

Pavement Thickness

(1) Design Formula

The design analysis of the pavement structure was made in accordance with the *Design Guidelines Criteria and Standards* and the *AASHTO Guide for the Design of Pavement Structures* (1993).

The following basic equation given in the guide was used:

$$\log_{10}(W_{18}) = Z_R \times S_o + 9.36 \times \log_{10} (SN + 1)$$

$$- 0.20 + \frac{\log_{10} \left[\frac{\Delta PSI}{4.2 - 1.5} \right]}{1 + \frac{1094}{(SN + 1)^{5.19}}}$$

$$+ 2.32 \times \log_{10} M_r - 8.07$$

where

- W18 = predicted number of 18-kip equivalent single axle load applications,
- ZR = standard normal deviate,
- So = combined standard error of the traffic prediction and performance prediction,
- ΔPSI = difference between the initial design serviceability index, Po, and the design terminal serviceability index, Pt,
- MR = Resilient modulus (psi)

$$SN = a_1 D_1 + a_2 D_2 m_2 + a_3 D_3 m_3$$

where

- a₁, a₂, a₃ = layer coefficients representative of surface, base and sub-base course, respectively
- D₁, D₂, D₃ = actual thickness (in inches) surface, base and sub-base course, respectively
- m₂, m₃ = drainage coefficients for base and sub-base layers, respectively

(2) Traffic and Equivalent Single-Axle Load

The Future Traffics (AADT) for all 10 years of analysis period (2013-2022) is shown in Table 17.2- 1.

Table 17.2-1 Future Traffics (AADT)

	Year	Car	Bus	Truck	Total
1	2013Y	1,339	108	353	1,800
2	2014Y	1,486	109	411	2,006
3	2015Y	1,649	110	479	2,238
4	2016Y	1,830	112	559	2,501
5	2017Y	2,031	113	651	2,795
6	2018Y	2,254	114	759	3,127
7	2019Y	2,513	118	834	3,465
8	2020Y	2,801	121	916	3,838
9	2021Y	3,123	125	1,007	4,255
10	2022Y	3,482	129	1,106	4,717
	Total	22,508	1,159	7,075	30,742

The accumulated ESAL for all 10 years of analysis period (2013-2022) is shown in Table 17.2-2 .

The final column, the total number of equivalent 18-kip single axle load, is calculated as follows:

$$ESAL = (AADT \times 365 \text{ days}/2 \text{ lanes}) \times EALF$$

Table 17.2- 2 Equivalent Standard Axle Load (ESAL)

Year	Car	ESAL-1	Bus	ESAL-2	Truck	ESAL-3	Total	Cumulative ESAL
2007Y	1,339	6,109	108	15,374	353	131,422	152,905	152,905
2008Y	1,486	6,780	109	15,516	411	153,015	175,311	328,216
2009Y	1,649	7,524	110	15,659	479	178,332	201,514	529,730
2010Y	1,830	8,349	112	15,943	559	208,116	232,408	762,138
2011Y	2,031	9,266	113	16,086	651	242,367	267,719	1,029,858
2012Y	2,254	10,284	114	16,228	759	282,576	309,087	1,338,945
2013Y	2,513	11,466	118	16,797	834	310,498	338,761	1,677,706
2014Y	2,801	12,780	121	17,224	916	341,027	371,031	2,048,737
2015Y	3,123	14,249	125	17,794	1,007	374,906	406,949	2,455,685
2016Y	3,482	15,887	129	18,363	1,106	411,764	446,014	2,901,699
Sub-total	22,508	102,693	1,159	164,984	7,075	2,634,023	2,901,699	

Say 2.9×10^6

(3) Design Requirement for ACP Design

Design requirement for ACP Design is below in Table 17.2- 3.

Table 17.2-3 Summary of Design Requirement for ACP Design

Item		Design requirement	Reference Clause (AASHTO)
1	The Performance Period	10 years (for ACP)	2.2.4(1) Time constraints
2	Design Traffic : ESAL	2.9×10^6	2.2.4(2)Design Reliability
3	Sub-grade Design CBR	8 %	2.2.4(4)Design CBR
4	Design Reliability : R Standard Normal Deviate : ZR	80 % -0.841	2.2.4(5)Design Reliability
5	Standard Deviation : So	0.45	2.2.4(5)Design Reliability
6	Design Serviceability Loss : Δ PSI	1.7	2.2.4(6) Pavement Performance Criteria
7	Effective Roadbed Resilient : MR Modulus	12,000	2.2.4(7) Modulus of Sub-grade Reaction
8	Sub-base Elastic Modulus : ESB	15,000 psi (CBR>25)	2.2.4(9)PCCP Modulus of Rupture
9	Drainage Coefficient : m_2, m_3	1.00	2.2.4(10)Drainage Coefficient
10	Layer Coefficient	Asphalt Concrete: a_1 0.38 Crushed Gravel: a_2 0.15 Granular Subbase: a_3 0.11	2.2.4(10)Drainage Coefficient

(4) Design Structure Number (SN)

Design Structure Number (SN) is calculated using Formula shown in (1).

