

APPENDIX E
Results of Economic and Financial Analysis
for Each Route Alignment Option

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Table App-E (1) Evaluation of Economic Costs and Benefits (Option A1a)

(Unit: Million USD, constant 2015 prices)

	Cost			Benefit (VOC, TTC)	Net Cash Flow	Assumed Discount Rate 15.0%	Discounted Cost	Discounted Benefits	Discounted Net Cash Flow
	Investment Cost	O/M Costs	Cost Total						
2020	379.63		379.63	0	-379.63	1.00	379.6	0.0	-379.6
2021	759.25		759.25	0.00	-759.25	1.15	660.2	0.0	-660.2
2022	1,138.89		1,138.89	0.00	-1,138.89	1.32	861.2	0.0	-861.2
2023	759.25		759.25	0.00	-759.25	1.52	499.2	0.0	-499.2
2024	696.14		696.14	0.00	-696.14	1.75	398.0	0.0	-398.0
2025		31.04	31.04	108.00	76.96	2.01	15.4	53.7	38.3
2026		31.04	31.04	200.00	168.96	2.31	13.4	86.5	73.0
2027		31.04	31.04	291.00	259.96	2.66	11.7	109.4	97.7
2028		31.04	31.04	383.00	351.96	3.06	10.1	125.2	115.1
2029		31.04	31.04	475.00	443.96	3.52	8.8	135.0	126.2
2030	0.00	31.04	31.04	566.00	534.96	4.05	7.7	139.9	132.2
2031	465.47	31.04	496.51	658.00	161.49	4.65	106.7	141.4	34.7
2032	1,086.10	31.04	1,117.14	750.00	-367.14	5.35	208.8	140.2	-68.6
2033	930.94	31.04	961.98	841.00	-120.98	6.15	156.3	136.7	-19.7
2034	498.94	31.04	529.98	933.00	403.02	7.08	74.9	131.9	57.0
2035		75.71	75.71	1,777.00	1,701.29	8.14	9.3	218.4	209.1
2036		75.71	75.71	2,191.00	2,115.29	9.36	8.1	234.1	226.1
2037		75.71	75.71	2,606.00	2,530.29	10.76	7.0	242.2	235.1
2038		75.71	75.71	3,021.00	2,945.29	12.38	6.1	244.1	238.0
2039		75.71	75.71	3,436.00	3,360.29	14.23	5.3	241.4	236.1
2040		75.71	75.71	3,851.00	3,775.29	16.37	4.6	235.3	230.7
2041		75.71	75.71	4,266.00	4,190.29	18.82	4.0	226.7	222.6
2042		75.71	75.71	4,681.00	4,605.29	21.64	3.5	216.3	212.8
2043		75.71	75.71	5,096.00	5,020.29	24.89	3.0	204.7	201.7
2044		75.71	75.71	5,511.00	5,435.29	28.63	2.6	192.5	189.9
2045		87.75	87.75	5,925.00	5,837.25	32.92	2.7	180.0	177.3
2046		87.75	87.75	5,925.00	5,837.25	37.86	2.3	156.5	154.2
2047		87.75	87.75	5,925.00	5,837.25	43.54	2.0	136.1	134.1
2048		87.75	87.75	5,925.00	5,837.25	50.07	1.8	118.3	116.6
2049		87.75	87.75	5,925.00	5,837.25	57.58	1.5	102.9	101.4
2050		87.75	87.75	5,925.00	5,837.25	66.21	1.3	89.5	88.2
2051		87.75	87.75	5,925.00	5,837.25	76.14	1.2	77.8	76.7
2052		87.75	87.75	5,925.00	5,837.25	87.57	1.0	67.7	66.7
2053		87.75	87.75	5,925.00	5,837.25	100.70	0.9	58.8	58.0
2054		87.75	87.75	5,925.00	5,837.25	115.80	0.8	51.2	50.4
2055		87.75	87.75	5,925.00	5,837.25	133.18	0.7	44.5	43.8
2056		87.75	87.75	5,925.00	5,837.25	153.15	0.6	38.7	38.1
2057		87.75	87.75	5,925.00	5,837.25	176.12	0.5	33.6	33.1
2058		87.75	87.75	5,925.00	5,837.25	202.54	0.4	29.3	28.8
2059		87.75	87.75	5,925.00	5,837.25	232.92	0.4	25.4	25.1
2060		87.75	87.75	5,925.00	5,837.25	267.86	0.3	22.1	21.8
2061		87.75	87.75	5,925.00	5,837.25	308.04	0.3	19.2	18.9
2062		87.75	87.75	5,925.00	5,837.25	354.25	0.2	16.7	16.5
2063		87.75	87.75	5,925.00	5,837.25	407.39	0.2	14.5	14.3
2064		87.75	87.75	5,925.00	5,837.25	468.50	0.2	12.6	12.5
Total	6,714.61	2,823	9,157.58	160,141.00	150,603.80	3,585.13	2.6	44.7	42.0

Source: JICA Study Team

Table App-E (2) Evaluation of Economic Costs and Benefits (Option A2a)

(Unit: Million USD, constant 2015 prices)

	Cost			Benefit (VOC, TTC)	Net Cash Flow	Assumed Discount Rate 15.0%	Discounted Cost	Discounted Benefits	Discounted Net Cash Flow
	Investment Cost	O/M Costs	Cost Total						
2020	385.02		385.02	0	-385.02	1.00	385.0	0.0	-385.0
2021	770.04		770.04	0.00	-770.04	1.15	669.6	0.0	-669.6
2022	1,155.06		1,155.06	0.00	-1,155.06	1.32	873.4	0.0	-873.4
2023	770.04		770.04	0.00	-770.04	1.52	506.3	0.0	-506.3
2024	708.27		708.27	0.00	-708.27	1.75	405.0	0.0	-405.0
2025		31.54	31.54	295.00	263.46	2.01	15.7	146.7	131.0
2026		31.54	31.54	296.00	264.46	2.31	13.6	128.0	114.3
2027		31.54	31.54	297.00	265.46	2.66	11.9	111.7	99.8
2028		31.54	31.54	298.00	266.46	3.06	10.3	97.4	87.1
2029		31.54	31.54	299.00	267.46	3.52	9.0	85.0	76.0
2030	0	31.54	31.54	300.00	268.46	4.05	7.8	74.2	66.4
2031	470	31.54	501.70	301.00	-200.70	4.65	107.8	64.7	-43.1
2032	1,097	31.54	1,128.57	302.00	-826.57	5.35	210.9	56.4	-154.5
2033	940	31.54	971.86	303.00	-668.86	6.15	158.0	49.2	-108.7
2034	503	31.54	534.31	304.00	-230.31	7.08	75.5	43.0	-32.5
2035		76.55	76.55	1,953.00	1,876.45	8.14	9.4	240.0	230.6
2036		76.55	76.55	2,401.00	2,324.45	9.36	8.2	256.6	248.4
2037		76.55	76.55	2,848.00	2,771.45	10.76	7.1	264.7	257.5
2038		76.55	76.55	3,296.00	3,219.45	12.38	6.2	266.3	260.1
2039		76.55	76.55	3,743.00	3,666.45	14.23	5.4	263.0	257.6
2040		76.55	76.55	4,191.00	4,114.45	16.37	4.7	256.1	251.4
2041		76.55	76.55	4,638.00	4,561.45	18.82	4.1	246.4	242.4
2042		76.55	76.55	5,086.00	5,009.45	21.64	3.5	235.0	231.4
2043		76.55	76.55	5,533.00	5,456.45	24.89	3.1	222.3	219.2
2044		76.55	76.55	5,981.00	5,904.45	28.63	2.7	208.9	206.3
2045		88.79	88.79	6,428.00	6,339.21	32.92	2.7	195.3	192.6
2046		88.79	88.79	6,428.00	6,339.21	37.86	2.3	169.8	167.5
2047		88.79	88.79	6,428.00	6,339.21	43.54	2.0	147.7	145.6
2048		88.79	88.79	6,428.00	6,339.21	50.07	1.8	128.4	126.6
2049		88.79	88.79	6,428.00	6,339.21	57.58	1.5	111.6	110.1
2050		88.79	88.79	6,428.00	6,339.21	66.21	1.3	97.1	95.7
2051		88.79	88.79	6,428.00	6,339.21	76.14	1.2	84.4	83.3
2052		88.79	88.79	6,428.00	6,339.21	87.57	1.0	73.4	72.4
2053		88.79	88.79	6,428.00	6,339.21	100.70	0.9	63.8	63.0
2054		88.79	88.79	6,428.00	6,339.21	115.80	0.8	55.5	54.7
2055		88.79	88.79	6,428.00	6,339.21	133.18	0.7	48.3	47.6
2056		88.79	88.79	6,428.00	6,339.21	153.15	0.6	42.0	41.4
2057		88.79	88.79	6,428.00	6,339.21	176.12	0.5	36.5	36.0
2058		88.79	88.79	6,428.00	6,339.21	202.54	0.4	31.7	31.3
2059		88.79	88.79	6,428.00	6,339.21	232.92	0.4	27.6	27.2
2060		88.79	88.79	6,428.00	6,339.21	267.86	0.3	24.0	23.7
2061		88.79	88.79	6,428.00	6,339.21	308.04	0.3	20.9	20.6
2062		88.79	88.79	6,428.00	6,339.21	354.25	0.3	18.1	17.9
2063		88.79	88.79	6,428.00	6,339.21	407.39	0.2	15.8	15.6
2064		88.79	88.79	6,428.00	6,339.21	468.50	0.2	13.7	13.5
Total	6,798.68	2,857	9,270.43	171,225.00	161,569.55	3,585.13	2.6	47.8	45.1

Source: JICA Study Team

Table App-E (3) Evaluation of Economic Costs and Benefits (Option A3a)

(Unit: Million USD, constant 2015 prices)

	Cost			Benefit (VOC, TTC)	Net Cash Flow	Assumed Discount Rate 15.0%	Discounted Cost	Discounted Benefits	Discounted Net Cash Flow
	Investment Cost	O/M Costs	Cost Total						
2020	435.62		435.62	0	-435.62	1.00	435.6	0.0	-435.6
2021	871.22		871.22	0.00	-871.22	1.15	757.6	0.0	-757.6
2022	1,306.84		1,306.84	0.00	-1,306.84	1.32	988.2	0.0	-988.2
2023	871.22		871.22	0.00	-871.22	1.52	572.8	0.0	-572.8
2024	801.59		801.59	0.00	-801.59	1.75	458.3	0.0	-458.3
2025		34.31	34.31	221.00	186.69	2.01	17.1	109.9	92.8
2026		34.31	34.31	313.00	278.69	2.31	14.8	135.3	120.5
2027		34.31	34.31	405.00	370.69	2.66	12.9	152.3	139.4
2028		34.31	34.31	496.00	461.69	3.06	11.2	162.1	150.9
2029		34.31	34.31	588.00	553.69	3.52	9.8	167.1	157.4
2030	0	34.31	34.31	680.00	645.69	4.05	8.5	168.1	159.6
2031	475	34.31	509.16	772.00	262.84	4.65	109.4	165.9	56.5
2032	1,108	34.31	1,142.27	864.00	-278.27	5.35	213.5	161.5	-52.0
2033	950	34.31	983.99	955.00	-28.99	6.15	159.9	155.2	-4.7
2034	507	34.31	540.92	1,047.00	506.08	7.08	76.4	148.0	71.5
2035		79.82	79.82	1,731.00	1,651.18	8.14	9.8	212.7	202.9
2036		79.82	79.82	2,192.00	2,112.18	9.36	8.5	234.2	225.7
2037		79.82	79.82	2,654.00	2,574.18	10.76	7.4	246.6	239.2
2038		79.82	79.82	3,115.00	3,035.18	12.38	6.5	251.7	245.3
2039		79.82	79.82	3,577.00	3,497.18	14.23	5.6	251.3	245.7
2040		79.82	79.82	4,038.00	3,958.18	16.37	4.9	246.7	241.8
2041		79.82	79.82	4,500.00	4,420.18	18.82	4.2	239.1	234.8
2042		79.82	79.82	4,961.00	4,881.18	21.64	3.7	229.2	225.5
2043		79.82	79.82	5,423.00	5,343.18	24.89	3.2	217.9	214.7
2044		79.82	79.82	5,884.00	5,804.18	28.63	2.8	205.6	202.8
2045		92.82	92.82	6,346.00	6,253.18	32.92	2.8	192.8	190.0
2046		92.82	92.82	6,346.00	6,253.18	37.86	2.5	167.6	165.2
2047		92.82	92.82	6,346.00	6,253.18	43.54	2.1	145.8	143.6
2048		92.82	92.82	6,346.00	6,253.18	50.07	1.9	126.8	124.9
2049		92.82	92.82	6,346.00	6,253.18	57.58	1.6	110.2	108.6
2050		92.82	92.82	6,346.00	6,253.18	66.21	1.4	95.8	94.4
2051		92.82	92.82	6,346.00	6,253.18	76.14	1.2	83.3	82.1
2052		92.82	92.82	6,346.00	6,253.18	87.57	1.1	72.5	71.4
2053		92.82	92.82	6,346.00	6,253.18	100.70	0.9	63.0	62.1
2054		92.82	92.82	6,346.00	6,253.18	115.80	0.8	54.8	54.0
2055		92.82	92.82	6,346.00	6,253.18	133.18	0.7	47.7	47.0
2056		92.82	92.82	6,346.00	6,253.18	153.15	0.6	41.4	40.8
2057		92.82	92.82	6,346.00	6,253.18	176.12	0.5	36.0	35.5
2058		92.82	92.82	6,346.00	6,253.18	202.54	0.5	31.3	30.9
2059		92.82	92.82	6,346.00	6,253.18	232.92	0.4	27.2	26.8
2060		92.82	92.82	6,346.00	6,253.18	267.86	0.3	23.7	23.3
2061		92.82	92.82	6,346.00	6,253.18	308.04	0.3	20.6	20.3
2062		92.82	92.82	6,346.00	6,253.18	354.25	0.3	17.9	17.7
2063		92.82	92.82	6,346.00	6,253.18	407.39	0.2	15.6	15.3
2064		92.82	92.82	6,346.00	6,253.18	468.50	0.2	13.5	13.3
Total	7,325.59	2,998	9,887.75	171,336.00	161,012.64	3,585.13	2.8	47.8	44.9

Source: JICA Study Team

Table App-E (4) Evaluation of Economic Costs and Benefits (Option B1a)

(Unit: Million USD, constant 2015 prices)

	Cost			Benefit (VOC, TTC)	Net Cash Flow	Assumed Discount Rate 15.0%	Discounted Cost	Discounted Benefits	Discounted Net Cash Flow
	Investment Cost	O/M Costs	Cost Total						
2020	379.63		379.63	0	-379.63	1.00	379.6	0.0	-379.6
2021	759.25		759.25	0.00	-759.25	1.15	660.2	0.0	-660.2
2022	1,138.89		1,138.89	0.00	-1,138.89	1.32	861.2	0.0	-861.2
2023	759.25		759.25	0.00	-759.25	1.52	499.2	0.0	-499.2
2024	696.14		696.14	0.00	-696.14	1.75	398.0	0.0	-398.0
2025		31.04	31.04	108.00	76.96	2.01	15.4	53.7	38.3
2026		31.04	31.04	200.00	168.96	2.31	13.4	86.5	73.0
2027		31.04	31.04	291.00	259.96	2.66	11.7	109.4	97.7
2028		31.04	31.04	383.00	351.96	3.06	10.1	125.2	115.1
2029		31.04	31.04	475.00	443.96	3.52	8.8	135.0	126.2
2030	0.00	31.04	31.04	566.00	534.96	4.05	7.7	139.9	132.2
2031	478.80	31.04	509.84	658.00	148.16	4.65	109.6	141.4	31.8
2032	1,117.18	31.04	1,148.22	750.00	-398.22	5.35	214.6	140.2	-74.4
2033	957.58	31.04	988.63	841.00	-147.63	6.15	160.7	136.7	-24.0
2034	510.85	31.04	541.89	933.00	391.11	7.08	76.6	131.9	55.3
2035		75.54	75.54	1,777.00	1,701.46	8.14	9.3	218.4	209.1
2036		75.54	75.54	2,233.00	2,157.46	9.36	8.1	238.6	230.6
2037		75.54	75.54	2,689.00	2,613.46	10.76	7.0	249.9	242.9
2038		75.54	75.54	3,145.00	3,069.46	12.38	6.1	254.1	248.0
2039		75.54	75.54	3,601.00	3,525.46	14.23	5.3	253.0	247.7
2040		75.54	75.54	4,057.00	3,981.46	16.37	4.6	247.9	243.3
2041		75.54	75.54	4,513.00	4,437.46	18.82	4.0	239.8	235.8
2042		75.54	75.54	4,969.00	4,893.46	21.64	3.5	229.6	226.1
2043		75.54	75.54	5,426.00	5,350.46	24.89	3.0	218.0	215.0
2044		75.54	75.54	5,882.00	5,806.46	28.63	2.6	205.5	202.8
2045		87.45	87.45	6,338.00	6,250.55	32.92	2.7	192.5	189.9
2046		87.45	87.45	6,338.00	6,250.55	37.86	2.3	167.4	165.1
2047		87.45	87.45	6,338.00	6,250.55	43.54	2.0	145.6	143.6
2048		87.45	87.45	6,338.00	6,250.55	50.07	1.7	126.6	124.8
2049		87.45	87.45	6,338.00	6,250.55	57.58	1.5	110.1	108.6
2050		87.45	87.45	6,338.00	6,250.55	66.21	1.3	95.7	94.4
2051		87.45	87.45	6,338.00	6,250.55	76.14	1.1	83.2	82.1
2052		87.45	87.45	6,338.00	6,250.55	87.57	1.0	72.4	71.4
2053		87.45	87.45	6,338.00	6,250.55	100.70	0.9	62.9	62.1
2054		87.45	87.45	6,338.00	6,250.55	115.80	0.8	54.7	54.0
2055		87.45	87.45	6,338.00	6,250.55	133.18	0.7	47.6	46.9
2056		87.45	87.45	6,338.00	6,250.55	153.15	0.6	41.4	40.8
2057		87.45	87.45	6,338.00	6,250.55	176.12	0.5	36.0	35.5
2058		87.45	87.45	6,338.00	6,250.55	202.54	0.4	31.3	30.9
2059		87.45	87.45	6,338.00	6,250.55	232.92	0.4	27.2	26.8
2060		87.45	87.45	6,338.00	6,250.55	267.86	0.3	23.7	23.3
2061		87.45	87.45	6,338.00	6,250.55	308.04	0.3	20.6	20.3
2062		87.45	87.45	6,338.00	6,250.55	354.25	0.2	17.9	17.6
2063		87.45	87.45	6,338.00	6,250.55	407.39	0.2	15.6	15.3
2064		87.45	87.45	6,338.00	6,250.55	468.50	0.2	13.5	13.3
Total	6,797.58	2,815	9,232.73	170,257.00	160,644.64	3,585.13	2.6	47.5	44.8

