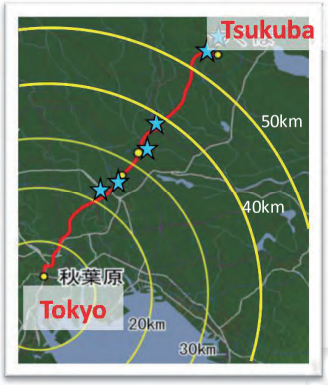


Proposed Solution for Affordable Housing

- **Demand in Greater Capital Region (2017)**
  - Backlog: about 578,000 units
  - New demand: about 245,000 units
- **Requirement**
  - Safe environment, Access to employment/livelihood, Affordable housing
- **Balanced housing (BP220)**
- **New towns integrated with rail development**



Kashiwa-no-Ha Smart City along Tsukuba Express

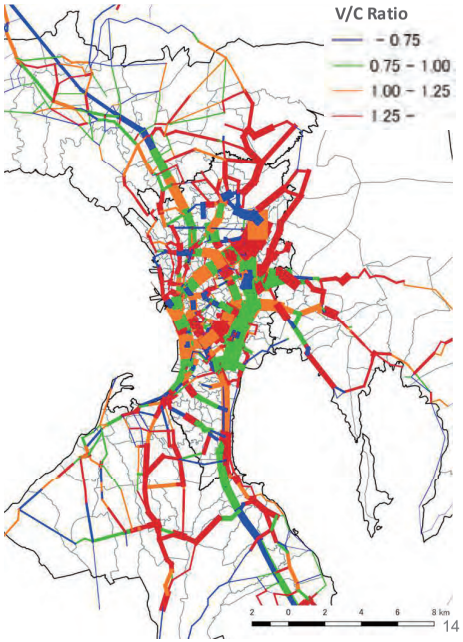


- Development of new urban areas along the line.
- The distance between metropolitan and new urban area is 20 – 40km.

Review of Current Build!Build!Build! Program

Current Transport Situation

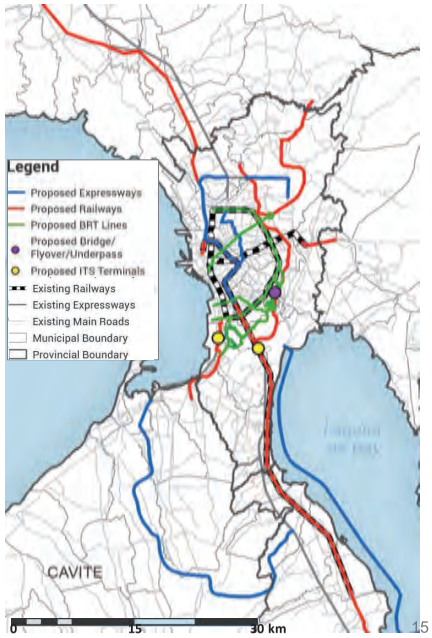
- Traffic congestion in Metro Manila occurs throughout the day.
- Traffic in outer areas of Metro Manila (BRLC) is just as bad.
- **Congestion cost** in Metro Manila is PHP2.7 billion/day; in adjoining areas, it is PHP2.2 billion/day. **(Assumption: expressway=60 kph, primary road=35 kph, secondary road=10 kph)**



Indicators	2017	
	Metro Manila	BRLC
Traffic demand (million trips/day)	13.4	5.1
Public transport share in total demand (%)	71	68
Occupancy of road space by private vehicles (%)	69	69
Volume Capacity Ratio	0.97	0.98
Transport cost (Php billion/day)	3.2	2.6
Congestions cost (PHP billion/day)	2.7	2.2
CO2 emission (000tons/year)	8.3	7.9