Calculation result of Design Structure Number (SN) is **3.24**

(5) Pavement Thickness

1) ACP Thickness

Considering a minimum thickness $D_1 = 10$ cm of asphalt concrete.

$$SN_1 \text{ of asphalt} = 0.38 \times 10 / 2.54 = 1.5$$

2) Base Course Thickness

If the aggregate Base Course D_2 is **15** cm

$$SN_2 \text{ of the base} = 0.15 \times 15 / 2.54 = 0.89$$

3) Subbase Thickness

$$SN_3 \text{ of Subbase} = SN - (SN_1 + SN_2) = 3.2 - (1.5 + 0.89) = 0.82$$

$$0.818 = 0.11 D / 2.54$$

$$D_3 = 0.818 \times 2.54 / 0.11 = \mathbf{18.9} \text{ cm}$$

Therefore the new pavement will be composed of:

- 10 cm Asphalt Concrete
- 15 cm Aggregate Base Course
- 20 cm Granular Subbase

Cost Estimation Sheets

Inner Ring Road : 2 Lanes + 2 Bike Lanes

Summary of Construction Cost 2+(2) Lanes

Item	Unit	Unit Price (USD)	Quantity	Construction Cost (USD)	Remarks
1 Earthwork					
1.1 Clearing & Graving	ha	12,900	7.9	102,150	
1.2 Embankment From Road Excavation	m ³	19.38	804.0	15,582	
1.3 Embankment From Borrow	m ³	4.21	68,069.0	286,570	
2 Slope Protection					
2.1 Slope Protection on Embankment Slope (Sodding)	m ²	2.44	16,980.0	41,431	
2.2 Masonry Retaining Wall	m ³	103.5	0.0	0	
3 Pavement					
3.1 Subgrade Preparation	m ²	0.35	62,297.2	21,804	
3.2 Granular Sub-base Course (t=20cm)	m ³	5.59	12,084.7	67,554	
3.3 Aggregate Base Course (t=15cm)	m ³	5.94	8,501.5	50,499	
3.4 Bituminous Concrete Binder Course (t=5cm)	m ²	9.61	54,100.2	519,903	
3.5 Bituminous Concrete Surface Course (t=5cm)	m ²	9.56	53,866.0	514,959	
3.6 Prime Coat	L.	1.66	65,201.3	108,234	
3.7 Tack Coat	L.	1	2,810.4	2,810	
4 Drainage					
4.1 Longitudinal Drainage	m	106	9,400.0	996,400	
4.2 Excavation for RCPC & RCBC	m ³	15.8	383.7	6,062	
4.3 Cross Drainage (RCPC φ0.600)	m	101.67	441.2	44,857	
4.3 Cross Drainage (RCPC φ1.000)	m	213.7	18.1	3,868	
4.4 Concrete for RCPC & RCBC	m ³	235.7	286.2	67,467	
4.5 Re-bar for RCPC & RCBC	ton	1,010.87	13.1	13,209	
5 Bridge					
5.1 RC Multi-Beam	m ²	2,300.00	240.0	552,000	
6 Public Utility Relocation/Protection					
6.1 Public Utility Relocation/Protection	L.S.	1	100,000	100,000	
7 Miscellaneous					
7.1 Sidewalk w=2.5m	m	82	4,684.0	384,088	
7.2 Traffic Sign each100m ×2	No.	129.53	94	12,176	
7.3 Guide Sign 4 Intersection	No.	259.36	13	3,372	
7.4 Pavement Marking	m ²	11.9	2,810.4	33,444	
7.5 Km. Post	No.	60.4	5	302	
7.6 Guard Rail	m	150	40.0	6,000	
7.7 Road Lighting	set	2,055.73	95	195,294	per km
A. Sub-total (1 to 7)				4,150,035	882,986
8 Engineer's Facility					
8.1 Engineer's Facility (1% of A)	L..S.		1	41,500	
9 Mobilization/Demobilization					
9.1 Mobilization/Demobilization (0.5% of A)	L..S.		1	20,750	
10 Contingency					
10.1 Contingency (10% of A)	L..S.		1	415,004	
B. Construction Cost Total (A + 8 to 10)				4,627,289	
11 Management Fee					
11.1 Engineering and Construction Management (6% of B)	L..S.		1	277,637	
11.2 Local Administration (4% of B)	L..S.		1	185,092	
C. Construction Cost Total (B + 11)				5,090,018	
12 Land Acquisition and Compensation					
12.1 Land Acquisition residential	m ²	256	4,000	1,024,000	
12.1 Land Acquisition agricultural	m ²	63	90,000	5,670,000	
D. Sub-total (C + 12)				11,784,018	
13 Sales Tax (10% of C)				1,178,402	
E. Project Cost				12,962,420	