Source: JICA Study Team

Table App-E (5) Evaluation of Economic Costs and Benefits (Option B2a)

(Unit: Million USD, constant 2015 prices)

	Cost			Benefit (VOC, TTC)	Net Cash Flow	Assumed Discount Rate 15.0%	Discounted Cost	Discounted Benefits	Discounted Net Cash Flow
	Investment Cost	O/M Costs	Cost Total						
2020	385.02		385.02	0	-385.02	1.00	385.0	0.0	-385.0
2021	770.04		770.04	0.00	-770.04	1.15	669.6	0.0	-669.6
2022	1,155.06		1,155.06	0.00	-1,155.06	1.32	873.4	0.0	-873.4
2023	770.04		770.04	0.00	-770.04	1.52	506.3	0.0	-506.3
2024	702.67		702.67	0.00	-702.67	1.75	401.8	0.0	-401.8
2025		31.54	31.54	295.00	263.46	2.01	15.7	146.7	131.0
2026		31.54	31.54	296.00	264.46	2.31	13.6	128.0	114.3
2027		31.54	31.54	297.00	265.46	2.66	11.9	111.7	99.8
2028		31.54	31.54	298.00	266.46	3.06	10.3	97.4	87.1
2029		31.54	31.54	299.00	267.46	3.52	9.0	85.0	76.0
2030	0.00	31.54	31.54	300.00	268.46	4.05	7.8	74.2	66.4
2031	483.48	31.54	515.02	301.00	-214.02	4.65	110.7	64.7	-46.0
2032	1,128.12	31.54	1,159.66	302.00	-857.66	5.35	216.7	56.4	-160.3
2033	966.96	31.54	998.50	303.00	-695.50	6.15	162.3	49.2	-113.0
2034	514.69	31.54	546.23	304.00	-242.23	7.08	77.2	43.0	-34.2
2035		76.43	76.43	1,858.00	1,781.57	8.14	9.4	228.3	218.9
2036		76.43	76.43	2,306.00	2,229.57	9.36	8.2	246.4	238.3
2037		76.43	76.43	2,754.00	2,677.57	10.76	7.1	255.9	248.8
2038		76.43	76.43	3,202.00	3,125.57	12.38	6.2	258.7	252.6
2039		76.43	76.43	3,650.00	3,573.57	14.23	5.4	256.5	251.1
2040		76.43	76.43	4,098.00	4,021.57	16.37	4.7	250.4	245.7
2041		76.43	76.43	4,546.00	4,469.57	18.82	4.1	241.5	237.5
2042		76.43	76.43	4,994.00	4,917.57	21.64	3.5	230.7	227.2
2043		76.43	76.43	5,442.00	5,365.57	24.89	3.1	218.6	215.6
2044		76.43	76.43	5,890.00	5,813.57	28.63	2.7	205.8	203.1
2045		88.64	88.64	6,338.00	6,249.36	32.92	2.7	192.5	189.8
2046		88.64	88.64	6,338.00	6,249.36	37.86	2.3	167.4	165.1
2047		88.64	88.64	6,338.00	6,249.36	43.54	2.0	145.6	143.5
2048		88.64	88.64	6,338.00	6,249.36	50.07	1.8	126.6	124.8
2049		88.64	88.64	6,338.00	6,249.36	57.58	1.5	110.1	108.5
2050		88.64	88.64	6,338.00	6,249.36	66.21	1.3	95.7	94.4
2051		88.64	88.64	6,338.00	6,249.36	76.14	1.2	83.2	82.1
2052		88.64	88.64	6,338.00	6,249.36	87.57	1.0	72.4	71.4
2053		88.64	88.64	6,338.00	6,249.36	100.70	0.9	62.9	62.1
2054		88.64	88.64	6,338.00	6,249.36	115.80	0.8	54.7	54.0
2055		88.64	88.64	6,338.00	6,249.36	133.18	0.7	47.6	46.9
2056		88.64	88.64	6,338.00	6,249.36	153.15	0.6	41.4	40.8
2057		88.64	88.64	6,338.00	6,249.36	176.12	0.5	36.0	35.5
2058		88.64	88.64	6,338.00	6,249.36	202.54	0.4	31.3	30.9
2059		88.64	88.64	6,338.00	6,249.36	232.92	0.4	27.2	26.8
2060		88.64	88.64	6,338.00	6,249.36	267.86	0.3	23.7	23.3
2061		88.64	88.64	6,338.00	6,249.36	308.04	0.3	20.6	20.3
2062		88.64	88.64	6,338.00	6,249.36	354.25	0.3	17.9	17.6
2063		88.64	88.64	6,338.00	6,249.36	407.39	0.2	15.6	15.3
2064		88.64	88.64	6,338.00	6,249.36	468.50	0.2	13.5	13.3
Total	6,876.07	2,853	9,343.57	168,495.00	158,766.41	3,585.13	2.6	47.0	44.3

Source: JICA Study Team

Table App-E (6) Evaluation of Economic Costs and Benefits (Option B3a)

(Unit: Million USD, constant 2015 prices)

	Cost			Benefit (VOC, TTC)	Net Cash Flow	Assumed Discount Rate 15.0%	Discounted Cost	Discounted Benefits	Discounted Net Cash Flow
	Investment Cost	O/M Costs	Cost Total						
2020	435.62		435.62	0	-435.62	1.00	435.6	0.0	-435.6
2021	871.22		871.22	0.00	-871.22	1.15	757.6	0.0	-757.6
2022	1,306.84		1,306.84	0.00	-1,306.84	1.32	988.2	0.0	-988.2
2023	871.22		871.22	0.00	-871.22	1.52	572.8	0.0	-572.8
2024	801.59		801.59	0.00	-801.59	1.75	458.3	0.0	-458.3
2025		34.31	34.31	221.00	186.69	2.01	17.1	109.9	92.8
2026		34.31	34.31	313.00	278.69	2.31	14.8	135.3	120.5
2027		34.31	34.31	405.00	370.69	2.66	12.9	152.3	139.4
2028		34.31	34.31	496.00	461.69	3.06	11.2	162.1	150.9
2029		34.31	34.31	588.00	553.69	3.52	9.8	167.1	157.4
2030	0.00	34.31	34.31	680.00	645.69	4.05	8.5	168.1	159.6
2031	492.07	34.31	526.38	772.00	245.62	4.65	113.1	165.9	52.8
2032	1,148.16	34.31	1,182.48	864.00	-318.48	5.35	221.0	161.5	-59.5
2033	984.14	34.31	1,018.45	955.00	-63.45	6.15	165.5	155.2	-10.3
2034	521.72	34.31	556.03	1,047.00	490.97	7.08	78.6	148.0	69.4
2035		79.71	79.71	2,285.00	2,205.29	8.14	9.8	280.8	271.0
2036		79.71	79.71	2,640.00	2,560.29	9.36	8.5	282.1	273.6
2037		79.71	79.71	2,995.00	2,915.29	10.76	7.4	278.3	270.9
2038		79.71	79.71	3,350.00	3,270.29	12.38	6.4	270.7	264.3
2039		79.71	79.71	3,705.00	3,625.29	14.23	5.6	260.3	254.7
2040		79.71	79.71	4,060.00	3,980.29	16.37	4.9	248.1	243.2
2041		79.71	79.71	4,416.00	4,336.29	18.82	4.2	234.6	230.4
2042		79.71	79.71	4,771.00	4,691.29	21.64	3.7	220.4	216.7
2043		79.71	79.71	5,126.00	5,046.29	24.89	3.2	205.9	202.7
2044		79.71	79.71	5,481.00	5,401.29	28.63	2.8	191.5	188.7
2045		92.66	92.66	5,836.00	5,743.34	32.92	2.8	177.3	174.5
2046		92.66	92.66	5,836.00	5,743.34	37.86	2.4	154.2	151.7
2047		92.66	92.66	5,836.00	5,743.34	43.54	2.1	134.1	131.9
2048		92.66	92.66	5,836.00	5,743.34	50.07	1.9	116.6	114.7
2049		92.66	92.66	5,836.00	5,743.34	57.58	1.6	101.4	99.8
2050		92.66	92.66	5,836.00	5,743.34	66.21	1.4	88.1	86.7
2051		92.66	92.66	5,836.00	5,743.34	76.14	1.2	76.6	75.4
2052		92.66	92.66	5,836.00	5,743.34	87.57	1.1	66.6	65.6
2053		92.66	92.66	5,836.00	5,743.34	100.70	0.9	58.0	57.0
2054		92.66	92.66	5,836.00	5,743.34	115.80	0.8	50.4	49.6
2055		92.66	92.66	5,836.00	5,743.34	133.18	0.7	43.8	43.1
2056		92.66	92.66	5,836.00	5,743.34	153.15	0.6	38.1	37.5
2057		92.66	92.66	5,836.00	5,743.34	176.12	0.5	33.1	32.6
2058		92.66	92.66	5,836.00	5,743.34	202.54	0.5	28.8	28.4
2059		92.66	92.66	5,836.00	5,743.34	232.92	0.4	25.1	24.7
2060		92.66	92.66	5,836.00	5,743.34	267.86	0.3	21.8	21.4
2061		92.66	92.66	5,836.00	5,743.34	308.04	0.3	18.9	18.6
2062		92.66	92.66	5,836.00	5,743.34	354.25	0.3	16.5	16.2
2063		92.66	92.66	5,836.00	5,743.34	407.39	0.2	14.3	14.1
2064		92.66	92.66	5,836.00	5,743.34	468.50	0.2	12.5	12.3
Total	7,432.59	2,993	9,990.42	161,890.00	151,463.97	3,585.13	2.8	45.2	42.2

Source: JICA Study Team

Table App-E (7) Evaluation of Economic Costs and Benefits (Option A1b)

(Unit: Million USD, constant 2015 prices)

	Cost			Benefit (VOC, TTC)	Net Cash Flow	Assumed Discount Rate 15.0%	Discounted Cost	Discounted Benefits	Discounted Net Cash Flow
	Investment Cost	O/M Costs	Cost Total						
2020	379.63		379.63	0.00	-379.63	1.00	379.6	0.0	-379.6
2021	759.25		759.25	0.00	-759.25	1.15	660.2	0.0	-660.2
2022	1,138.89		1,138.89	0.00	-1,138.89	1.32	861.2	0.0	-861.2
2023	759.25		759.25	0.00	-759.25	1.52	499.2	0.0	-499.2
2024	696.14		696.14	0.00	-696.14	1.75	398.0	0.0	-398.0
2025		31.04	31.04	108.00	76.96	2.01	15.4	53.7	38.3
2026		31.04	31.04	200.00	168.96	2.31	13.4	86.5	73.0
2027		31.04	31.04	291.00	259.96	2.66	11.7	109.4	97.7
2028		31.04	31.04	383.00	351.96	3.06	10.1	125.2	115.1
2029		31.04	31.04	475.00	443.96	3.52	8.8	135.0	126.2
2030	399	31.04	429.70	566.00	136.30	4.05	106.2	139.9	33.7
2031	32	31.04	63.36	658.00	594.64	4.65	13.6	141.4	127.8
2032	1,196	31.04	1,227.02	750.00	-477.02	5.35	229.3	140.2	-89.2
2033	797	31.04	828.36	841.00	12.64	6.15	134.6	136.7	2.1
2034	673	31.04	704.19	933.00	228.81	7.08	99.5	131.9	32.3
2035		75.71	75.71	1777.00	1,701.29	8.14	9.3	218.4	209.1
2036		75.71	75.71	2191.00	2,115.29	9.36	8.1	234.1	226.1
2037		75.71	75.71	2606.00	2,530.29	10.76	7.0	242.2	235.1
2038		75.71	75.71	3021.00	2,945.29	12.38	6.1	244.1	238.0
2039		75.71	75.71	3436.00	3,360.29	14.23	5.3	241.4	236.1
2040		75.71	75.71	3851.00	3,775.29	16.37	4.6	235.3	230.7
2041		75.71	75.71	4266.00	4,190.29	18.82	4.0	226.7	222.6
2042		75.71	75.71	4681.00	4,605.29	21.64	3.5	216.3	212.8
2043		75.71	75.71	5096.00	5,020.29	24.89	3.0	204.7	201.7
2044		75.71	75.71	5511.00	5,435.29	28.63	2.6	192.5	189.9
2045		87.75	87.75	5925.00	5,837.25	32.92	2.7	180.0	177.3
2046		87.75	87.75	5925.00	5,837.25	37.86	2.3	156.5	154.2
2047		87.75	87.75	5925.00	5,837.25	43.54	2.0	136.1	134.1
2048		87.75	87.75	5925.00	5,837.25	50.07	1.8	118.3	116.6
2049		87.75	87.75	5925.00	5,837.25	57.58	1.5	102.9	101.4
2050		87.75	87.75	5925.00	5,837.25	66.21	1.3	89.5	88.2
2051		87.75	87.75	5925.00	5,837.25	76.14	1.2	77.8	76.7
2052		87.75	87.75	5925.00	5,837.25	87.57	1.0	67.7	66.7
2053		87.75	87.75	5925.00	5,837.25	100.70	0.9	58.8	58.0
2054		87.75	87.75	5925.00	5,837.25	115.80	0.8	51.2	50.4
2055		87.75	87.75	5925.00	5,837.25	133.18	0.7	44.5	43.8
2056		87.75	87.75	5925.00	5,837.25	153.15	0.6	38.7	38.1
2057		87.75	87.75	5925.00	5,837.25	176.12	0.5	33.6	33.1
2058		87.75	87.75	5925.00	5,837.25	202.54	0.4	29.3	28.8
2059		87.75	87.75	5925.00	5,837.25	232.92	0.4	25.4	25.1
2060		87.75	87.75	5925.00	5,837.25	267.86	0.3	22.1	21.8
2061		87.75	87.75	5925.00	5,837.25	308.04	0.3	19.2	18.9
2062		87.75	87.75	5925.00	5,837.25	354.25	0.2	16.7	16.5
2063		87.75	87.75	5925.00	5,837.25	407.39	0.2	14.5	14.3
2064		87.75	87.75	5925.00	5,837.25	468.50	0.2	12.6	12.5
Total	6,830.58	2,823	9,273.55	160,141.00	150,487.82	3,585.13	2.6	44.7	42.0

Source: JICA Study Team

Table App-E (8) Evaluation of Economic Costs and Benefits (Option A2b)

(Unit: Million USD, constant 2015 prices)

	Cost			Benefit (VOC, TTC)	Net Cash Flow	Assumed Discount Rate 15.0%	Discounted Cost	Discounted Benefits	Discounted Net Cash Flow
	Investment Cost	O/M Costs	Cost Total						
2020	385.02		385.02	0	-385.02	1.00	385.0	0.0	-385.0
2021	770.04		770.04	0.00	-770.04	1.15	669.6	0.0	-669.6
2022	1,155.06		1,155.06	0.00	-1,155.06	1.32	873.4	0.0	-873.4
2023	770.04		770.04	0.00	-770.04	1.52	506.3	0.0	-506.3
2024	708.27		708.27	0.00	-708.27	1.75	405.0	0.0	-405.0
2025		31.54	31.54	295.00	263.46	2.01	15.7	146.7	131.0
2026		31.54	31.54	296.00	264.46	2.31	13.6	128.0	114.3
2027		31.54	31.54	297.00	265.46	2.66	11.9	111.7	99.8
2028		31.54	31.54	298.00	266.46	3.06	10.3	97.4	87.1
2029		31.54	31.54	299.00	267.46	3.52	9.0	85.0	76.0
2030	402	31.54	433.33	300.00	-133.33	4.05	107.1	74.2	-33.0
2031	804	31.54	835.11	301.00	-534.11	4.65	179.5	64.7	-114.8
2032	1,205	31.54	1,236.89	302.00	-934.89	5.35	231.2	56.4	-174.7
2033	804	31.54	835.11	303.00	-532.11	6.15	135.7	49.2	-86.5
2034	678	31.54	709.52	304.00	-405.52	7.08	100.3	43.0	-57.3
2035		76.55	76.55	1,953.00	1,876.45	8.14	9.4	240.0	230.6
2036		76.55	76.55	2,401.00	2,324.45	9.36	8.2	256.6	248.4
2037		76.55	76.55	2,848.00	2,771.45	10.76	7.1	264.7	257.5
2038		76.55	76.55	3,296.00	3,219.45	12.38	6.2	266.3	260.1
2039		76.55	76.55	3,743.00	3,666.45	14.23	5.4	263.0	257.6
2040		76.55	76.55	4,191.00	4,114.45	16.37	4.7	256.1	251.4
2041		76.55	76.55	4,638.00	4,561.45	18.82	4.1	246.4	242.4
2042		76.55	76.55	5,086.00	5,009.45	21.64	3.5	235.0	231.4
2043		76.55	76.55	5,533.00	5,456.45	24.89	3.1	222.3	219.2
2044		76.55	76.55	5,981.00	5,904.45	28.63	2.7	208.9	206.3
2045		88.79	88.79	6,428.00	6,339.21	32.92	2.7	195.3	192.6
2046		88.79	88.79	6,428.00	6,339.21	37.86	2.3	169.8	167.5
2047		88.79	88.79	6,428.00	6,339.21	43.54	2.0	147.7	145.6
2048		88.79	88.79	6,428.00	6,339.21	50.07	1.8	128.4	126.6
2049		88.79	88.79	6,428.00	6,339.21	57.58	1.5	111.6	110.1
2050		88.79	88.79	6,428.00	6,339.21	66.21	1.3	97.1	95.7
2051		88.79	88.79	6,428.00	6,339.21	76.14	1.2	84.4	83.3
2052		88.79	88.79	6,428.00	6,339.21	87.57	1.0	73.4	72.4
2053		88.79	88.79	6,428.00	6,339.21	100.70	0.9	63.8	63.0
2054		88.79	88.79	6,428.00	6,339.21	115.80	0.8	55.5	54.7
2055		88.79	88.79	6,428.00	6,339.21	133.18	0.7	48.3	47.6
2056		88.79	88.79	6,428.00	6,339.21	153.15	0.6	42.0	41.4
2057		88.79	88.79	6,428.00	6,339.21	176.12	0.5	36.5	36.0
2058		88.79	88.79	6,428.00	6,339.21	202.54	0.4	31.7	31.3
2059		88.79	88.79	6,428.00	6,339.21	232.92	0.4	27.6	27.2
2060		88.79	88.79	6,428.00	6,339.21	267.86	0.3	24.0	23.7
2061		88.79	88.79	6,428.00	6,339.21	308.04	0.3	20.9	20.6
2062		88.79	88.79	6,428.00	6,339.21	354.25	0.3	18.1	17.9
2063		88.79	88.79	6,428.00	6,339.21	407.39	0.2	15.8	15.6
2064		88.79	88.79	6,428.00	6,339.21	468.50	0.2	13.7	13.5
Total	7,680.67	2,857	10,152.41	171,225.00	160,687.57	3,585.13	2.8	47.8	44.8