Transport Projects in Build!Build!Build! Program

	Name	Cost (PHP Bil.)
Flagship Projects	BGC to Origas Road Link Project	5.6
	NLEX-SLEX Connector Road	23.2
	NAIA Expressway Phase II	17.9
	NLEX Harbor Link, Segment 10	9.0
	Cavite - Laguna Expressway	35.4
	Mega Manila Subway	355
	PNR North 1 (North South Commuter Rail)	105
	PNR South Commuter	134
	Unified Common Station	2.8
	Line 7 (MRT 7)	62.7
	LRT Line 2 East (Masinag) Extension Project	0.9
	LRT 1 South (Cavite) Extension Project	65.9
	Metro Manila BRT- Line 1 (Quezon Avenue BRT)	4.8
	Metro Manila BRT- Line 2 (Central Corridor)	37.8
	South Integrated Transport System (bus terminal)	4.0
	Southwest Integrated Transport System (bus terminal)	4.0
	BGC to NAIA BRT System	24.0
Other Key Projects	Intelligent Transport System (traffic signal)	4.7
	LRT1/MRT3 Capacity Expansion	10.7
	Skyway Stage 3	26.7
	Laguna Lakeshore Expressway (Dike Road)	123
Others	DOTr	534
	DPWH	102
	MMDA	-
Total		1,693



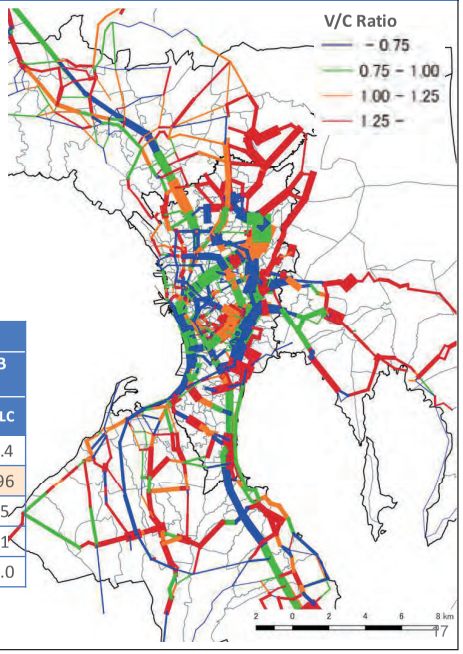
Impact of Build!Build!Build! Projects

- **Current traffic situation in Metro Manila will improve but not in adjoining areas. Vehicle Capacity (V/C) Ratio in 2017, 2035 (Do Nothing) and 2035 (Do Build!Build!Build! projects) is 0.97, 1.10 and 0.79 in Metro Manila, and 0.98, 1.33 and 0.96 in adjoining areas, respectively.**
- **Transport cost in adjoining areas will increase rapidly.**

	Indicators	2017	2035 Do Nothing	Traffic Mgmt (1)	LRT+MRT Capacity Expansion (2)	Skyway3+ NS Connector (3)	LRT1,LRT2 Ext, MRT7 (4)	NSCR +MMSP (5)	NS-C5-Dike Road Expy (6)	Remaining B!B!B! Project (7)
Metro Manila	Traffic demand (mil. trips/day)	13.4	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1
	Rail Ridership (mil. pax/day)	1.2	1.5	1.3	1.6	1.4	1.6	4.0	4.0	4.0
	Network Performance (Volume Capacity (V/C) Ratio)	0.97	1.10	0.98	0.98	0.92	0.90	0.85	0.80	0.79
	Transport Cost (PHP bil./day)	3.2	5.2	4.1	4.1	3.9	3.5	3.0	2.8	2.8
Adjoining Areas	Traffic demand (mil. trips/day)	5.1	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4
	Rail Ridership (mil. pax/day)	-	-	-	-	-	0.4	1.0	1.0	1.0
	Network Performance (Volume Capacity (V/C) Ratio)	0.98	1.33	1.20	1.21	1.20	1.19	1.14	1.09	0.96
	Transport Cost (PHP bil./day)	2.6	6.2	5.2	5.4	5.2	5.2	4.8	4.6	4.5

Impact of Build!Build!Build! Projects

- Metro Manila's traffic situation will improve much.
- Congestions in outer areas is more significant, requiring additional projects.
- CBD access must be strengthened.