Clearing and Grubbing

2+(2) Lanes

STA.	Distance (m)	Cut		Embankment		Remarks
		Area (m ²)	Volume (m ³)	Area (m ²)	Volume (m ³)	
0+000.00				30.0		
0+100.00	100.00		0	22.0	2,600	
0+166.00	66.00			17.5	1,304	
0+200.00	34.00		0	17.0	587	
0+240.00	40.00			19.0	720	
0+300.00	60.00		0	18.5	1,125	
0+327.00	27.00			18.5	500	
0+400.00	73.00		0	20.0	1,405	
0+473.50	73.50			18.0	1,397	
0+500.00	26.50		0	19.5	497	
0+600.00	100.00		0	20.5	2,000	
0+640.00	40.00			20.5	820	
0+700.00	60.00		0	19.0	1,185	
0+800.00	100.00		0	19.0	1,900	
0+840.00	40.00			18.5	750	
0+900.00	60.00		0	17.0	1,065	
0+969.30	69.30			17.5	1,195	
0+987.30	18.00			19.0	329	
1+000.00	12.70		0	18.0	235	
1+023.00	23.00		0	18.0	414	
Bridge	16.00					
1+039.00				18.0		
1+100.00	61.00		0	18.0	1,098	
1+200.00	100.00		0	20.0	1,900	
1+300.00	100.00		0	24.0	2,200	
1+400.00	100.00		0	28.0	2,600	
1+500.00	100.00		0	30.0	2,900	
1+600.00	100.00		0	30.0	3,000	
1+700.00	100.00		0	30.0	3,000	
1+800.00	100.00		0	30.0	3,000	
1+900.00	100.00		0	30.0	3,000	
2+000.00	100.00		0	30.0	3,000	
2+100.00	100.00		0	30.0	3,000	
2+200.00	100.00		0	30.0	3,000	
2+300.00	100.00		0	30.0	3,000	
2+400.00	100.00		0	30.0	3,000	
2+500.00	100.00		0	30.0	3,000	
2+600.00	100.00		0	30.0	3,000	
2+700.00	100.00		0	30.0	3,000	
2+800.00	100.00		0	30.0	3,000	
2+900.00	100.00		0	30.0	3,000	
3+000.00	100.00		0	30.0	3,000	
3+100.00	100.00		0	30.0	3,000	
3+200.00	100.00		0	30.0	3,000	
3+300.00	100.00		0	30.0	3,000	
3+400.00	100.00		0	30.0	3,000	
3+500.00	100.00		0	30.0	3,000	
3+600.00	100.00		0	30.0	3,000	
3+700.00	100.00		0	30.0	3,000	
3+800.00	100.00		0	30.0	3,000	
3+900.00	100.00		0	30.0	3,000	
4+000.00	100.00		0	30.0	3,000	
4+100.00	100.00		0	30.0	3,000	
4+200.00	100.00		0	30.0	3,000	
4+300.00	100.00		0	30.0	3,000	
4+400.00	100.00		0	30.0	3,000	
4+500.00	100.00		0	30.0	3,000	
4+600.00	100.00		0	30.0	3,000	
4+700.00	100.00		0	30.0	3,000	
Total	4700.00		0		126,726	

Cut & Embankment

2+(2) Lanes

STA.	Distance (m)	Cut		Embankment		Remarks
		Area (m ²)	Volume (m ³)	Area (m ²)	Volume (m ³)	
		0+000.00				
0+100.00	100.00	1.1	55	1.0	50	
0+166.00	66.00		36	6.9	261	
0+200.00	34.00		0	6.2	223	
0+240.00	40.00		0	16.0	444	
0+300.00	60.00		0	14.1	903	
0+327.00	27.00		0	16.0	406	
0+400.00	73.00		0	26.9	1,566	
0+473.50	73.50		0	9.6	1,341	
0+500.00	26.50		0	20.9	404	
0+600.00	100.00		0	25.3	2,310	
0+640.00	40.00		0	24.7	1,000	
0+700.00	60.00		0	15.3	1,200	
0+800.00	100.00		0	19.3	1,730	
0+840.00	40.00		0	17.0	726	
0+900.00	60.00	1.3	39	1.2	546	
0+969.30	69.30		45	2.2	118	
0+987.30	18.00		0	15.7	161	
1+000.00	12.70	6.3	40		100	
1+023.00	23.00		72	9.2	106	
Bridge						
1+039.00				9.2		
1+100.00	61.00		0	9.2	561	
1+200.00	100.00		0	15.4	1,230	
1+300.00	100.00		0	23.0	1,920	
1+400.00	100.00		0	9.8	1,640	
1+500.00	100.00		0	20.6	1,520	
1+600.00	100.00		0	14.0	1,730	
1+700.00	100.00		0	13.4	1,370	
1+800.00	100.00		0	18.4	1,590	
1+900.00	100.00		0	20.8	1,960	
2+000.00	100.00		0	13.1	1,695	
2+100.00	100.00	0.1	5	13.3	1,320	
2+200.00	100.00		5	14.9	1,410	
2+300.00	100.00		0	26.7	2,080	
2+400.00	100.00		0	27.0	2,685	
2+500.00	100.00		0	17.9	2,245	
2+600.00	100.00		0	16.3	1,710	
2+700.00	100.00		0	24.6	2,045	
2+800.00	100.00		0	31.9	2,825	
2+900.00	100.00		0	37.6	3,475	
3+000.00	100.00		0	28.6	3,310	
3+100.00	100.00		0	16.1	2,235	
3+200.00	100.00	1.0	50	9.1	1,260	
3+300.00	100.00		50	18.6	1,385	
3+400.00	100.00		0	10.3	1,445	
3+500.00	100.00		0	34.1	2,220	
3+600.00	100.00		0	36.4	3,525	
3+700.00	100.00		0	28.6	3,250	
3+800.00	100.00		0	12.4	2,050	
3+900.00	100.00		0	14.3	1,335	
4+000.00	100.00		0	10.9	1,260	
4+100.00	100.00		0	21.4	1,615	
4+200.00	100.00		0	29.3	2,535	
4+300.00	100.00		0	35.8	3,255	
4+400.00	100.00		0	28.8	3,230	
4+500.00	100.00		0	42.4	3,560	
4+600.00	100.00	5.9	295	6.3	2,435	
4+700.00	100.00		295	0.0	315	
Total			987		88,826	
Surplus Excavation					0	
Disposal of unsuitable material					987	
Embankment From Borrow					88,826	