Source: JICA Study Team

Table App-E (9) Evaluation of Economic Costs and Benefits (Option A3b)

(Unit: Million USD, constant 2015 prices)

	Cost			Benefit (VOC, TTC)	Net Cash Flow	Assumed Discount Rate 15.0%	Discounted Cost	Discounted Benefits	Discounted Net Cash Flow
	Investment Cost	O/M Costs	Cost Total						
2020	435.62		435.62	0.00	-435.62	1.00	435.6	0.0	-435.6
2021	871.22		871.22	0.00	-871.22	1.15	757.6	0.0	-757.6
2022	1,306.84		1,306.84	0.00	-1,306.84	1.32	988.2	0.0	-988.2
2023	871.22		871.22	0.00	-871.22	1.52	572.8	0.0	-572.8
2024	801.59		801.59	0.00	-801.59	1.75	458.3	0.0	-458.3
2025		34.31	34.31	221.00	186.69	2.01	17.1	109.9	92.8
2026		34.31	34.31	313.00	278.69	2.31	14.8	135.3	120.5
2027		34.31	34.31	405.00	370.69	2.66	12.9	152.3	139.4
2028		34.31	34.31	496.00	461.69	3.06	11.2	162.1	150.9
2029		34.31	34.31	588.00	553.69	3.52	9.8	167.1	157.4
2030	405	34.31	439.22	680.00	240.78	4.05	108.6	168.1	59.5
2031	810	34.31	844.13	772.00	-72.13	4.65	181.4	165.9	-15.5
2032	1,215	34.31	1,249.03	864.00	-385.03	5.35	233.5	161.5	-72.0
2033	810	34.31	844.13	955.00	110.87	6.15	137.2	155.2	18.0
2034	681	34.31	715.13	1,047.00	331.87	7.08	101.1	148.0	46.9
2035		79.82	79.82	1,731.00	1,651.18	8.14	9.8	212.7	202.9
2036		79.82	79.82	2,192.00	2,112.18	9.36	8.5	234.2	225.7
2037		79.82	79.82	2,654.00	2,574.18	10.76	7.4	246.6	239.2
2038		79.82	79.82	3,115.00	3,035.18	12.38	6.5	251.7	245.3
2039		79.82	79.82	3,577.00	3,497.18	14.23	5.6	251.3	245.7
2040		79.82	79.82	4,038.00	3,958.18	16.37	4.9	246.7	241.8
2041		79.82	79.82	4,500.00	4,420.18	18.82	4.2	239.1	234.8
2042		79.82	79.82	4,961.00	4,881.18	21.64	3.7	229.2	225.5
2043		79.82	79.82	5,423.00	5,343.18	24.89	3.2	217.9	214.7
2044		79.82	79.82	5,884.00	5,804.18	28.63	2.8	205.6	202.8
2045		92.82	92.82	6,346.00	6,253.18	32.92	2.8	192.8	190.0
2046		92.82	92.82	6,346.00	6,253.18	37.86	2.5	167.6	165.2
2047		92.82	92.82	6,346.00	6,253.18	43.54	2.1	145.8	143.6
2048		92.82	92.82	6,346.00	6,253.18	50.07	1.9	126.8	124.9
2049		92.82	92.82	6,346.00	6,253.18	57.58	1.6	110.2	108.6
2050		92.82	92.82	6,346.00	6,253.18	66.21	1.4	95.8	94.4
2051		92.82	92.82	6,346.00	6,253.18	76.14	1.2	83.3	82.1
2052		92.82	92.82	6,346.00	6,253.18	87.57	1.1	72.5	71.4
2053		92.82	92.82	6,346.00	6,253.18	100.70	0.9	63.0	62.1
2054		92.82	92.82	6,346.00	6,253.18	115.80	0.8	54.8	54.0
2055		92.82	92.82	6,346.00	6,253.18	133.18	0.7	47.7	47.0
2056		92.82	92.82	6,346.00	6,253.18	153.15	0.6	41.4	40.8
2057		92.82	92.82	6,346.00	6,253.18	176.12	0.5	36.0	35.5
2058		92.82	92.82	6,346.00	6,253.18	202.54	0.5	31.3	30.9
2059		92.82	92.82	6,346.00	6,253.18	232.92	0.4	27.2	26.8
2060		92.82	92.82	6,346.00	6,253.18	267.86	0.3	23.7	23.3
2061		92.82	92.82	6,346.00	6,253.18	308.04	0.3	20.6	20.3
2062		92.82	92.82	6,346.00	6,253.18	354.25	0.3	17.9	17.7
2063		92.82	92.82	6,346.00	6,253.18	407.39	0.2	15.6	15.3
2064		92.82	92.82	6,346.00	6,253.18	468.50	0.2	13.5	13.3
Total	8,206.56	2,998	10,768.72	171,336.00	160,131.66	3,585.13	3.0	47.8	44.7

Source: JICA Study Team

Table App-E (10) Evaluation of Economic Costs and Benefits (Option B1b)

(Unit: Million USD, constant 2015 prices)

	Cost			Benefit (VOC, TTC)	Net Cash Flow	Assumed Discount Rate 15.0%	Discounted Cost	Discounted Benefits	Discounted Net Cash Flow
	Investment Cost	O/M Costs	Cost Total						
2020	379.63		379.63	0.00	-379.63	1.00	379.6	0.0	-379.6
2021	759.25		759.25	0.00	-759.25	1.15	660.2	0.0	-660.2
2022	1,138.89		1,138.89	0.00	-1,138.89	1.32	861.2	0.0	-861.2
2023	759.25		759.25	0.00	-759.25	1.52	499.2	0.0	-499.2
2024	696.14		696.14	0.00	-696.14	1.75	398.0	0.0	-398.0
2025		31.04	31.04	108.00	76.96	2.01	15.4	53.7	38.3
2026		31.04	31.04	200.00	168.96	2.31	13.4	86.5	73.0
2027		31.04	31.04	291.00	259.96	2.66	11.7	109.4	97.7
2028		31.04	31.04	383.00	351.96	3.06	10.1	125.2	115.1
2029		31.04	31.04	475.00	443.96	3.52	8.8	135.0	126.2
2030	408	31.04	438.58	566.00	127.42	4.05	108.4	139.9	31.5
2031	815	31.04	846.12	658.00	-188.12	4.65	181.9	141.4	-40.4
2032	1,223	31.04	1,253.67	750.00	-503.67	5.35	234.3	140.2	-94.1
2033	815	31.04	846.12	841.00	-5.12	6.15	137.5	136.7	-0.8
2034	685	31.04	716.11	933.00	216.89	7.08	101.2	131.9	30.7
2035		75.55	75.55	1777.00	1,701.45	8.14	9.3	218.4	209.1
2036		75.55	75.55	2233.00	2,157.45	9.36	8.1	238.6	230.6
2037		75.55	75.55	2689.00	2,613.45	10.76	7.0	249.9	242.9
2038		75.55	75.55	3145.00	3,069.45	12.38	6.1	254.1	248.0
2039		75.55	75.55	3601.00	3,525.45	14.23	5.3	253.0	247.7
2040		75.55	75.55	4057.00	3,981.45	16.37	4.6	247.9	243.3
2041		75.55	75.55	4513.00	4,437.45	18.82	4.0	239.8	235.8
2042		75.55	75.55	4969.00	4,893.45	21.64	3.5	229.6	226.1
2043		75.55	75.55	5426.00	5,350.45	24.89	3.0	218.0	215.0
2044		75.55	75.55	5882.00	5,806.45	28.63	2.6	205.5	202.8
2045		87.45	87.45	6338.00	6,250.55	32.92	2.7	192.5	189.9
2046		87.45	87.45	6338.00	6,250.55	37.86	2.3	167.4	165.1
2047		87.45	87.45	6338.00	6,250.55	43.54	2.0	145.6	143.6
2048		87.45	87.45	6338.00	6,250.55	50.07	1.7	126.6	124.8
2049		87.45	87.45	6338.00	6,250.55	57.58	1.5	110.1	108.6
2050		87.45	87.45	6338.00	6,250.55	66.21	1.3	95.7	94.4
2051		87.45	87.45	6338.00	6,250.55	76.14	1.1	83.2	82.1
2052		87.45	87.45	6338.00	6,250.55	87.57	1.0	72.4	71.4
2053		87.45	87.45	6338.00	6,250.55	100.70	0.9	62.9	62.1
2054		87.45	87.45	6338.00	6,250.55	115.80	0.8	54.7	54.0
2055		87.45	87.45	6338.00	6,250.55	133.18	0.7	47.6	46.9
2056		87.45	87.45	6338.00	6,250.55	153.15	0.6	41.4	40.8
2057		87.45	87.45	6338.00	6,250.55	176.12	0.5	36.0	35.5
2058		87.45	87.45	6338.00	6,250.55	202.54	0.4	31.3	30.9
2059		87.45	87.45	6338.00	6,250.55	232.92	0.4	27.2	26.8
2060		87.45	87.45	6338.00	6,250.55	267.86	0.3	23.7	23.3
2061		87.45	87.45	6338.00	6,250.55	308.04	0.3	20.6	20.3
2062		87.45	87.45	6338.00	6,250.55	354.25	0.2	17.9	17.6
2063		87.45	87.45	6338.00	6,250.55	407.39	0.2	15.6	15.3
2064		87.45	87.45	6338.00	6,250.55	468.50	0.2	13.5	13.3
Total	7,678.57	2,815	10,113.80	170,257.00	159,763.57	3,585.13	2.8	47.5	44.6

Source: JICA Study Team

Table App-E (11) Evaluation of Economic Costs and Benefits (Option B2b)

(Unit: Million USD, constant 2015 prices)

	Cost			Benefit (VOC, TTC)	Net Cash Flow	Assumed Discount Rate 15.0%	Discounted Cost	Discounted Benefits	Discounted Net Cash Flow
	Investment Cost	O/M Costs	Cost Total						
2020	385.02		385.02	0	-385.02	1.00	385.0	0.0	-385.0
2021	770.04		770.04	0.00	-770.04	1.15	669.6	0.0	-669.6
2022	1,155.06		1,155.06	0.00	-1,155.06	1.32	873.4	0.0	-873.4
2023	770.04		770.04	0.00	-770.04	1.52	506.3	0.0	-506.3
2024	708.27		708.27	0.00	-708.27	1.75	405.0	0.0	-405.0
2025		31.54	31.54	295.00	263.46	2.01	15.7	146.7	131.0
2026		31.54	31.54	296.00	264.46	2.31	13.6	128.0	114.3
2027		31.54	31.54	297.00	265.46	2.66	11.9	111.7	99.8
2028		31.54	31.54	298.00	266.46	3.06	10.3	97.4	87.1
2029		31.54	31.54	299.00	267.46	3.52	9.0	85.0	76.0
2030	411	31.54	442.21	300.00	-142.21	4.05	109.3	74.2	-35.2
2031	821	31.54	852.87	301.00	-551.87	4.65	183.3	64.7	-118.6
2032	1,232	31.54	1,263.54	302.00	-961.54	5.35	236.2	56.4	-179.7
2033	821	31.54	852.87	303.00	-549.87	6.15	138.6	49.2	-89.4
2034	689	31.54	720.44	304.00	-416.44	7.08	101.8	43.0	-58.9
2035		75.71	75.71	1,858.00	1,782.29	8.14	9.3	228.3	219.0
2036		75.71	75.71	2,306.00	2,230.29	9.36	8.1	246.4	238.3
2037		75.71	75.71	2,754.00	2,678.29	10.76	7.0	255.9	248.9
2038		75.71	75.71	3,202.00	3,126.29	12.38	6.1	258.7	252.6
2039		75.71	75.71	3,650.00	3,574.29	14.23	5.3	256.5	251.1
2040		75.71	75.71	4,098.00	4,022.29	16.37	4.6	250.4	245.8
2041		75.71	75.71	4,546.00	4,470.29	18.82	4.0	241.5	237.5
2042		75.71	75.71	4,994.00	4,918.29	21.64	3.5	230.7	227.2
2043		75.71	75.71	5,442.00	5,366.29	24.89	3.0	218.6	215.6
2044		75.71	75.71	5,890.00	5,814.29	28.63	2.6	205.8	203.1
2045		88.64	88.64	6,338.00	6,249.36	32.92	2.7	192.5	189.8
2046		88.64	88.64	6,338.00	6,249.36	37.86	2.3	167.4	165.1
2047		88.64	88.64	6,338.00	6,249.36	43.54	2.0	145.6	143.5
2048		88.64	88.64	6,338.00	6,249.36	50.07	1.8	126.6	124.8
2049		88.64	88.64	6,338.00	6,249.36	57.58	1.5	110.1	108.5
2050		88.64	88.64	6,338.00	6,249.36	66.21	1.3	95.7	94.4
2051		88.64	88.64	6,338.00	6,249.36	76.14	1.2	83.2	82.1
2052		88.64	88.64	6,338.00	6,249.36	87.57	1.0	72.4	71.4
2053		88.64	88.64	6,338.00	6,249.36	100.70	0.9	62.9	62.1
2054		88.64	88.64	6,338.00	6,249.36	115.80	0.8	54.7	54.0
2055		88.64	88.64	6,338.00	6,249.36	133.18	0.7	47.6	46.9
2056		88.64	88.64	6,338.00	6,249.36	153.15	0.6	41.4	40.8
2057		88.64	88.64	6,338.00	6,249.36	176.12	0.5	36.0	35.5
2058		88.64	88.64	6,338.00	6,249.36	202.54	0.4	31.3	30.9
2059		88.64	88.64	6,338.00	6,249.36	232.92	0.4	27.2	26.8
2060		88.64	88.64	6,338.00	6,249.36	267.86	0.3	23.7	23.3
2061		88.64	88.64	6,338.00	6,249.36	308.04	0.3	20.6	20.3
2062		88.64	88.64	6,338.00	6,249.36	354.25	0.3	17.9	17.6
2063		88.64	88.64	6,338.00	6,249.36	407.39	0.2	15.6	15.3
2064		88.64	88.64	6,338.00	6,249.36	468.50	0.2	13.5	13.3
Total	7,762.65	2,845	10,222.92	168,495.00	157,887.06	3,585.13	2.9	47.0	44.0

Source: JICA Study Team

Table App-E (12) Evaluation of Economic Costs and Benefits (Option B3b)

(Unit: Million USD, constant 2015 prices)