Indicators	2035			
	Do-nothing		With BBB	
	Metro Manila	BRLC	Metro Manila	BRLC
Traffic demand (million trips/day)	17.1	10.4	17.1	10.4
Volume Capacity Ratio	1.10	1.33	0.79	0.96
Transport cost (Php billion/day)	5.2	6.2	2.8	4.5
Congestions cost (PHP billion/day)	4.7	5.8	2.5	4.1
CO2 emission (000tons/year)	11.9	18.1	9.1	12.0

Transport Sector Goals and Strategies

Goals and Objectives

Metro Manila Greenprint 2030
Buidling a Green, Connected and Resilient Metropolis for All

Build!Build!Build! Projects

+

Additional Projects
(DPWH, DOTr, MMDA, Roadmap1)

- **5 NOs for Mega Manila in Dream Plan**
  - **No** traffic congestion
  - **No** households living in high hazard risk areas
  - **No** barrier for seamless mobility
  - **No** excessive transport cost burden for low-income groups
  - **No** air pollution

Transport Sector Strategies

- **Ensure the achievement of goals and objectives**
  - Leverage on the north–south mass transit backbone
  - Transform Metro Manila's urban structure
- **Continue improvement**
  - Constant traffic management using ICT/ITS
  - Constant removal of bottlenecks
  - Plan long-term projects and implement short-term actions
- **Coordinate sectors**
  - Transport, urban development, and hazard risk reductions
  - Road, rail network, bus/jeepney
  - Involve LGUs

Additional to Build!Build!Build! Projects
(DPWH, DOTr, MMDA, Roadmap1)

Proposed Areas of Additional Projects

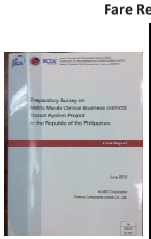
1. **Round-the-clock Traffic Management**
   - Promote conventional traffic management (engineering, enforcement, education)
   - Modernize buses/jeepneys
   - Introduce ICT/ITS in traffic management
2. **Development of a Hierarchical/Integrated Metro Network**
   - Develop MMSP and NSCR as backbones
   - Strengthen CBD access (secondary lines)
   - Improve accessibility to metro
3. **Development of an Integrated Urban Expressway Network**
   - Promote NLEx–SLEx connectivity
   - Establish the North Luzon–C5–Dike Road spine
   - Develop secondary routes
4. **Secondary Road Development in Outer Areas together with Urban/Regional Planning**
5. **New Town/Urban Area Development Integrated with NSCR/MMSP**

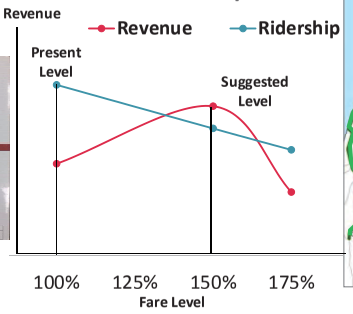
Potential Role of Road Traffic Management is Significant!!

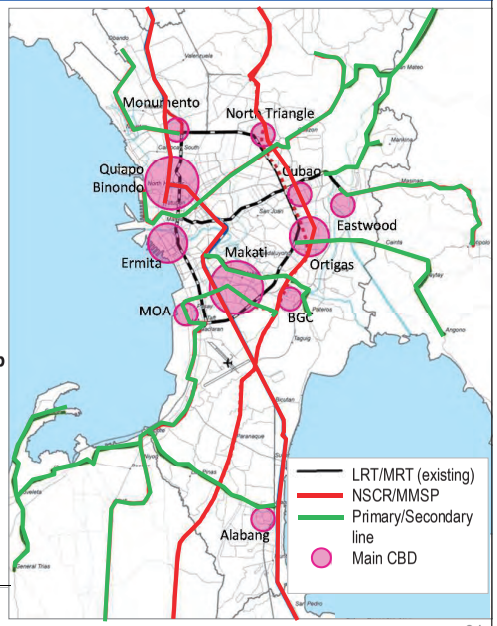
- **Assumption:** **10% increase in road capacities through various traffic management measures** such as traffic signaling, enforcement vs. illegal roadside parking, improvement of bus/jeepney loading/unloading, improved driving manner, removal of engineering bottlenecks including bridges and flyovers, improvement of pedestrian facilities and walking environment, **enforcement**, and **education**.
- **Effects:** Transport cost in 2035 will decrease **from PHP5.2 billion/day (Do Nothing) to PHP4.1 billion/day** in Metro Manila and **from PHP6.2 billion/day (Do Nothing) to PHP5.2 billion/day** in adjoining areas. Equivalent to large infrastructure projects.