Vegetation Slope Protection

2+(2) Lanes

STA.	Distance (m)	Left Side				Right Side				Remarks
		Cut		Embankment		Cut		Embankment		
		Length (m)	Area (m ²)	Length (m)	Area (m ²)	Length (m)	Area (m ²)	Length (m)	Area (m ²)	
0+000.00										
0+100.00	100.00				0			1.1	55	
0+166.00	66.00				0			1.8	96	
0+200.00	34.00				0			1.5	56	
0+240.00	40.00				0			3.4	98	
0+300.00	60.00				0			3.0	192	
0+327.00	27.00				0			3.1	82	
0+400.00	73.00				0			2.7	212	
0+473.50	73.50				0			2.3	184	
0+500.00	26.50				0			1.6	52	
0+600.00	100.00				0			1.4	150	
0+640.00	40.00				0			2.3	74	
0+700.00	60.00				0			3.0	159	
0+800.00	100.00				0			2.2	260	
0+840.00	40.00				0			4.3	130	
0+900.00	60.00				0			1.0	159	
0+969.30	69.30				0			3.6	159	
0+987.30	18.00				0			3.6	65	
1+000.00	12.70		0		0			1.0	29	
1+023.00	23.00		0		0			2.2	37	
Bridge										
1+039.00								2.2		
1+100.00	61.00				0			2.2	134	
1+200.00	100.00				0				110	
1+300.00	100.00				0				0	
1+400.00	100.00				0				0	
1+500.00	100.00				0				0	
1+600.00	100.00				0				0	
1+700.00	100.00				0				0	
1+800.00	100.00				0				0	
1+900.00	100.00		0		0		0		0	
2+000.00	100.00		0		0		0		0	
2+100.00	100.00		0		0		0		0	
2+200.00	100.00		0		0		0		0	
2+300.00	100.00		0		0		0		0	
2+400.00	100.00		0		0		0		0	
2+500.00	100.00		0		0		0		0	
2+600.00	100.00		0		0		0		0	
2+700.00	100.00		0		0		0		0	
2+800.00	100.00		0		0		0		0	
2+900.00	100.00		0		0		0		0	
3+000.00	100.00		0		0		0		0	
3+100.00	100.00		0		0		0		0	
3+200.00	100.00		0		0		0		0	
3+300.00	100.00		0		0		0		0	
3+400.00	100.00		0		0		0		0	
3+500.00	100.00		0		0		0		0	
3+600.00	100.00		0		0		0		0	
3+700.00	100.00		0		0		0		0	
3+800.00	100.00		0		0		0		0	
3+900.00	100.00		0		0		0		0	
4+000.00	100.00		0		0		0		0	
4+100.00	100.00		0		0		0		0	
4+200.00	100.00		0		0		0		0	
4+300.00	100.00		0		0		0		0	
4+400.00	100.00		0		0		0		0	
4+500.00	100.00		0		0		0		0	
4+600.00	100.00		0		0		0		0	
4+700.00	100.00		0		0		0		0	
Total			0		0		0		2,493	