	Cost			Benefit (VOC, TTC)	Net Cash Flow	Assumed Discount Rate 15.0%	Discounted Cost	Discounted Benefits	Discounted Net Cash Flow
	Investment Cost	O/M Costs	Cost Total						
2020	435.62		435.62	0	-435.62	1.00	435.6	0.0	-435.6
2021	871.22		871.22	0.00	-871.22	1.15	757.6	0.0	-757.6
2022	1,306.84		1,306.84	0.00	-1,306.84	1.32	988.2	0.0	-988.2
2023	871.22		871.22	0.00	-871.22	1.52	572.8	0.0	-572.8
2024	801.59		801.59	0.00	-801.59	1.75	458.3	0.0	-458.3
2025		34.31	34.31	221.00	186.69	2.01	17.1	109.9	92.8
2026		34.31	34.31	313.00	278.69	2.31	14.8	135.3	120.5
2027		34.31	34.31	405.00	370.69	2.66	12.9	152.3	139.4
2028		34.31	34.31	496.00	461.69	3.06	11.2	162.1	150.9
2029		34.31	34.31	588.00	553.69	3.52	9.8	167.1	157.4
2030	416	34.31	450.70	680.00	229.30	4.05	111.4	168.1	56.7
2031	833	34.31	867.10	772.00	-95.10	4.65	186.4	165.9	-20.4
2032	1,249	34.31	1,283.49	864.00	-419.49	5.35	239.9	161.5	-78.4
2033	833	34.31	867.10	955.00	87.90	6.15	140.9	155.2	14.3
2034	696	34.31	730.25	1,047.00	316.75	7.08	103.2	148.0	44.8
2035		79.71	79.71	2,285.00	2,205.29	8.14	9.8	280.8	271.0
2036		79.71	79.71	2,640.00	2,560.29	9.36	8.5	282.1	273.6
2037		79.71	79.71	2,995.00	2,915.29	10.76	7.4	278.3	270.9
2038		79.71	79.71	3,350.00	3,270.29	12.38	6.4	270.7	264.3
2039		79.71	79.71	3,705.00	3,625.29	14.23	5.6	260.3	254.7
2040		79.71	79.71	4,060.00	3,980.29	16.37	4.9	248.1	243.2
2041		79.71	79.71	4,416.00	4,336.29	18.82	4.2	234.6	230.4
2042		79.71	79.71	4,771.00	4,691.29	21.64	3.7	220.4	216.7
2043		79.71	79.71	5,126.00	5,046.29	24.89	3.2	205.9	202.7
2044		79.71	79.71	5,481.00	5,401.29	28.63	2.8	191.5	188.7
2045		92.66	92.66	5,836.00	5,743.34	32.92	2.8	177.3	174.5
2046		92.66	92.66	5,836.00	5,743.34	37.86	2.4	154.2	151.7
2047		92.66	92.66	5,836.00	5,743.34	43.54	2.1	134.1	131.9
2048		92.66	92.66	5,836.00	5,743.34	50.07	1.9	116.6	114.7
2049		92.66	92.66	5,836.00	5,743.34	57.58	1.6	101.4	99.8
2050		92.66	92.66	5,836.00	5,743.34	66.21	1.4	88.1	86.7
2051		92.66	92.66	5,836.00	5,743.34	76.14	1.2	76.6	75.4
2052		92.66	92.66	5,836.00	5,743.34	87.57	1.1	66.6	65.6
2053		92.66	92.66	5,836.00	5,743.34	100.70	0.9	58.0	57.0
2054		92.66	92.66	5,836.00	5,743.34	115.80	0.8	50.4	49.6
2055		92.66	92.66	5,836.00	5,743.34	133.18	0.7	43.8	43.1
2056		92.66	92.66	5,836.00	5,743.34	153.15	0.6	38.1	37.5
2057		92.66	92.66	5,836.00	5,743.34	176.12	0.5	33.1	32.6
2058		92.66	92.66	5,836.00	5,743.34	202.54	0.5	28.8	28.4
2059		92.66	92.66	5,836.00	5,743.34	232.92	0.4	25.1	24.7
2060		92.66	92.66	5,836.00	5,743.34	267.86	0.3	21.8	21.4
2061		92.66	92.66	5,836.00	5,743.34	308.04	0.3	18.9	18.6
2062		92.66	92.66	5,836.00	5,743.34	354.25	0.3	16.5	16.2
2063		92.66	92.66	5,836.00	5,743.34	407.39	0.2	14.3	14.1
2064		92.66	92.66	5,836.00	5,743.34	468.50	0.2	12.5	12.3
Total	8,313.58	2,993	10,871.41	161,890.00	150,582.98	3,585.13	3.0	45.2	42.0

Source: JICA Study Team

Table App-E (13) Cash Flow of MMSP (Option A1a)

(Unit: Million USD, constant 2015 prices)

Year	Investments	O&M Costs	Costs	Revenue	Net Cash Flow	
1	2020	446.62	36.52	483.14	-483.14	
2	2021	893.24	36.52	929.76	-929.76	
3	2022	1339.87	36.52	1376.39	-1,376.39	
4	2023	893.24	36.52	929.76	-929.76	
5	2024	893.24	36.52	929.76	-929.76	
6	2025		36.52	36.52	159.49	122.97
7	2026		36.52	36.52	171.30	134.78
8	2027		36.52	36.52	183.99	147.47
9	2028		36.52	36.52	197.61	161.09
10	2029		36.52	36.52	212.25	175.73
11	2030	0	89.07	89.07	227.97	138.90
12	2031	547.61	89.07	636.68	244.86	-391.82
13	2032	1277.76	89.07	1366.83	262.99	-1,103.84
14	2033	1095.22	89.07	1184.29	282.47	-901.82
15	2034	730.15	89.07	819.22	303.39	-515.83
16	2035		89.07	89.07	1,023.04	933.97
17	2036		89.07	89.07	1,088.62	999.55
18	2037		89.07	89.07	1,158.40	1,069.33
19	2038		89.07	89.07	1,232.66	1,143.59
20	2039		89.07	89.07	1,311.68	1,222.61
21	2040		103.24	103.24	1,395.76	1,292.52
22	2041		103.24	103.24	1,485.24	1,382.00
23	2042		103.24	103.24	1,580.45	1,477.21
24	2043		103.24	103.24	1,681.76	1,578.52
25	2044		103.24	103.24	1,789.57	1,686.33
26	2045		103.24	103.24	1,904.29	1,801.05
27	2046		103.24	103.24	1,923.33	1,820.09
28	2047		103.24	103.24	1,942.56	1,839.32
29	2048		103.24	103.24	1,961.99	1,858.75
30	2049		103.24	103.24	1,981.61	1,878.37
31	2050		103.24	103.24	2,001.42	1,898.18
32	2051		103.24	103.24	2,021.44	1,918.20
33	2052		103.24	103.24	2,041.65	1,938.41
34	2053		103.24	103.24	2,062.07	1,958.83
35	2054		103.24	103.24	2,082.69	1,979.45
36	2055		103.24	103.24	2,103.52	2,000.28
37	2056		103.24	103.24	2,124.55	2,021.31
38	2057		103.24	103.24	2,145.80	2,042.56
39	2058		103.24	103.24	2,167.25	2,064.01
40	2059		103.24	103.24	2,188.93	2,085.69
41	2060		103.24	103.24	2,210.82	2,107.58
42	2061		103.24	103.24	2,232.92	2,129.68
43	2062		103.24	103.24	2,255.25	2,152.01
44	2063		103.24	103.24	2,277.81	2,174.57
45	2064		103.24	103.24	2,300.58	2,197.34
FIRR					9.20%	

Source: JICA Study Team

Table App-E (14) Cash Flow of MMSP (Option A2a)

(Unit: Million USD, constant 2015 prices)

Year	Investments	O&M Costs	Costs	Revenue	Net Cash Flow	
1	2020	452.96	37.11	490.07	-490.07	
2	2021	905.93	37.11	943.04	-943.04	
3	2022	1358.89	37.11	1396	-1,396.00	
4	2023	905.93	37.11	943.04	-943.04	
5	2024	905.93	37.11	943.04	-943.04	
6	2025		37.11	37.11	148.58	111.47
7	2026		37.11	37.11	159.83	122.72
8	2027		37.11	37.11	171.94	134.83
9	2028		37.11	37.11	184.97	147.86
10	2029		37.11	37.11	198.98	161.87
11	2030	0	90.06	90.06	214.05	123.99
12	2031	553.12	90.06	643.18	230.27	-412.91
13	2032	1290.62	90.06	1380.68	247.71	-1,132.97
14	2033	1106.25	90.06	1196.31	266.48	-929.83
15	2034	737.5	90.06	827.56	286.67	-540.89
16	2035		90.06	90.06	1,020.90	930.84
17	2036		90.06	90.06	1,087.75	997.69
18	2037		90.06	90.06	1,158.98	1,068.92
19	2038		90.06	90.06	1,234.88	1,144.82
20	2039		90.06	90.06	1,315.74	1,225.68
21	2040		104.46	104.46	1,401.90	1,297.44
22	2041		104.46	104.46	1,493.71	1,389.25
23	2042		104.46	104.46	1,591.52	1,487.06
24	2043		104.46	104.46	1,695.74	1,591.28
25	2044		104.46	104.46	1,806.78	1,702.32
26	2045		104.46	104.46	1,925.10	1,820.64
27	2046		104.46	104.46	1,944.35	1,839.89
28	2047		104.46	104.46	1,963.79	1,859.33
29	2048		104.46	104.46	1,983.43	1,878.97
30	2049		104.46	104.46	2,003.27	1,898.81
31	2050		104.46	104.46	2,023.30	1,918.84
32	2051		104.46	104.46	2,043.53	1,939.07
33	2052		104.46	104.46	2,063.97	1,959.51
34	2053		104.46	104.46	2,084.61	1,980.15
35	2054		104.46	104.46	2,105.45	2,000.99
36	2055		104.46	104.46	2,126.51	2,022.05
37	2056		104.46	104.46	2,147.77	2,043.31
38	2057		104.46	104.46	2,169.25	2,064.79
39	2058		104.46	104.46	2,190.94	2,086.48
40	2059		104.46	104.46	2,212.85	2,108.39
41	2060		104.46	104.46	2,234.98	2,130.52
42	2061		104.46	104.46	2,257.33	2,152.87
43	2062		104.46	104.46	2,279.90	2,175.44
44	2063		104.46	104.46	2,302.70	2,198.24
45	2064		104.46	104.46	2,325.73	2,221.27
FIRR					9.08%	

Source: JICA Study Team

Table App-E (15) Cash Flow of MMSP (Option A3a)

(Unit: Million USD, constant 2015 prices)

Year		Investments	O&M Costs	Costs	Revenue	Net Cash Flow
1	2020	512.49	40.37	552.86		-552.86
2	2021	1024.97	40.37	1065.34		-1,065.34
3	2022	1537.46	40.37	1577.83		-1,577.83
4	2023	1024.97	40.37	1065.34		-1,065.34
5	2024	1024.97	40.37	1065.34		-1,065.34
6	2025		40.37	40.37	172.27	131.90
7	2026		40.37	40.37	185.49	145.12
8	2027		40.37	40.37	199.73	159.36
9	2028		40.37	40.37	215.05	174.68
10	2029		40.37	40.37	231.55	191.18
11	2030	0	93.91	93.91	249.32	155.41
12	2031	558.64	93.91	652.55	268.45	-384.10
13	2032	1303.48	93.91	1397.39	289.05	-1,108.34
14	2033	1117.27	93.91	1211.18	311.23	-899.95
15	2034	744.85	93.91	838.76	335.11	-503.65
16	2035		93.91	93.91	1,108.69	1,014.78
17	2036		93.91	93.91	1,181.74	1,087.83
18	2037		93.91	93.91	1,259.61	1,165.70
19	2038		93.91	93.91	1,342.62	1,248.71
20	2039		93.91	93.91	1,431.09	1,337.18
21	2040		109.2	109.2	1,525.39	1,416.19
22	2041		109.2	109.2	1,625.90	1,516.70
23	2042		109.2	109.2	1,733.04	1,623.84
24	2043		109.2	109.2	1,847.24	1,738.04
25	2044		109.2	109.2	1,968.96	1,859.76
26	2045		109.2	109.2	2,098.71	1,989.51
27	2046		109.2	109.2	2,119.70	2,010.50
28	2047		109.2	109.2	2,140.89	2,031.69
29	2048		109.2	109.2	2,162.30	2,053.10
30	2049		109.2	109.2	2,183.92	2,074.72
31	2050		109.2	109.2	2,205.76	2,096.56
32	2051		109.2	109.2	2,227.82	2,118.62
33	2052		109.2	109.2	2,250.10	2,140.90
34	2053		109.2	109.2	2,272.60	2,163.40
35	2054		109.2	109.2	2,295.33	2,186.13
36	2055		109.2	109.2	2,318.28	2,209.08
37	2056		109.2	109.2	2,341.46	2,232.26
38	2057		109.2	109.2	2,364.88	2,255.68
39	2058		109.2	109.2	2,388.53	2,279.33
40	2059		109.2	109.2	2,412.41	2,303.21
41	2060		109.2	109.2	2,436.54	2,327.34
42	2061		109.2	109.2	2,460.90	2,351.70
43	2062		109.2	109.2	2,485.51	2,376.31
44	2063		109.2	109.2	2,510.36	2,401.16
45	2064		109.2	109.2	2,535.47	2,426.27
					FIRR	9.11%

Source: JICA Study Team

Table App-E (16) Cash Flow of MMSP (Option B1a)

(Unit: Million USD, constant 2015 prices)

Year	Investments	O&M Costs	Costs	Revenue	Net Cash Flow	
1	2020	446.62	36.52	483.14	-483.14	
2	2021	893.24	36.52	929.76	-929.76	
3	2022	1339.87	36.52	1376.39	-1,376.39	
4	2023	893.24	36.52	929.76	-929.76	
5	2024	893.24	36.52	929.76	-929.76	
6	2025		36.52	36.52	159.49	122.97
7	2026		36.52	36.52	171.30	134.78
8	2027		36.52	36.52	183.99	147.47
9	2028		36.52	36.52	197.61	161.09
10	2029		88.87	88.87	212.25	123.38
11	2030	0	88.87	88.87	227.97	139.10
12	2031	563.29	88.87	652.16	244.86	-407.30
13	2032	1314.33	88.87	1403.2	262.99	-1,140.21
14	2033	1126.57	88.87	1215.44	282.47	-932.97
15	2034	751.05	88.87	839.92	303.39	-536.53
16	2035		88.87	88.87	1,104.54	1,015.67
17	2036		88.87	88.87	1,170.43	1,081.56
18	2037		88.87	88.87	1,240.24	1,151.37
19	2038		88.87	88.87	1,314.22	1,225.35
20	2039		102.88	102.88	1,392.61	1,289.73
21	2040		102.88	102.88	1,475.68	1,372.80
22	2041		102.88	102.88	1,563.71	1,460.83
23	2042		102.88	102.88	1,656.98	1,554.10
24	2043		102.88	102.88	1,755.82	1,652.94
25	2044		102.88	102.88	1,860.55	1,757.67
26	2045		102.88	102.88	1,971.54	1,868.66
27	2046		102.88	102.88	1,991.25	1,888.37
28	2047		102.88	102.88	2,011.16	1,908.28
29	2048		102.88	102.88	2,031.28	1,928.40
30	2049		102.88	102.88	2,051.59	1,948.71
31	2050		102.88	102.88	2,072.10	1,969.22
32	2051		102.88	102.88	2,092.82	1,989.94
33	2052		102.88	102.88	2,113.75	2,010.87
34	2053		102.88	102.88	2,134.89	2,032.01
35	2054		102.88	102.88	2,156.24	2,053.36
36	2055		102.88	102.88	2,177.80	2,074.92
37	2056		102.88	102.88	2,199.58	2,096.70
38	2057		102.88	102.88	2,221.58	2,118.70
39	2058		102.88	102.88	2,243.79	2,140.91
40	2059		102.88	102.88	2,266.23	2,163.35
41	2060		102.88	102.88	2,288.89	2,186.01
42	2061		102.88	102.88	2,311.78	2,208.90
43	2062		102.88	102.88	2,334.90	2,232.02
44	2063		102.88	102.88	2,358.25	2,255.37
45	2064		102.88	102.88	2,381.83	2,278.95
FIRR					9.39%	

Source: JICA Study Team

Table App-E (17) Cash Flow of MMSP (Option B2a)

(Unit: Million USD, constant 2015 prices)

Year	Investments	O&M Costs	Costs	Revenue	Net Cash Flow	
1	2020	452.96	37.11	490.07	-490.07	
2	2021	905.93	37.11	943.04	-943.04	
3	2022	1358.89	37.11	1396	-1,396.00	
4	2023	905.93	37.11	943.04	-943.04	
5	2024	905.93	37.11	943.04	-943.04	
6	2025		37.11	37.11	148.58	111.47
7	2026		37.11	37.11	159.83	122.72
8	2027		37.11	37.11	171.94	134.83
9	2028		37.11	37.11	184.97	147.86
10	2029		37.11	37.11	198.98	161.87
11	2030	0.00	89.92	89.92	214.05	124.13
12	2031	568.80	89.92	658.72	230.27	-428.45
13	2032	1327.20	89.92	1417.12	247.71	-1,169.41
14	2033	1137.60	89.92	1227.52	266.48	-961.04
15	2034	758.40	89.92	848.32	286.67	-561.65
16	2035		89.92	89.92	1,114.20	1,024.28
17	2036		89.92	89.92	1,182.95	1,093.03
18	2037		89.92	89.92	1,255.94	1,166.02
19	2038		89.92	89.92	1,333.43	1,243.51
20	2039		89.92	89.92	1,415.70	1,325.78
21	2040		104.28	104.28	1,503.05	1,398.77
22	2041		104.28	104.28	1,595.79	1,491.51
23	2042		104.28	104.28	1,694.25	1,589.97
24	2043		104.28	104.28	1,798.78	1,694.50
25	2044		104.28	104.28	1,909.77	1,805.49
26	2045		104.28	104.28	2,027.60	1,923.32
27	2046		104.28	104.28	2,047.87	1,943.59
28	2047		104.28	104.28	2,068.35	1,964.07
29	2048		104.28	104.28	2,089.04	1,984.76
30	2049		104.28	104.28	2,109.93	2,005.65
31	2050		104.28	104.28	2,131.03	2,026.75
32	2051		104.28	104.28	2,152.34	2,048.06
33	2052		104.28	104.28	2,173.86	2,069.58
34	2053		104.28	104.28	2,195.60	2,091.32
35	2054		104.28	104.28	2,217.55	2,113.27
36	2055		104.28	104.28	2,239.73	2,135.45
37	2056		104.28	104.28	2,262.13	2,157.85
38	2057		104.28	104.28	2,284.75	2,180.47
39	2058		104.28	104.28	2,307.60	2,203.32
40	2059		104.28	104.28	2,330.67	2,226.39
41	2060		104.28	104.28	2,353.98	2,249.70
42	2061		104.28	104.28	2,377.52	2,273.24
43	2062		104.28	104.28	2,401.29	2,297.01
44	2063		104.28	104.28	2,425.31	2,321.03
45	2064		104.28	104.28	2,449.56	2,345.28
FIRR					9.38%	

Source: JICA Study Team

Table App-E (18) Cash Flow of MMSP (Option B3a)

(Unit: Million USD, constant 2015 prices)