Development of a Hierarchical/Integrated Metro Network

- Role of urban rail
  - Free from road congestions
  - Stable travel time
- Ensure interline connectivity.
- Integrate fares through a common fare system.
- Practice TOD (walking environment for rail users)

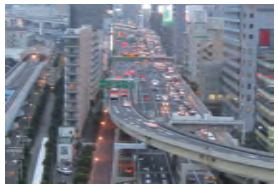




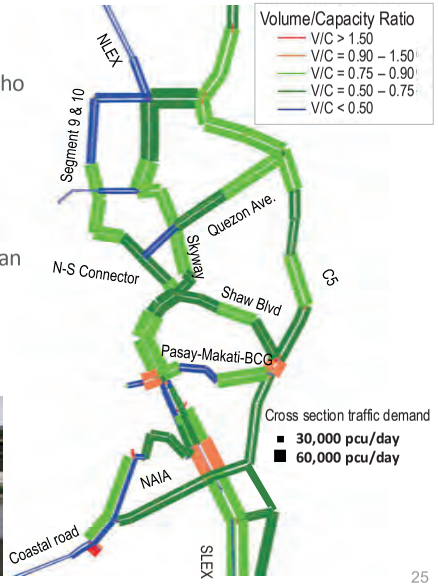


Comprehensive Urban Expressways to be developed as an Integrated Network

- **Role of urban expressway**
  - Attract long-trip vehicle traffic from at-grade urban roads
  - Provide congestion free fast travel to those who are willing to pay for such service (**impact on road congestion is significant**)
  - Strengthen network resilience
- **Should be integrated in terms of:**
  - Physical (between expressways, and with urban roads)
  - Toll system
  - Operational and management

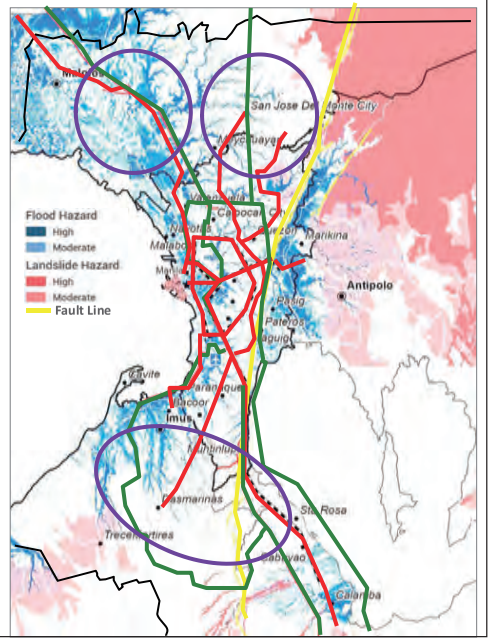


Distribution of Expressway Demand (Dream Plan, 2030)