Vegetation of Cut slope	0
Vegetation of Embankment slope	2,493

Masonry Retaining Wall

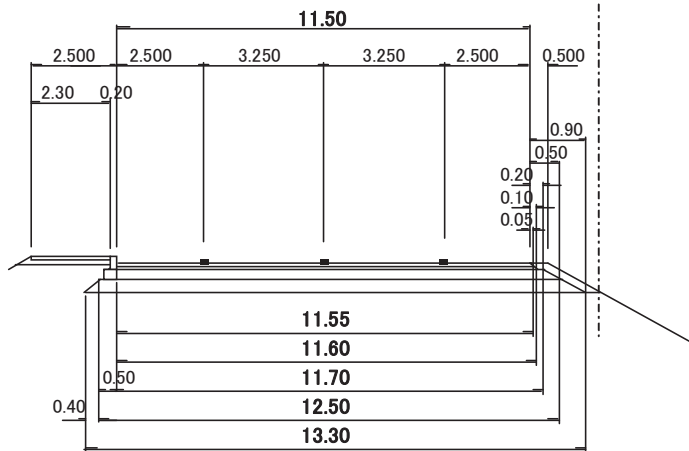
2+(2) Lanes

STA.	Distance (m)	Left Side			Right Side			Remarks
		Height (m)	Area (m ²)	Volume (m ³)	Height (m)	Area (m ²)	Volume (m ³)	
0+000.00		0						
0+100.00	100.00	1.2	0.330	17		0.000	0	
0+166.00	66.00	1.6	1.050	46		0.000	0	
0+200.00	34.00	1.6	1.280	40		0.000	0	
0+240.00	40.00	2.1	1.596	58		0.000	0	
0+300.00	60.00	2.1	1.943	106		0.000	0	
0+327.00	27.00	2.1	1.943	52		0.000	0	
0+400.00	73.00	2.8	2.481	161		0.000	0	
0+473.50	73.50	1.7	2.166	171		0.000	0	
0+500.00	26.50	2.5	1.943	54		0.000	0	
0+600.00	100.00	2.5	2.563	225		0.000	0	
0+640.00	40.00	2.6	2.646	104		0.000	0	
0+700.00	60.00	2.8	2.903	166		0.000	0	
0+800.00	100.00	2.4	2.730	282		0.000	0	
0+840.00	40.00	2.1	2.166	98		0.000	0	
0+900.00	60.00	1.5	1.530	111		0.000	0	
0+969.30	69.30	1	0.891	84		0.000	0	
0+987.30	18.00	1.9	1.106	18		0.000	0	
1+000.00	12.70	0	0.606	11		0.000	0	
1+023.00	23.00	1.7	0.521	13		0.000	0	
Bridge								
1+039.00		1.7						
1+100.00	61.00	1.7	1.403	43		0.000	0	
1+200.00	100.00	1.9	1.530	147	1.8	0.563	28	
1+300.00	100.00	2.1	1.800	167	2.1	1.731	115	
1+400.00	100.00	1.5	1.530	167	1.7	1.663	170	
1+500.00	100.00	1.7	1.280	141	1.8	1.466	156	
1+600.00	100.00	1.5	1.280	128	1.5	1.341	140	
1+700.00	100.00	1.5	1.163	122	1.5	1.163	125	
1+800.00	100.00	1	0.891	103	1.8	1.341	125	
1+900.00	100.00	1.9	1.106	100	1.9	1.596	147	
2+000.00	100.00	1.5	1.403	125	1.4	1.341	147	
2+100.00	100.00	1.3	1.050	123	1.3	0.996	117	
2+200.00	100.00	1.7	1.163	111	1.6	1.106	105	
2+300.00	100.00	1.9	1.530	135	2.1	1.596	135	
2+400.00	100.00	2	1.731	163	2.1	1.943	177	
2+500.00	100.00	1.7	1.596	166	1.7	1.663	180	
2+600.00	100.00	1.7	1.403	150	1.6	1.341	150	
2+700.00	100.00	1.9	1.530	147	1.9	1.466	140	
2+800.00	100.00	2.3	1.943	174	2.3	1.943	170	
2+900.00	100.00	3	2.816	238	1.8	1.871	191	
3+000.00	100.00	2.1	2.646	273	2.2	1.800	184	
3+100.00	100.00	1.6	1.596	212	1.7	1.731	177	
3+200.00	100.00	0	0.480	104	1.5	1.280	151	
3+300.00	100.00	1.8	0.563	52	1.7	1.280	128	
3+400.00	100.00	1.3	1.221	89	1.8	1.466	137	
3+500.00	100.00	2.2	1.466	134	2.4	1.943	170	
3+600.00	100.00	2.4	2.243	185	2.4	2.400	217	
3+700.00	100.00	2.1	2.166	220	2.1	2.166	228	
3+800.00	100.00	1.7	1.663	191	1.3	1.403	178	
3+900.00	100.00	1.5	1.280	147	1.9	1.280	134	
4+000.00	100.00	1.5	1.163	122	1.5	1.403	134	
4+100.00	100.00	1.8	1.341	125	1.9	1.403	140	
4+200.00	100.00	2.1	1.731	154	2.2	1.871	164	
4+300.00	100.00	2.2	2.016	187	2.4	2.243	206	
4+400.00	100.00	2.2	2.090	205	2.2	2.243	224	
4+500.00	100.00	1.7	1.731	191	2.8	2.563	240	
4+600.00	100.00	1.7	1.403	157	2	2.400	248	
4+700.00	100.00	0	0.521	96	0	0.650	153	
Total				7,311			5,731	

Masonry Retaining Wall	Concrete	13.042 m ³
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Unit Quantities of Pavement Type - 2