Year		Investments	O&M Costs	Costs	Revenue	Net Cash Flow
1	2020	512.49	40.37	552.86		-552.86
2	2021	1024.97	40.37	1065.34		-1,065.34
3	2022	1537.46	40.37	1577.83		-1,577.83
4	2023	1024.97	40.37	1065.34		-1,065.34
5	2024	1024.97	40.37	1065.34		-1,065.34
6	2025		40.37	40.37	172.27	131.90
7	2026		40.37	40.37	185.49	145.12
8	2027		40.37	40.37	199.73	159.36
9	2028		40.37	40.37	215.05	174.68
10	2029		40.37	40.37	231.55	191.18
11	2030	0	93.78	93.78	249.32	155.54
12	2031	578.9	93.78	672.68	268.45	-404.23
13	2032	1350.78	93.78	1444.56	289.05	-1,155.51
14	2033	1157.81	93.78	1251.59	311.23	-940.36
15	2034	771.87	93.78	865.65	335.11	-530.54
16	2035		93.78	93.78	1,200.07	1,106.29
17	2036		93.78	93.78	1,274.43	1,180.65
18	2037		93.78	93.78	1,353.39	1,259.61
19	2038		93.78	93.78	1,437.25	1,343.47
20	2039		93.78	93.78	1,526.31	1,432.53
21	2040		109.01	109.01	1,620.88	1,511.87
22	2041		109.01	109.01	1,721.32	1,612.31
23	2042		109.01	109.01	1,827.98	1,718.97
24	2043		109.01	109.01	1,941.24	1,832.23
25	2044		109.01	109.01	2,061.53	1,952.52
26	2045		109.01	109.01	2,189.27	2,080.26
27	2046		109.01	109.01	2,211.16	2,102.15
28	2047		109.01	109.01	2,233.27	2,124.26
29	2048		109.01	109.01	2,255.60	2,146.59
30	2049		109.01	109.01	2,278.16	2,169.15
31	2050		109.01	109.01	2,300.94	2,191.93
32	2051		109.01	109.01	2,323.95	2,214.94
33	2052		109.01	109.01	2,347.19	2,238.18
34	2053		109.01	109.01	2,370.66	2,261.65
35	2054		109.01	109.01	2,394.37	2,285.36
36	2055		109.01	109.01	2,418.31	2,309.30
37	2056		109.01	109.01	2,442.49	2,333.48
38	2057		109.01	109.01	2,466.92	2,357.91
39	2058		109.01	109.01	2,491.59	2,382.58
40	2059		109.01	109.01	2,516.50	2,407.49
41	2060		109.01	109.01	2,541.67	2,432.66
42	2061		109.01	109.01	2,567.09	2,458.08
43	2062		109.01	109.01	2,592.76	2,483.75
44	2063		109.01	109.01	2,618.68	2,509.67
45	2064		109.01	109.01	2,644.87	2,535.86
FIRR						9.35%

Source: JICA Study Team

Table App-E (19) Cash Flow of MMSP (Option A1b)

(Unit: Million USD, constant 2015 prices)

Year	Investments	O&M Costs	Costs	Revenue	Net Cash Flow	
1	2020	446.62	36.52	483.14	-483.14	
2	2021	893.24	36.52	929.76	-929.76	
3	2022	1339.87	36.52	1376.39	-1,376.39	
4	2023	893.24	36.52	929.76	-929.76	
5	2024	893.24	36.52	929.76	-929.76	
6	2025		36.52	36.52	159.49	122.97
7	2026		36.52	36.52	171.30	134.78
8	2027		36.52	36.52	183.99	147.47
9	2028		36.52	36.52	197.61	161.09
10	2029		36.52	36.52	212.25	175.73
11	2030	469.01	89.07	558.08	227.97	-330.11
12	2031	38.02	89.07	127.09	244.86	117.77
13	2032	1407.03	89.07	1496.1	262.99	-1,233.11
14	2033	938.02	89.07	1027.09	282.47	-744.62
15	2034	938.02	89.07	1027.09	303.39	-723.70
16	2035		89.07	89.07	1,023.04	933.97
17	2036		89.07	89.07	1,088.62	999.55
18	2037		89.07	89.07	1,158.40	1,069.33
19	2038		89.07	89.07	1,232.66	1,143.59
20	2039		89.07	89.07	1,311.68	1,222.61
21	2040		103.24	103.24	1,395.76	1,292.52
22	2041		103.24	103.24	1,485.24	1,382.00
23	2042		103.24	103.24	1,580.45	1,477.21
24	2043		103.24	103.24	1,681.76	1,578.52
25	2044		103.24	103.24	1,789.57	1,686.33
26	2045		103.24	103.24	1,904.29	1,801.05
27	2046		103.24	103.24	1,923.33	1,820.09
28	2047		103.24	103.24	1,942.56	1,839.32
29	2048		103.24	103.24	1,961.99	1,858.75
30	2049		103.24	103.24	1,981.61	1,878.37
31	2050		103.24	103.24	2,001.42	1,898.18
32	2051		103.24	103.24	2,021.44	1,918.20
33	2052		103.24	103.24	2,041.65	1,938.41
34	2053		103.24	103.24	2,062.07	1,958.83
35	2054		103.24	103.24	2,082.69	1,979.45
36	2055		103.24	103.24	2,103.52	2,000.28
37	2056		103.24	103.24	2,124.55	2,021.31
38	2057		103.24	103.24	2,145.80	2,042.56
39	2058		103.24	103.24	2,167.25	2,064.01
40	2059		103.24	103.24	2,188.93	2,085.69
41	2060		103.24	103.24	2,210.82	2,107.58
42	2061		103.24	103.24	2,232.92	2,129.68
43	2062		103.24	103.24	2,255.25	2,152.01
44	2063		103.24	103.24	2,277.81	2,174.57
45	2064		103.24	103.24	2,300.58	2,197.34

FIRR 9.13%

Source: JICA Study Team

Table App-E (20) Cash Flow of MMSP (Option A2b)

(Unit: Million USD, constant 2015 prices)

Year	Investments	O&M Costs	Costs	Revenue	Net Cash Flow	
1	2020	452.96	37.11	490.07	-490.07	
2	2021	905.93	37.11	943.04	-943.04	
3	2022	1358.89	37.11	1396	-1,396.00	
4	2023	905.93	37.11	943.04	-943.04	
5	2024	905.93	37.11	943.04	-943.04	
6	2025		37.11	37.11	148.58	111.47
7	2026		37.11	37.11	159.83	122.72
8	2027		37.11	37.11	171.94	134.83
9	2028		37.11	37.11	184.97	147.86
10	2029		37.11	37.11	198.98	161.87
11	2030	472.69	90.06	562.75	214.05	-348.70
12	2031	945.37	90.06	1035.43	230.27	-805.16
13	2032	1418.06	90.06	1508.12	247.71	-1,260.41
14	2033	945.37	90.06	1035.43	266.48	-768.95
15	2034	945.37	90.06	1035.43	286.67	-748.76
16	2035		90.06	90.06	1,020.90	930.84
17	2036		90.06	90.06	1,087.75	997.69
18	2037		90.06	90.06	1,158.98	1,068.92
19	2038		90.06	90.06	1,234.88	1,144.82
20	2039		90.06	90.06	1,315.74	1,225.68
21	2040		104.46	104.46	1,401.90	1,297.44
22	2041		104.46	104.46	1,493.71	1,389.25
23	2042		104.46	104.46	1,591.52	1,487.06
24	2043		104.46	104.46	1,695.74	1,591.28
25	2044		104.46	104.46	1,806.78	1,702.32
26	2045		104.46	104.46	1,925.10	1,820.64
27	2046		104.46	104.46	1,944.35	1,839.89
28	2047		104.46	104.46	1,963.79	1,859.33
29	2048		104.46	104.46	1,983.43	1,878.97
30	2049		104.46	104.46	2,003.27	1,898.81
31	2050		104.46	104.46	2,023.30	1,918.84
32	2051		104.46	104.46	2,043.53	1,939.07
33	2052		104.46	104.46	2,063.97	1,959.51
34	2053		104.46	104.46	2,084.61	1,980.15
35	2054		104.46	104.46	2,105.45	2,000.99
36	2055		104.46	104.46	2,126.51	2,022.05
37	2056		104.46	104.46	2,147.77	2,043.31
38	2057		104.46	104.46	2,169.25	2,064.79
39	2058		104.46	104.46	2,190.94	2,086.48
40	2059		104.46	104.46	2,212.85	2,108.39
41	2060		104.46	104.46	2,234.98	2,130.52
42	2061		104.46	104.46	2,257.33	2,152.87
43	2062		104.46	104.46	2,279.90	2,175.44
44	2063		104.46	104.46	2,302.70	2,198.24
45	2064		104.46	104.46	2,325.73	2,221.27
FIRR					8.64%	

Source: JICA Study Team

Table App-E (21) Cash Flow of MMSP (Option A3b)

(Unit: Million USD, constant 2015 prices)

Year	Investments	O&M Costs	Costs	Revenue	Net Cash Flow	
1	2020	512.49	40.37	552.86	-552.86	
2	2021	1024.97	40.37	1065.34	-1,065.34	
3	2022	1537.46	40.37	1577.83	-1,577.83	
4	2023	1024.97	40.37	1065.34	-1,065.34	
5	2024	1024.97	40.37	1065.34	-1,065.34	
6	2025		40.37	40.37	172.27	131.90
7	2026		40.37	40.37	185.49	145.12
8	2027		40.37	40.37	199.73	159.36
9	2028		40.37	40.37	215.05	174.68
10	2029		40.37	40.37	231.55	191.18
11	2030	476.36	93.91	570.27	249.32	-320.95
12	2031	952.72	93.91	1046.63	268.45	-778.18
13	2032	1429.08	93.91	1522.99	289.05	-1,233.94
14	2033	952.72	93.91	1046.63	311.23	-735.40
15	2034	952.72	93.91	1046.63	335.11	-711.52
16	2035		93.91	93.91	1,108.69	1,014.78
17	2036		93.91	93.91	1,181.74	1,087.83
18	2037		93.91	93.91	1,259.61	1,165.70
19	2038		93.91	93.91	1,342.62	1,248.71
20	2039		93.91	93.91	1,431.09	1,337.18
21	2040		109.2	109.2	1,525.39	1,416.19
22	2041		109.2	109.2	1,625.90	1,516.70
23	2042		109.2	109.2	1,733.04	1,623.84
24	2043		109.2	109.2	1,847.24	1,738.04
25	2044		109.2	109.2	1,968.96	1,859.76
26	2045		109.2	109.2	2,098.71	1,989.51
27	2046		109.2	109.2	2,119.70	2,010.50
28	2047		109.2	109.2	2,140.89	2,031.69
29	2048		109.2	109.2	2,162.30	2,053.10
30	2049		109.2	109.2	2,183.92	2,074.72
31	2050		109.2	109.2	2,205.76	2,096.56
32	2051		109.2	109.2	2,227.82	2,118.62
33	2052		109.2	109.2	2,250.10	2,140.90
34	2053		109.2	109.2	2,272.60	2,163.40
35	2054		109.2	109.2	2,295.33	2,186.13
36	2055		109.2	109.2	2,318.28	2,209.08
37	2056		109.2	109.2	2,341.46	2,232.26
38	2057		109.2	109.2	2,364.88	2,255.68
39	2058		109.2	109.2	2,388.53	2,279.33
40	2059		109.2	109.2	2,412.41	2,303.21
41	2060		109.2	109.2	2,436.54	2,327.34
42	2061		109.2	109.2	2,460.90	2,351.70
43	2062		109.2	109.2	2,485.51	2,376.31
44	2063		109.2	109.2	2,510.36	2,401.16
45	2064		109.2	109.2	2,535.47	2,426.27
FIRR					8.71%	

Source: JICA Study Team

Table App-E (22) Cash Flow of MMSP (Option B1b)

(Unit: Million USD, constant 2015 prices)

Year	Investments	O&M Costs	Costs	Revenue	Net Cash Flow	
1	2020	446.62	36.52	483.14	-483.14	
2	2021	893.24	36.52	929.76	-929.76	
3	2022	1339.87	36.52	1376.39	-1,376.39	
4	2023	893.24	36.52	929.76	-929.76	
5	2024	893.24	36.52	929.76	-929.76	
6	2025		36.52	36.52	159.49	122.97
7	2026		36.52	36.52	171.30	134.78
8	2027		36.52	36.52	183.99	147.47
9	2028		36.52	36.52	197.61	161.09
10	2029		36.52	36.52	212.25	175.73
11	2030	479.46	88.88	568.34	227.97	-340.37
12	2031	958.92	88.88	1047.8	244.86	-802.94
13	2032	1438.38	88.88	1527.26	262.99	-1,264.27
14	2033	958.92	88.88	1047.8	282.47	-765.33
15	2034	958.92	88.88	1047.8	303.39	-744.41
16	2035		88.88	88.88	1,104.54	1,015.66
17	2036		88.88	88.88	1,170.43	1,081.55
18	2037		88.88	88.88	1,240.24	1,151.36
19	2038		88.88	88.88	1,314.22	1,225.34
20	2039		88.88	88.88	1,392.61	1,303.73
21	2040		102.88	102.88	1,475.68	1,372.80
22	2041		102.88	102.88	1,563.71	1,460.83
23	2042		102.88	102.88	1,656.98	1,554.10
24	2043		102.88	102.88	1,755.82	1,652.94
25	2044		102.88	102.88	1,860.55	1,757.67
26	2045		102.88	102.88	1,971.54	1,868.66
27	2046		102.88	102.88	1,991.25	1,888.37
28	2047		102.88	102.88	2,011.16	1,908.28
29	2048		102.88	102.88	2,031.28	1,928.40
30	2049		102.88	102.88	2,051.59	1,948.71
31	2050		102.88	102.88	2,072.10	1,969.22
32	2051		102.88	102.88	2,092.82	1,989.94
33	2052		102.88	102.88	2,113.75	2,010.87
34	2053		102.88	102.88	2,134.89	2,032.01
35	2054		102.88	102.88	2,156.24	2,053.36
36	2055		102.88	102.88	2,177.80	2,074.92
37	2056		102.88	102.88	2,199.58	2,096.70
38	2057		102.88	102.88	2,221.58	2,118.70
39	2058		102.88	102.88	2,243.79	2,140.91
40	2059		102.88	102.88	2,266.23	2,163.35
41	2060		102.88	102.88	2,288.89	2,186.01
42	2061		102.88	102.88	2,311.78	2,208.90
43	2062		102.88	102.88	2,334.90	2,232.02
44	2063		102.88	102.88	2,358.25	2,255.37
45	2064		102.88	102.88	2,381.83	2,278.95
FIRR					8.97%	

Source: JICA Study Team

Table App-E (23) Cash Flow of MMSP (Option B2b)

(Unit: Million USD, constant 2015 prices)

Year	Investments	O&M Costs	Costs	Revenue	Net Cash Flow	
1	2020	452.96	37.11	490.07	-490.07	
2	2021	905.93	37.11	943.04	-943.04	
3	2022	1358.89	37.11	1396	-1,396.00	
4	2023	905.93	37.11	943.04	-943.04	
5	2024	905.93	37.11	943.04	-943.04	
6	2025		37.11	37.11	148.58	111.47
7	2026		37.11	37.11	159.83	122.72
8	2027		37.11	37.11	171.94	134.83
9	2028		37.11	37.11	184.97	147.86
10	2029		37.11	37.11	198.98	161.87
11	2030	483.14	89.07	572.21	214.05	-358.16
12	2031	966.27	89.07	1055.34	230.27	-825.07
13	2032	1449.41	89.07	1538.48	247.71	-1,290.77
14	2033	966.27	89.07	1055.34	266.48	-788.86
15	2034	966.27	89.07	1055.34	286.67	-768.67
16	2035		89.07	89.07	1,114.20	1,025.13
17	2036		89.07	89.07	1,182.95	1,093.88
18	2037		89.07	89.07	1,255.94	1,166.87
19	2038		89.07	89.07	1,333.43	1,244.36
20	2039		89.07	89.07	1,415.70	1,326.63
21	2040		104.28	104.28	1,503.05	1,398.77
22	2041		104.28	104.28	1,595.79	1,491.51
23	2042		104.28	104.28	1,694.25	1,589.97
24	2043		104.28	104.28	1,798.78	1,694.50
25	2044		104.28	104.28	1,909.77	1,805.49
26	2045		104.28	104.28	2,027.60	1,923.32
27	2046		104.28	104.28	2,047.87	1,943.59
28	2047		104.28	104.28	2,068.35	1,964.07
29	2048		104.28	104.28	2,089.04	1,984.76
30	2049		104.28	104.28	2,109.93	2,005.65
31	2050		104.28	104.28	2,131.03	2,026.75
32	2051		104.28	104.28	2,152.34	2,048.06
33	2052		104.28	104.28	2,173.86	2,069.58
34	2053		104.28	104.28	2,195.60	2,091.32
35	2054		104.28	104.28	2,217.55	2,113.27
36	2055		104.28	104.28	2,239.73	2,135.45
37	2056		104.28	104.28	2,262.13	2,157.85
38	2057		104.28	104.28	2,284.75	2,180.47
39	2058		104.28	104.28	2,307.60	2,203.32
40	2059		104.28	104.28	2,330.67	2,226.39
41	2060		104.28	104.28	2,353.98	2,249.70
42	2061		104.28	104.28	2,377.52	2,273.24
43	2062		104.28	104.28	2,401.29	2,297.01
44	2063		104.28	104.28	2,425.31	2,321.03
45	2064		104.28	104.28	2,449.56	2,345.28
FIRR					8.95%	

Source: JICA Study Team

Table App-E (24) Cash Flow of MMSP (Option B3b)

(Unit: Million USD, constant 2015 prices)