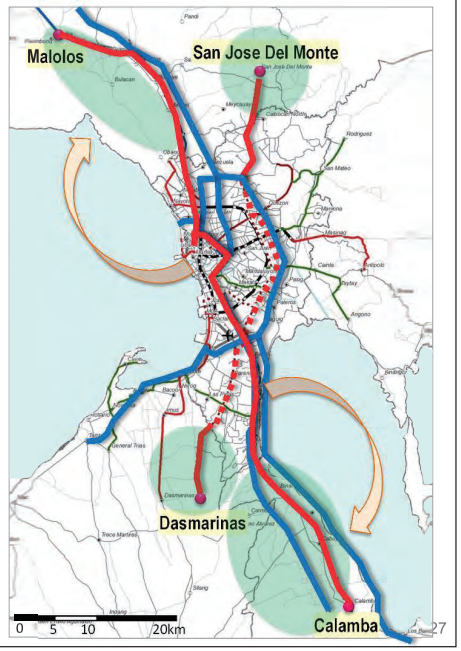
Secondary Roads Development

- **Update/Prepare urban/regional plans in outer areas in integration with Metro Manila**
  - New growth centers
  - Integrated planning: transport – land use – environment
  - Coordination among LGUs
- **Identify secondary roads packages in integration with urban/regional plans**



Integrated New Town Development

- Demand of affordable housing in GCR (2017): 823,000 units
- Large demand for those who reside in high hazard risk areas.
- Affordable housing must be provided in integration with suburban rails.
- New towns to function as new growth centers by adding roles (residential, commercial, business, public service).



Additional Projects

		Project Title	Cost (PhP bil.)
Expressway	Urban Expressway	C-5 Expressway	13.6
		R4 Expressway (Shaw Blvd.)	23.4
		R7 Expressway (Manila - San Jose Del Monte)	24.5
	Others	Southeast Metro Manila Expressway (C-6) Project	31.3
		North Luzon Expressway East: Phase I & II	23.6
		Central Luzon Link Expressway (CLLEx): Phase I & II	1.0
		Plaridel Bypass Phase II & III	4.4
		C6 North Section	4.3
		CAVITEX Extension	12.7
		Sub-total	235.2
	Total (Expressway)		**373.6**
Urban Roads	Interchange/Flyover/Underpass		1.0
	Bridges		30.3
	Primary Roads in Metro Manila		23.1
	Primary Roads in BRLC		0.3
	Secondary Road (Metro Manila)		63.9
	Secondary Road (BRLC)		15.0
	Total (Urban Road)		**148.1**
Traffic Mgmt	Comprehensive Traffic & Transport Management Study for Metro Manila		-
	Total (Traffic Management)		-

		Project Title	Cost (PhP bil.)
Railway	NSCR System O&M		0.1
	PNR Freight Line		0.1
	Mega Manila Subway Phase 2		-
	LRT1 (Rehabilitation, North Extension		10.2
	LRT2 (Rehab., East&West Extension)		69.9
	MRT3 (North&South Extension)		68.6
	Manila Metro Line 4 (Metro Manila - Taytay)		85.0
	Manila Metro Line 5 (Makati Transit System Loop)		301.8
	Manila Metro Line 6 (Niyog – Dasmarinas)		65.1
	Secondary Line (Ortigas, Marikina, Cavite, Alabang,)		102.2
	Others		0.3
	Total (Railway)		**703.3**
Road-based Public Transport	Bus	PUV Route Rationalization Study: Metro Manila	0.1
		North Integrated Transport System	4.0
		NAIA Intermodal Terminal	2.0
	BRT	Metro Manila BRT - Line 3 (C5)	31.2
		Metro Manila BRT Line 4 - Roxas Blvd.	19.9
	Others		5.0
	Total (Road-based Public Transport)		**135.8**
Airport (Total)			**0.7**
Port/Water Transport (Total)			**0.04**