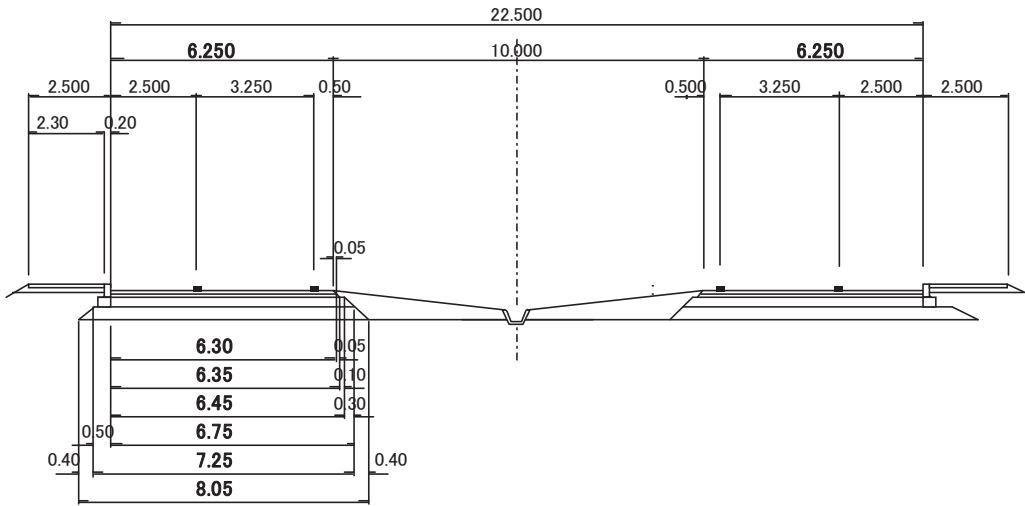
STA. 0+000 ~ STA. 1+100



			per 1.00m
工種	Unit		Quantities
Granular Subbase Course t=200mm	m ³	$1/2 \times (12.50 + 13.30) \times 0.20 \times 1.00$	2.580
Aggregate Base Course t=150mm	m ³	$1/2 \times (11.70 + 12.50) \times 0.15 \times 1.00$	1.815
Asphalt Concrete Binder Course t=50 mm	m ²	11.55 x 1.00	11.550
Asphalt Concrete Wearing Course t=50 mm	m ²	11.50 x 1.00	11.500
Prime Coat (1.2L/m ²)	L.	11.60 x 1.00 x 1.20	13.92
Tack Coat (0.3L/m ²)	L.	11.55 x 1.00 x 0.30	3.465
Traffic Paint	m ²	0.200 x 3 x 1.00	0.60
Subgrade Preparation	m ²	13.300 x 1.00	13.30
Sidewalk w=2.5m	m	1.00 x 1.00	1.00

Unit Quantities of Pavement Type - 1

STA. 1+100 ~ STA. 4+700



Item	Unit	Quantities	per 1.00m
Granular Subbase Course t=200mm	m ³	$1/2 \times (7.25 + 8.05) \times 0.20 \times 1.00 \times 2$	3.060
Aggregate Base Course t=150mm	m ³	$1/2 \times (6.45 + 6.75) \times 0.15 \times 1.00 \times 2$	1.980
Asphalt Concrete Binder Course t=50 mm	m ²	$6.30 \times 1.00 \times 2$	12.600
Asphalt Concrete Wearing Course t=50 mm	m ²	$6.25 \times 1.00 \times 2$	12.500
Prime Coat (1.2L/m ²)	L.	$6.35 \times 1.00 \times 1.20 \times 2$	15.24
Tack Coat (0.3L/m ²)	L.	$6.30 \times 1.00 \times 0.30 \times 2$	3.78
Traffic Paint	m ²	$0.200 \times 2 \times 1.00 \times 2$	0.80
Subgrade Preparation	m ²	$8.05 \times 1.00 \times 2$	16.10
Median strip w=10.0m	m	1.00	1.00
Sidewalk w=2.5m	m	1.00×2	2.00

Sidewalk	Concrete Curb	m	1.00×2	2.00
	Sidewalk Pavement t=50mm	m ³	$2.30 \times 0.05 \times 1.00 \times 2$	0.23
	Subbase Course t=150mm	m ³	$2.30 \times 0.15 \times 1.00 \times 2$	0.69