Year	Investments	O&M Costs	Costs	Revenue	Net Cash Flow
1	2020	512.49		512.49	-512.49
2	2021	1024.97		1024.97	-1,024.97
3	2022	1537.46		1537.46	-1,537.46
4	2023	1024.97		1024.97	-1,024.97
5	2024	1024.97		1024.97	-1,024.97
6	2025		40.37	172.27	131.90
7	2026		40.37	185.49	145.12
8	2027		40.37	199.73	159.36
9	2028		40.37	215.05	174.68
10	2029		40.37	231.55	191.18
11	2030	489.87	40.37	249.32	-280.92
12	2031	979.75	40.37	268.45	-751.67
13	2032	1469.62	40.37	289.05	-1,220.94
14	2033	979.75	40.37	311.23	-708.89
15	2034	979.75	40.37	335.11	-685.01
16	2035		93.78	1,200.07	1,106.29
17	2036		93.78	1,274.43	1,180.65
18	2037		93.78	1,353.39	1,259.61
19	2038		93.78	1,437.25	1,343.47
20	2039		93.78	1,526.31	1,432.53
21	2040		93.78	1,620.88	1,527.10
22	2041		93.78	1,721.32	1,627.54
23	2042		93.78	1,827.98	1,734.20
24	2043		93.78	1,941.24	1,847.46
25	2044		93.78	2,061.53	1,967.75
26	2045		109.01	2,189.27	2,080.26
27	2046		109.01	2,211.16	2,102.15
28	2047		109.01	2,233.27	2,124.26
29	2048		109.01	2,255.60	2,146.59
30	2049		109.01	2,278.16	2,169.15
31	2050		109.01	2,300.94	2,191.93
32	2051		109.01	2,323.95	2,214.94
33	2052		109.01	2,347.19	2,238.18
34	2053		109.01	2,370.66	2,261.65
35	2054		109.01	2,394.37	2,285.36
36	2055		109.01	2,418.31	2,309.30
37	2056		109.01	2,442.49	2,333.48
38	2057		109.01	2,466.92	2,357.91
39	2058		109.01	2,491.59	2,382.58
40	2059		109.01	2,516.50	2,407.49
41	2060		109.01	2,541.67	2,432.66
42	2061		109.01	2,567.09	2,458.08
43	2062		109.01	2,592.76	2,483.75
44	2063		109.01	2,618.68	2,509.67
45	2064		109.01	2,644.87	2,535.86
FIRR					9.22%

Source: JICA Study Team

ANNEXES

ANNEX A
Perspective Images of TOD Example in BGC

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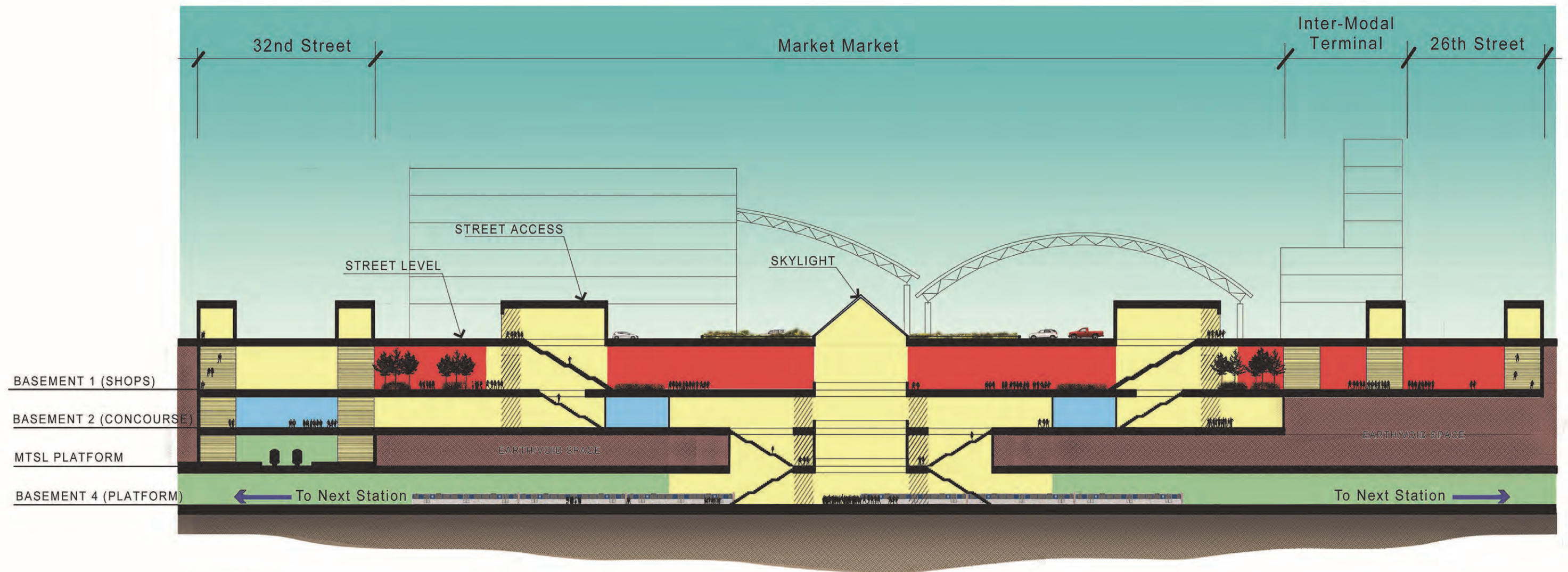


Aerial Perspective with Partial Section

Information Collection Survey for the Mega Manila Subway Project
(JICA Study Team, 2015)

Source: *JICA Study Team*

Figure Annex-A (1) Aerial Perspective with Partial Section



Legend

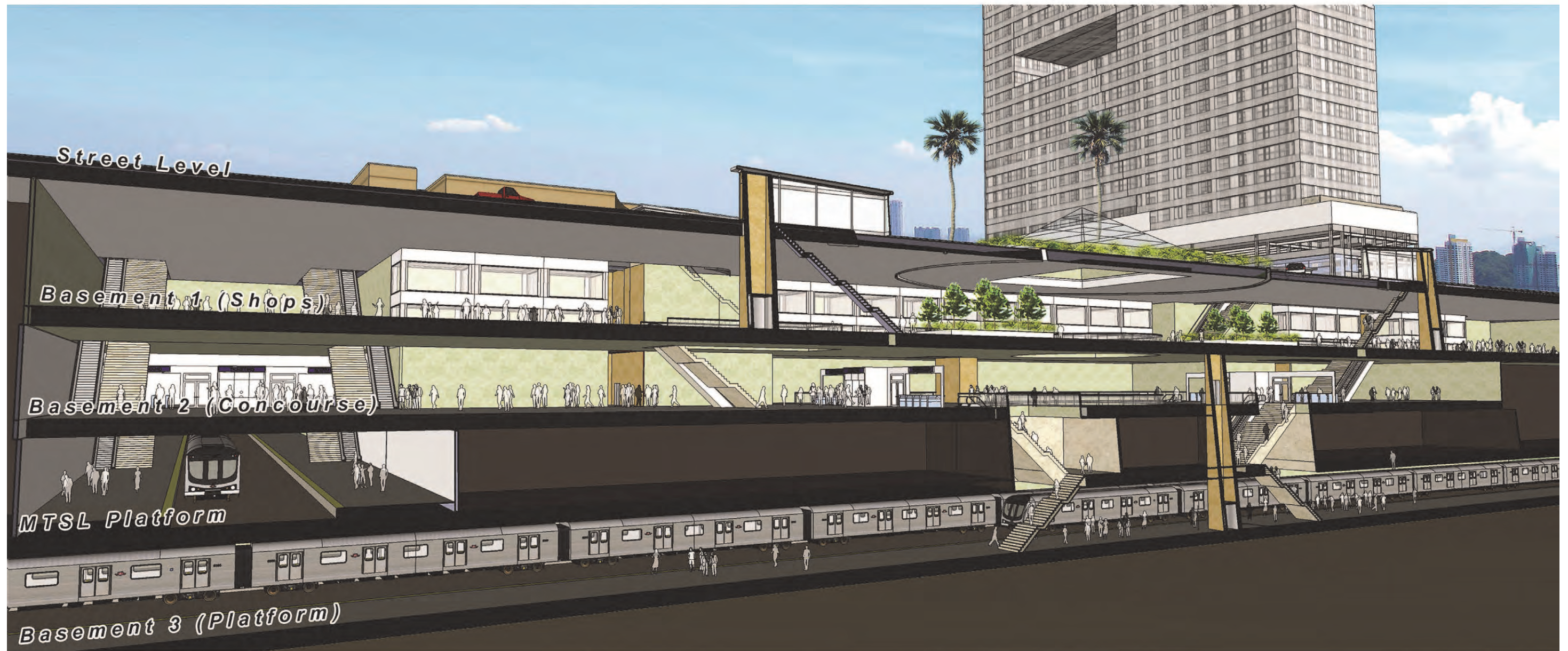
- Ticketing
- Platform
- Commercial
- Access (between levels)
- Elevator

**McKinley Parkway Road Sub-Grade Dev't
Section Along McKinley Parkway**

Information Collection Survey for the Mega Manila Subway Project
(JICA Study Team, 2015)

Source: JICA Study Team

Figure Annex-A (2) Section along McKinley Parkway



Sectional Perspective (from MTSL Station)

Information Collection Survey for the Mega Manila Subway Project
(JICA Study Team, 2015)

Source: JICA Study Team

Figure Annex-A (3) Sectional Perspective (1)



Sectional Perspective (Longitudinal)

Information Collection Survey for the Mega Manila Subway Project
(JICA Study Team, 2015)

Source: JICA Study Team

Figure Annex-A (4) Sectional Perspective (2)

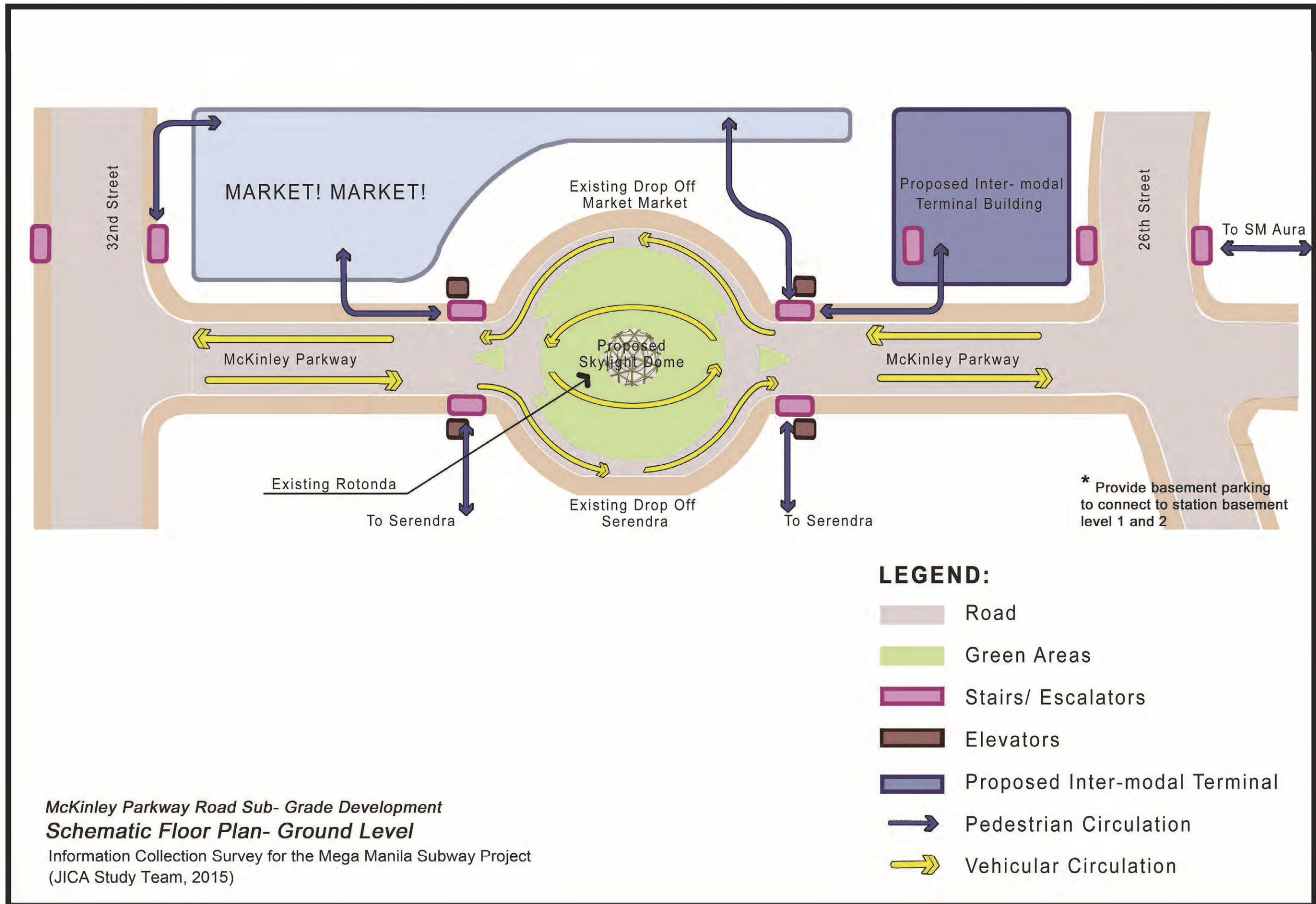


Sectional Perspective (Across McKinley Road)

Information Collection Survey for the Mega Manila Subway Project
(JICA Study Team, 2015)

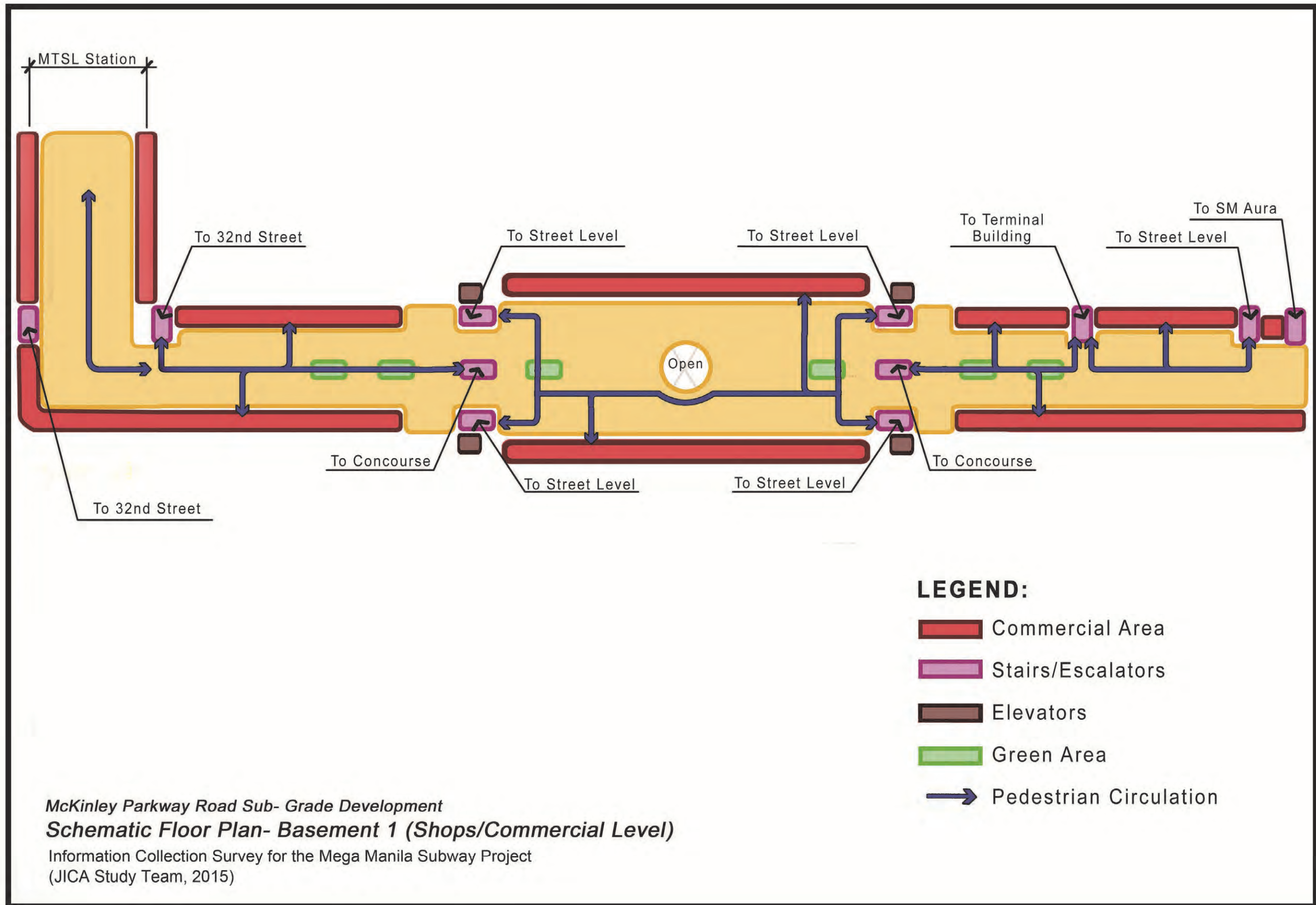
Source: JICA Study Team

Figure Annex-A (5) Sectional Perspective (3)