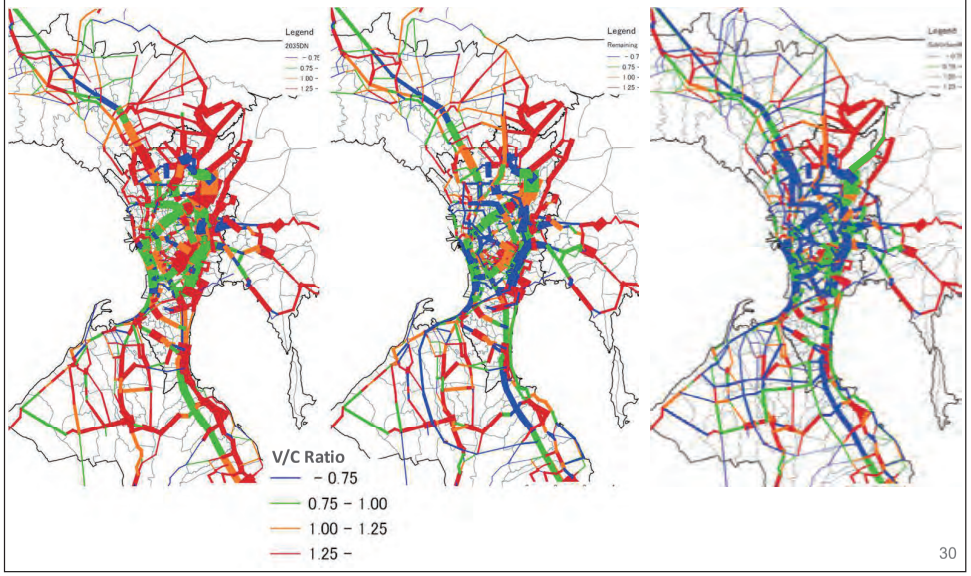
Total Project Costs = PHP1,362 billion

Impact of Additional Projects to Build!Build!Build!

- Bottlenecks will remain in outer areas.
- Need for an integrated urban and transport development plan for the northern, eastern, and southern areas of the study area.

Indicators	Current (2017)		2035					
			Do-nothing		With BBB		Additional Projects	
	Metro Manila	BRLC	Metro Manila	BRLC	Metro Manila	BRLC	Metro Manila	BRLC
Traffic demand (million trips/day)	13.4	5.1	17.1	10.4	17.1	10.4	17.1	10.4
Volume Capacity Ratio	0.97	0.98	1.10	1.33	0.79	0.96	0.65	0.77
Transport cost (Php billion/day)	3.2	2.6	5.2	6.2	2.9	4.5	2.1	3.4

Impact of Additional Projects to Build!Build!Build!



Affordability

- **Investment Cost vs Budget Envelope**
  - Money is not a problem.
  - Accelerate pending/new projects.
  - Plan further for effective projects.
- **Indicative Investment Cost**
  - Build!Build!Build! Projects: PHP1,693 billion
  - Additional Projects: PHP1,362 billion
- **Enough money!!**

	2018-2022	2022-2027	2027-2035
GDP (PHP bil.) 1/	117,748	148,421	395,395
GRDP Share of 3 regions (PHP bil.) 2/	67,692	76,579	159,665
Infrastructure Budget (PHP bil.) 3/	4,376	6,551	14,099
Transport Budget (PHP bil.) 4/	2,844	5,383	9,164

1/ GDP growth rate: 7-8%/year
2/ 30 – 60% of GDP
3/ 5-10% of GRDP
4/ 65% of total infrastructure budget

Key Performance Indicators

- **Roadmap must be monitored with simple and measurable, monitorable key performance indicators.**

Scope	Main KPI
Traffic Performance	• Average travel speed (kph) • Average volume capacity ratio • On-board congestion (LRT/MRT)
Economic	• Congestion cost
Social	• Average time for work trip • Average public transport cost per user • No. of resettled households
Financial	• Cost recovery ratio • Fare box ratio
Environment	• Emission volumes • No. of households in high hazard areas

Conclusion and Recommendations

Conclusion and Recommendations

- Goals are achievable
  - If the projects are implemented timely.
  - If the expected infrastructure capacities are fully tapped.
  - If transportation – land use developments are properly integrated.

Next Steps

- Fine-tuning of the draft final report based on the comments.
- Inter-Agency Technical Committee on Transport Planning (IATCTP): 28 November 2017
- NEDA Infrastructure Committee (INFRACOM): 14 December 2017

Thank you for your kind attention.