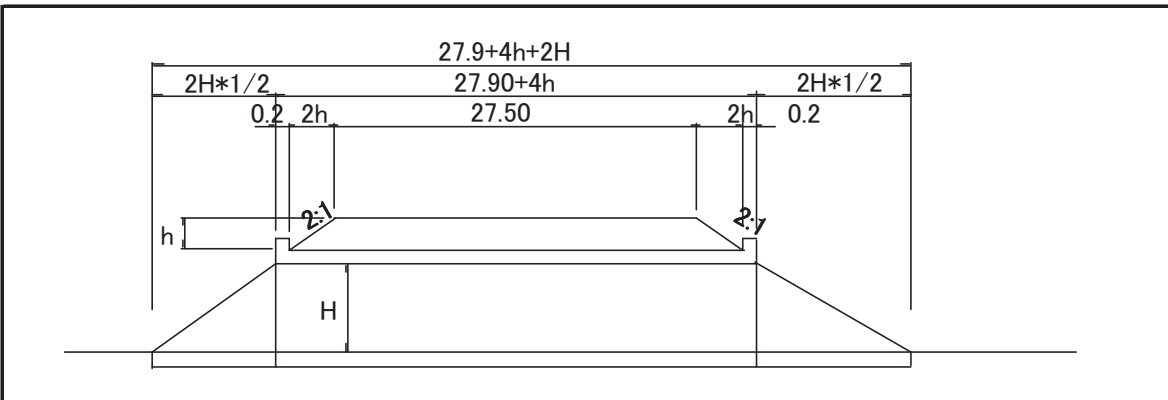
Pavement Quantities

2+(2) Lanes

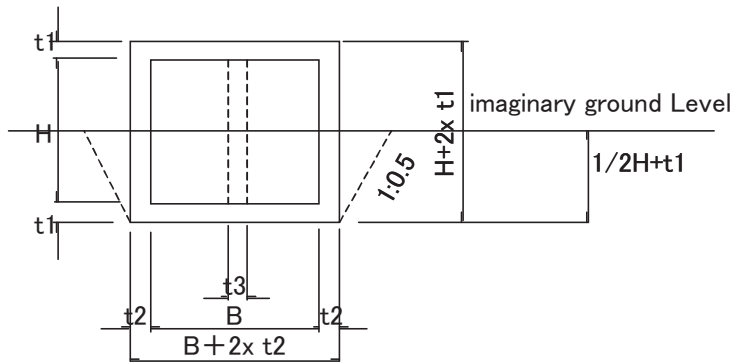
Description	Unit	Type-1				Type-2					Total	
		Unit Quantity (per m)	Total Length (m)	Bridge Length (m)	Pavement Length (m)	Quantities	Unit Quantity (per m)	Total Length (m)	Bridge Length (m)	Pavement Length (m)		Quantities
Subgrade Preparation	sq.m	16.10	3,600.00	0.00	3,600.00	57,960.00	13.30	1,100.00	16.00	1,084.00	14,417.20	72,377.2
Granular Subbase Course t=200mm	cu.m	3.06				11,016.00	2.58				2,796.72	13,812.7
Aggregate Base Course t=150mm	cu.m	1.98				7,128.00	1.82				1,967.46	9,095.5
Asphalt Concrete Binder Course t=50 mm	sq.m	12.60				45,360.00	11.55				12,520.20	57,880.2
Asphalt Concrete Wearing Course t=50 mm	sq.m	12.50				45,000.00	11.50				12,466.00	57,466.0
Prime Coat	L.	15.24				54,864.00	13.92				15,089.28	69,953.3
Tack Coat	L.	3.78				13,608.00	3.47				3,756.06	17,364.1
Traffic Paint	sq.m	0.80				2,880.00	0.60				650.40	3,530.4
Mounted Median Strip w=10.0m	m	1.00				3,600.00	0.00				0.00	3,600.0
Sidewalk w=2.5m	m	2.00				7,200.00	1.00				1,084.00	8,284.0

Type of Road Structure	Pave. Type	Section	Distance (m)	Earthwork (m)	Bridge (m)	Remarks	
	2		0+000				
			1+023	1,023	1,023		
			1+039	16		16	
			1+100	61	61		
		Subtotal		1,100	1,084	16	
	1		1+100				
		4+700	3,600	3,600			
	Total		4,700	4,684	16		

RCBC Quantities 4+(2) Lanes



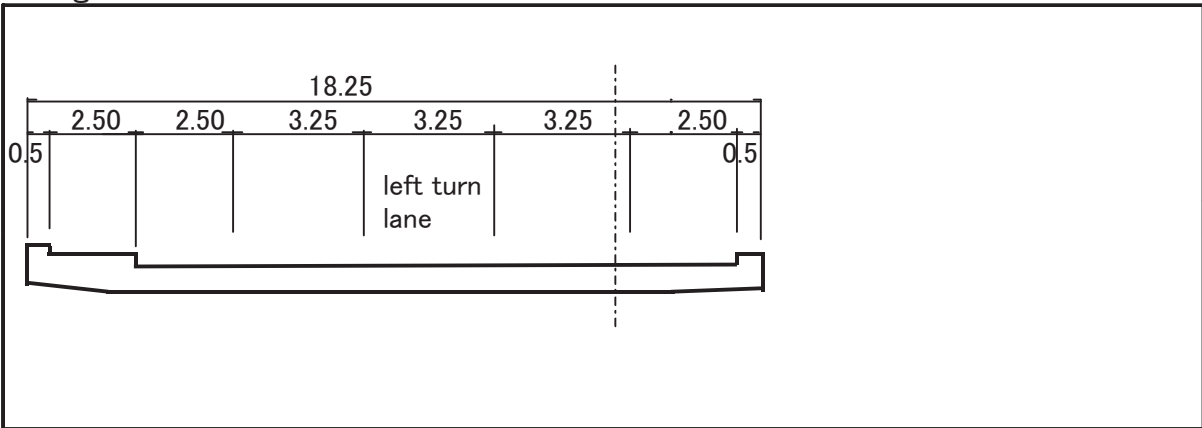
No.	STA	Type	h	Length	Remarks
			(m)	(m)	
1	2+123.00	1.50 x 1.00	0.0	29.90	
2	2+275.00	1.50 x 1.00	0.0	29.90	
3	3+236.00	3.00 x 1.50	0.3	32.10	
4	3+809.00	2.00 x 1.50	0.0	30.90	
5	4+359.00	2- 3.00 x 2.00	0.3	33.10	
		x			
Total		1.50 x 1.00		59.80	
		2.00 x 1.50		30.90	
		3.00 x 1.50		32.10	
		2- 3.00 x 2.00		33.10	