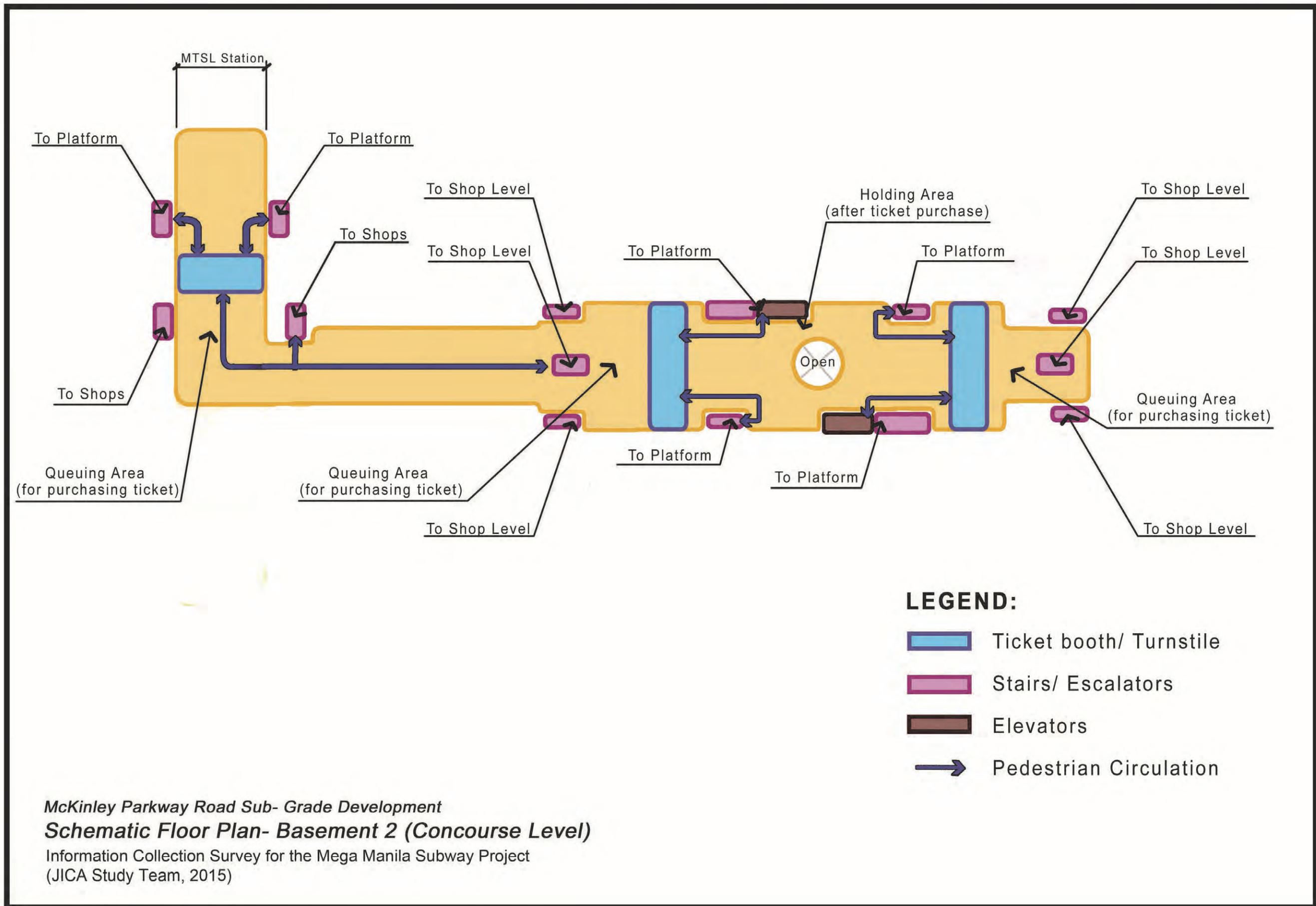
Source: JICA Study Team

Figure Annex-A (6) Schematic Floor Plan – Ground Level



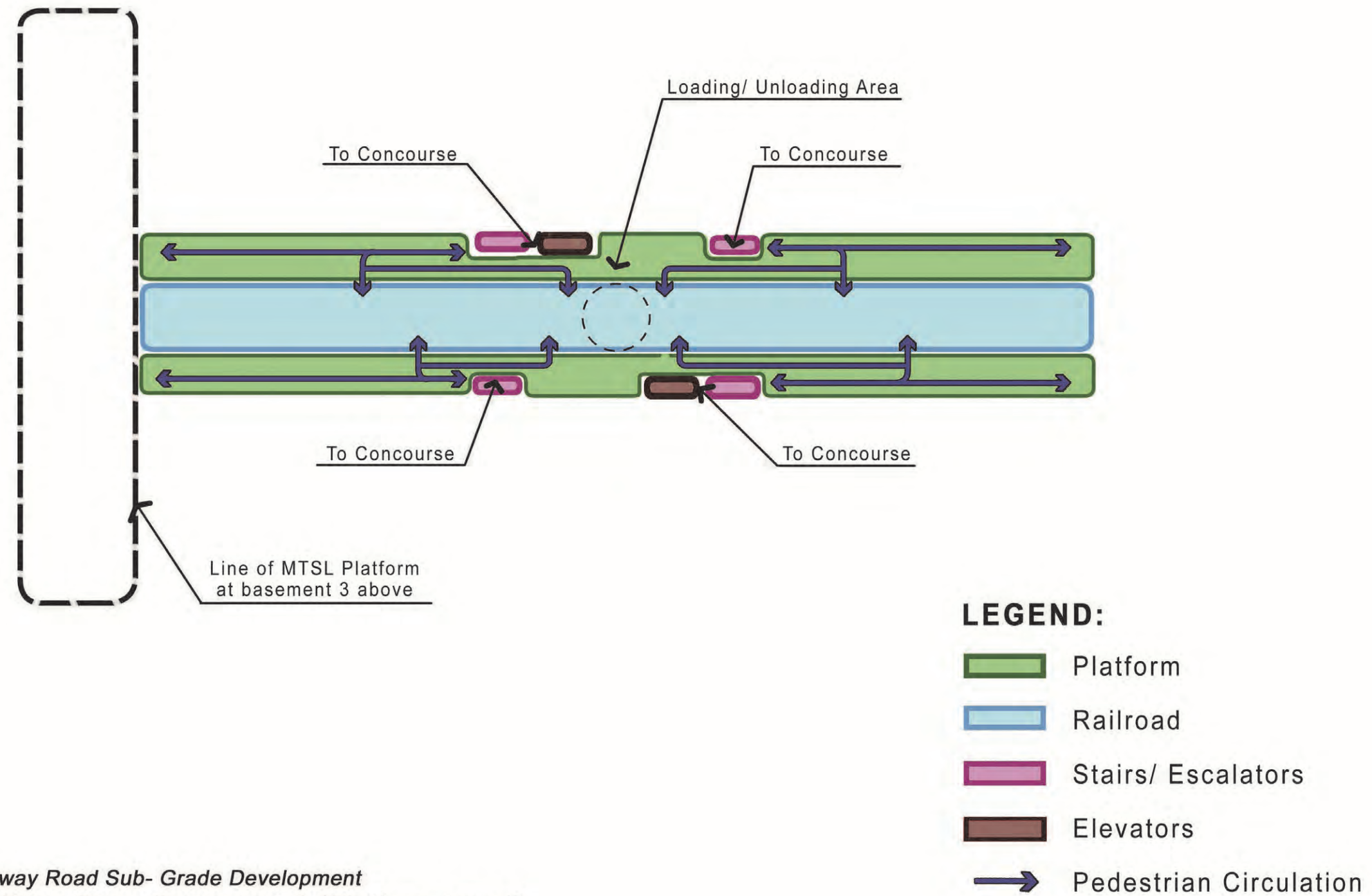
Source: JICA Study Team

Figure Annex-A (7) Schematic Floor Plan – Basement 1



Source: JICA Study Team

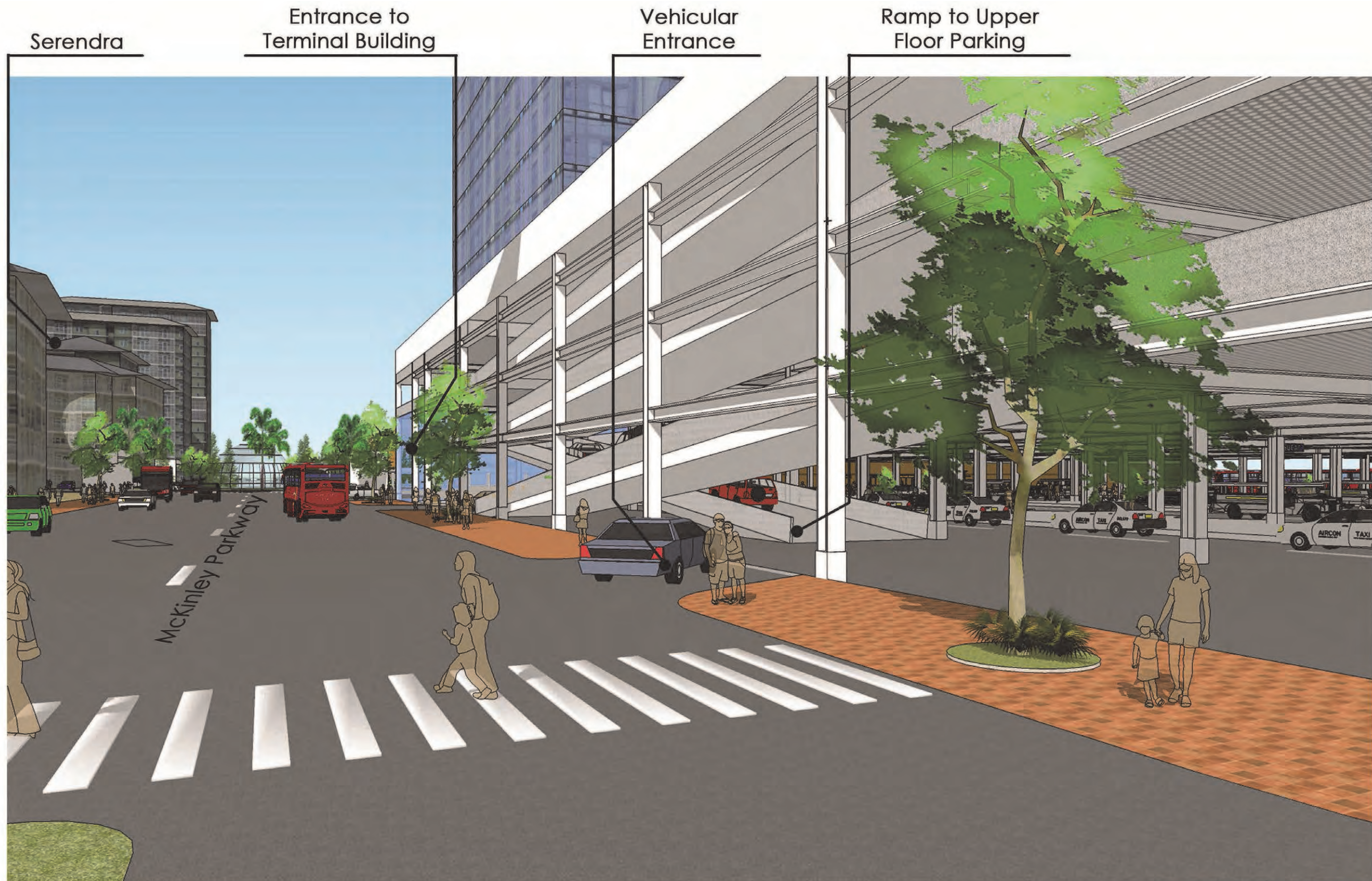
Figure Annex-A (8) Schematic Floor Plan – Basement 2



McKinley Parkway Road Sub- Grade Development
Schematic Floor Plan- Basement 4 (Platform Level)
Information Collection Survey for the Mega Manila Subway Project
(JICA Study Team, 2015)

Source: JICA Study Team

Figure Annex-A (9) Schematic Floor Plan – Basement 4

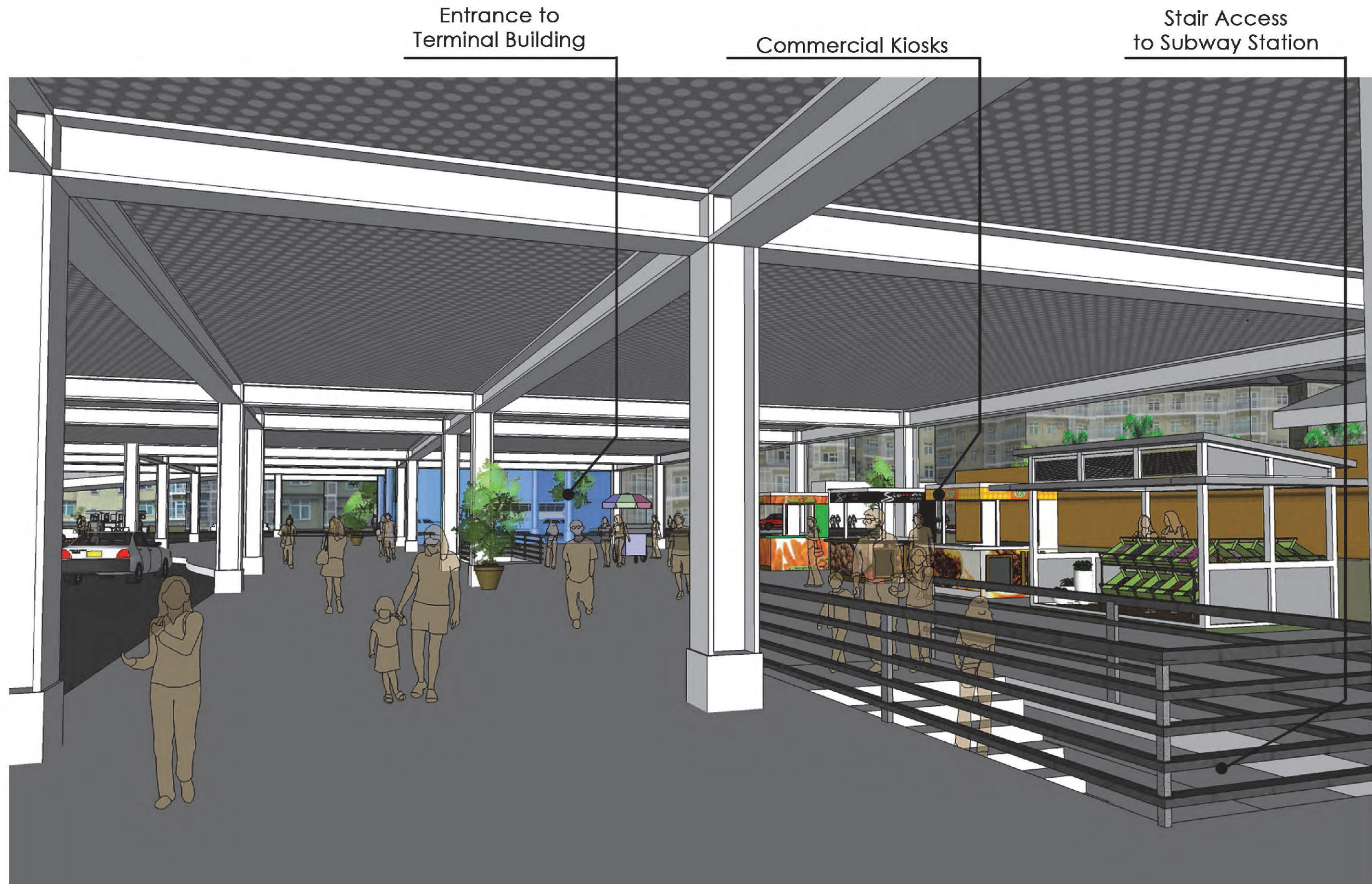


Inter-Modal Terminal Building

Information Collection Survey for the Mega Manila Subway Project
(JICA Study Team, 2015)

Source: JICA Study Team

Figure Annex-A (10) Inter-Modal Terminal Building



Commercial Kiosks Mega-Manila Subway

Information Collection Survey for the Mega Manila Subway Project
(JICA Study Team, 2015)

Source: JICA Study Team

Figure Annex-A (11) Commercial Kiosks



Bus and Jeepney Terminal

Information Collection Survey for the Mega Manila Subway Project
(JICA Study Team, 2015)

Source: JICA Study Team

Figure Annex-A (12) Bus and Jeepney Terminal



Taxi Bay

Information Collection Survey for the Mega Manila Subway Project
(JICA Study Team, 2015)

Source: JICA Study Team

Figure Annex-A (13) Taxi Bay

ANNEX B
3D CAD Images of Construction of Underground Structures

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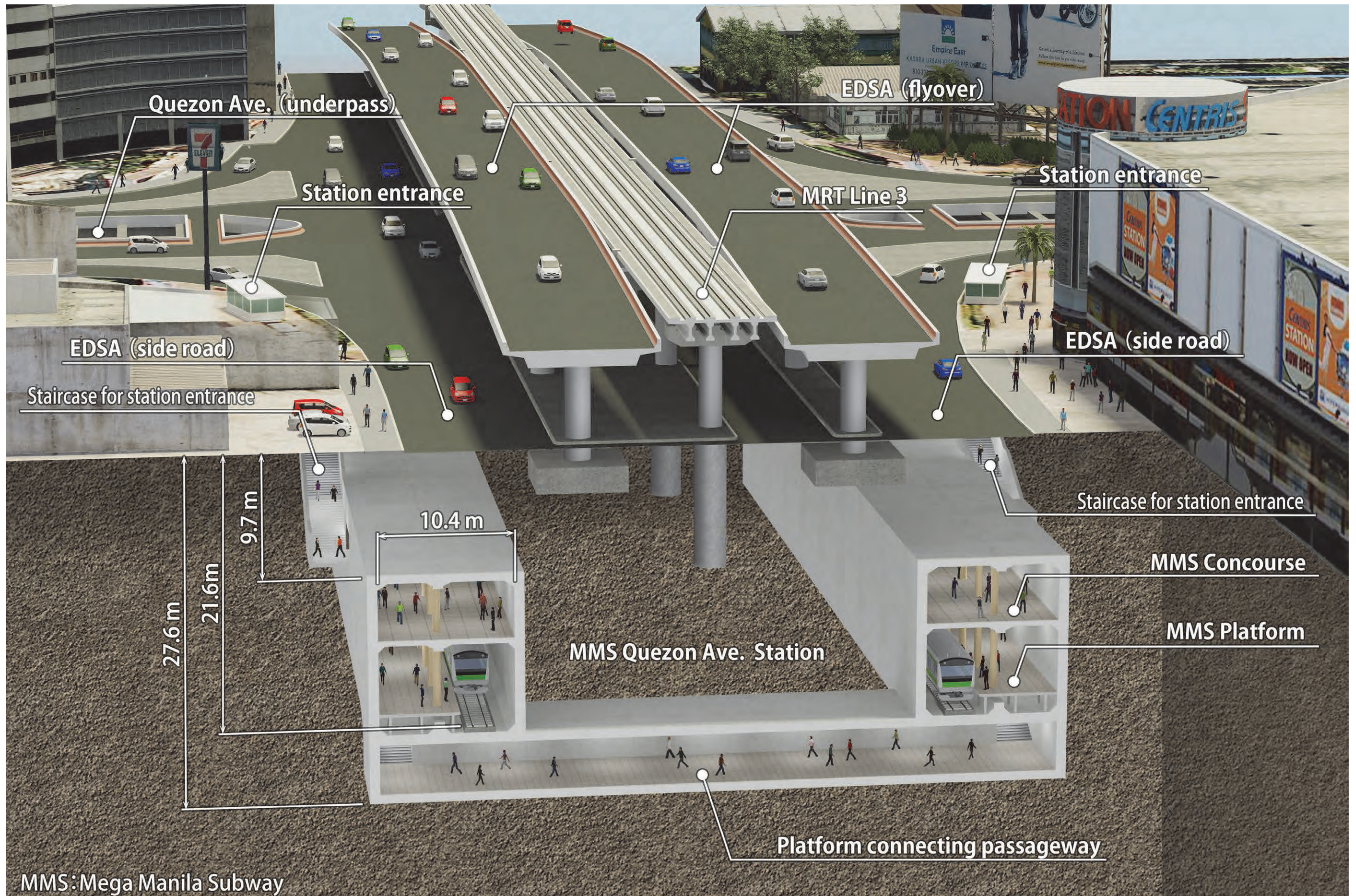


Figure Annex-B (1) Typical Underground Section with Road Crossing, MRT Line 3 and Flyover (EDSA and Quezon Avenue – Option 1 in Central Zone)

Source: JICA Study Team

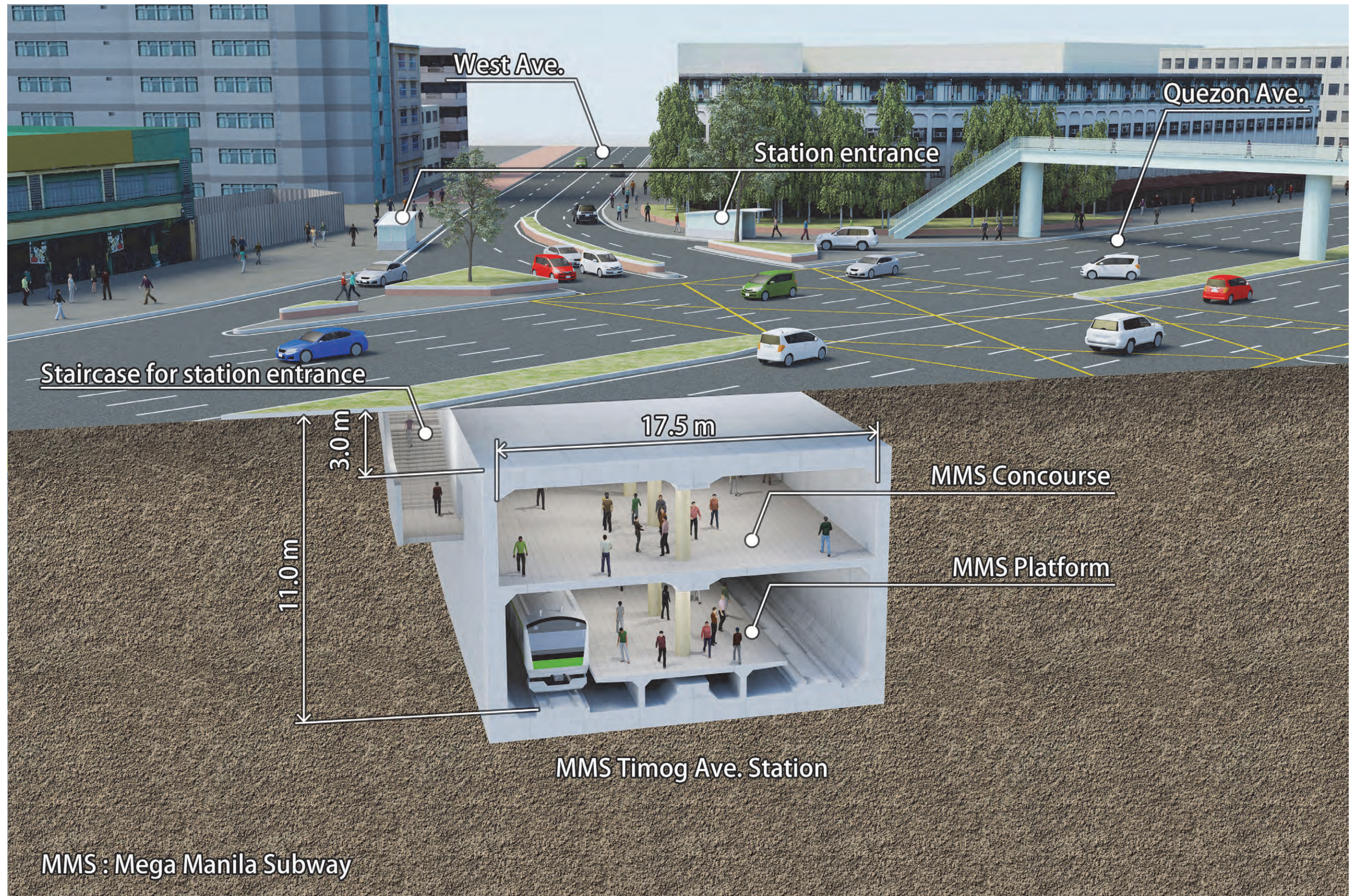


Figure Annex-B (2) Typical Underground Section with Road Crossing (Quezon Avenue and Timog Avenue – Option 2 in Central Zone)

Source: JICA Study Team

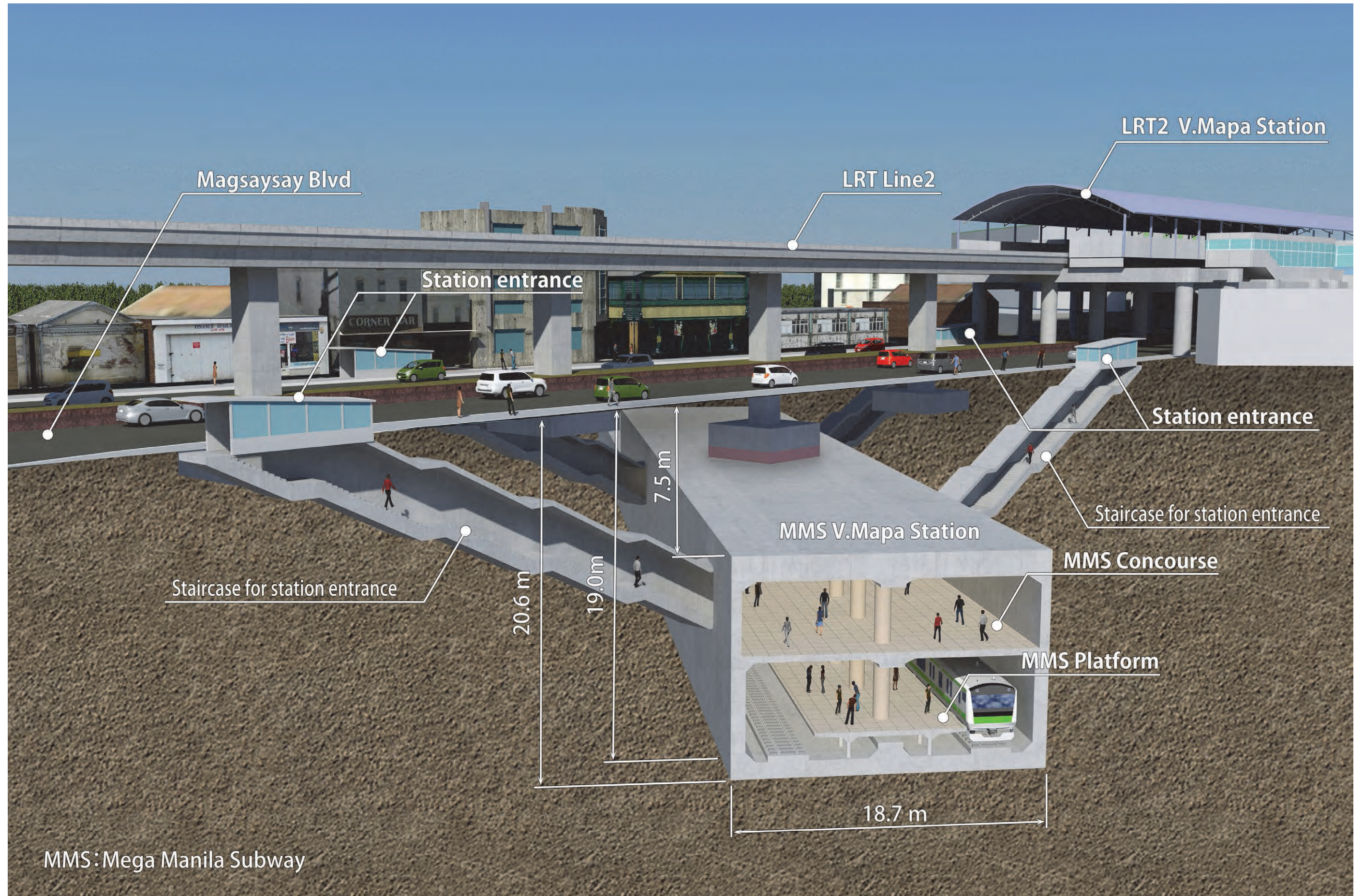
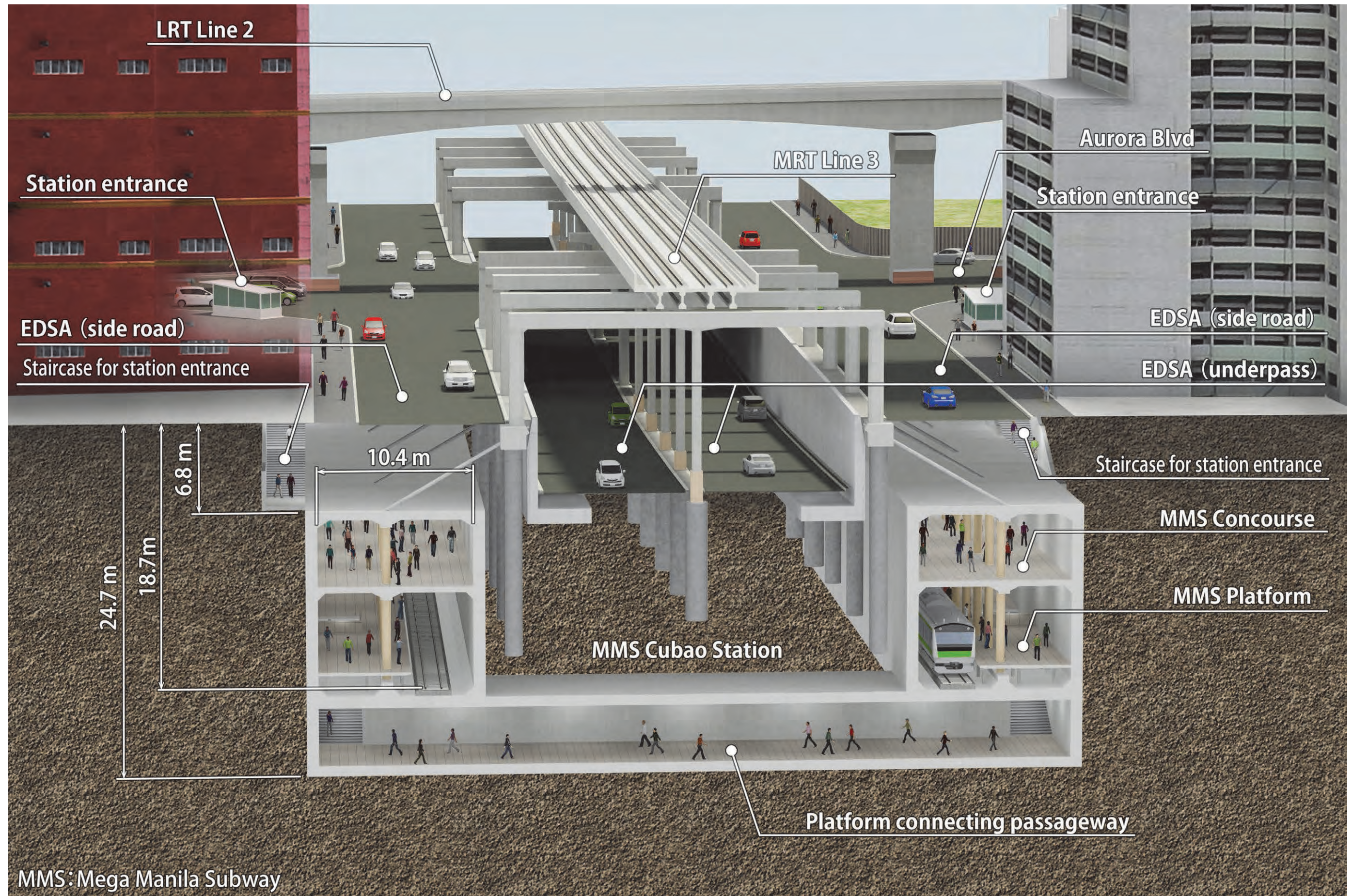


Figure Annex-B (3) Typical Underground Station with Road Crossing (V. Mapa Station – Option 3 in Central Zone)

Source: JICA Study Team



MMS: Mega Manila Subway

Source: JICA Study Team

Figure Annex-B (4) Typical Underground Station requiring Neighboring Construction (Cubao Station at EDSA and Aurora Boulevard – Option 1 in Central Zone)

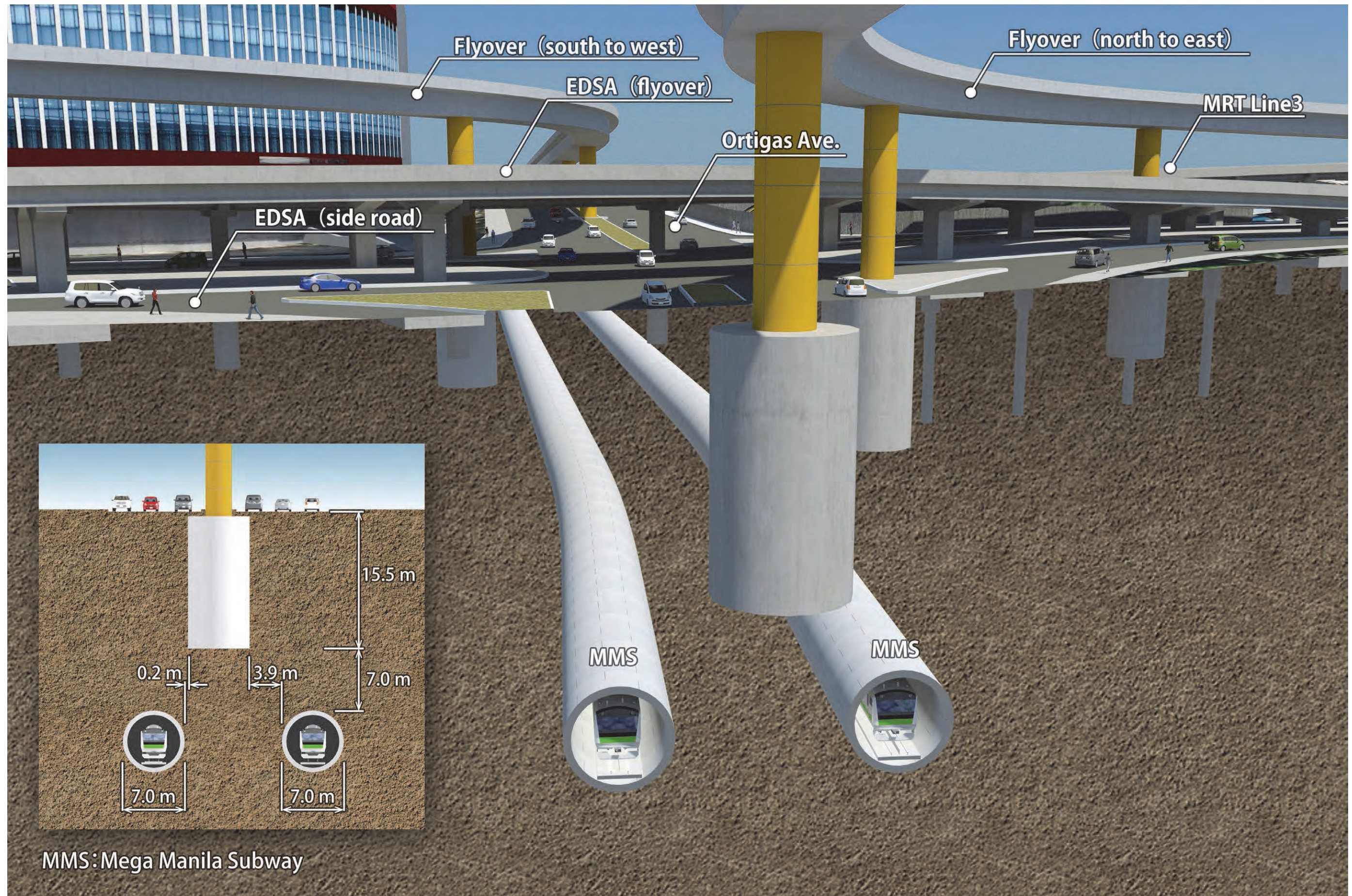


Figure Annex-B (5) Typical Underground Structure requiring Neighboring Construction (EDSA and Ortigas Avenue – Option 2 in Central Zone)

Source: JICA Study Team



Figure Annex-B (6) Transition Section from Underground Structure to Elevated Structure (Along Mindanao Avenue – North Part of Central Zone)

Source: JICA Study Team



Figure Annex-B (7) Typical Elevated Section along Existing Road (Quirino Highway – Option A in North Zone)

Source: JICA Study Team