Type / Length	Dimension (m)	Concrete(m ³)	Re-bar(ton)	Excavation(m ³)
1.50 x 1.00 59.80	B = 1.50 H = 1.00 t1 = 0.25 t2 = 0.20	80.73	25% 20.18	102.03
2.00 x 1.50 30.90	B = 2.00 H = 1.50 t1 = 0.25 t2 = 0.20	55.62	25% 13.91	89.61
3.00 x 1.50 32.10	B = 3.00 H = 1.50 t1 = 0.30 t2 = 0.25	91.49	25% 22.87	135.66
2-3.00 x 2.00 33.10	B = 6.25 H = 2.00 t1 = 0.30 t2 = 0.25 t3 = 0.25	183.71	25% 45.93	318.42
Total		411.54	103.64	645.73

Bridge Quantities

4+(2) Lanes



No.	STA	Type	L	W	Area	Remarks	
			(m)	(m)	(m ²)		
1	1+023.00	RC Multi-Beam					
	1+039.00		16.00	18.25	292.00		
Total		RC Multi-Beam			292.00		

Land Acquisition

STA	Distance	ROW Width	Area	residence	agricultural	Remarks
	(m)	(m)	(m ²)	(m ²)	(m ²)	
0+000						
0+170	170	30	5,100	5,100		
0+850	680	30	20,400		20,400	
1+025	175	30	5,250	5,250		
4+700	3,675	30	110,250		110,250	
Total	4,700		141,000	10,350	130,650	

Cost Estimation Sheets

Inner Ring Road : 4 Lanes + 2 Bike Lanes

Summary of Construction Cost 4+(2) Lanes

Item	Unit	Unit Price (USD)	Quantity	Construction Cost (USD)	Remarks
1 Earthwork					
1.1 Clearing & Graving	ha	12,900	14.1	181,890	
1.2 Embankment From Road Excavation	m ³	19.38	804.0	1336.0	
1.3 Embankment From Borrow	m ³	4.21	97,682.0	411,241	
2 Slope Protection					
2.1 Slope Protection on Embankment Slope (Sodding)	m ²	2.44	16,980.0	41,431	
2.2 Masonry Retaining Wall	m ³	103.5	14,539.0	1,504,787	
3 Pavement					
3.1 Subgrade Preparation	m ²	0.35	105,858.4	37,050	
3.2 Granular Sub-base Course (t=20cm)	m ³	5.59	12,084.7	20,422.2	
3.3 Aggregate Base Course (t=15cm)	m ³	5.94	8,501.5	13,349.4	
3.4 Bituminous Concrete Binder Course (t=5cm)	m ²	9.61	54,100.2	519,903	
3.5 Bituminous Concrete Surface Course (t=5cm)	m ²	9.56	53,866.0	514,959	
3.6 Prime Coat	L.	106,795.2	177,280	106,795.2	
3.7 Tack Coat	L.	26,698.8	26,699	26,698.8	
4 Drainage					
4.1 Longitudinal Drainage	m	106	9,400.0	996,400	
4.2 Excavation for RCPC & RCBC	m ³	15.8	383.7	645.7	
4.3 Cross Drainage (RCPC φ0.600)	m	101.67	441.2	753.2	
4.3 Cross Drainage (RCPC φ1.000)	m	213.7	18.1	31.1	
4.4 Concrete for RCPC & RCBC	m ³	235.7	286.2	453.9	
4.5 Re-bar for RCPC & RCBC	ton	1,010.87	105.3	106,445	
5 Bridge					
5.1 RC Multi-Beam	m ²	2,300.00	456.0	1,048,800	
6 Public Utility Relocation/Protection					
6.1 Public Utility Relocation/Protection	L.S.	1	100,000	100,000	
7 Miscellaneous					
7.1 Sidewalk w=2.5m	m	82	4,684.0	768,176	
7.2 Mounted Median Strip w=3.5.5m	m	63		295,092	
7.3 Traffic Sign each100m ×2	No.	129.53	94	12,176	
7.4 Guide Sign 4 Intersection	No.	259.36	13	3,372	
7.5 Pavement Marking	m ²	11.9	5,620.8	66,888	
7.6 Km. Post	No.	5	5	302	
7.7 Guard Rail	m	40.0	40.0	6,000	
7.8 Road Lighting	set	190	190	390,589	per km
A. Sub-total (1 to 7)				8,258,998	1,757,234
8 Engineer's Facility					
8.1 Engineer's Facility (1% of A)	L..S.		^1	82,590	
9 Mobilization/Demobilization					
9.1 Mobilization/Demobilization (0.5% of A)	L..S.		1	41,295	
10 Contingency					
10.1 Contingency (10% of A)	L..S.		1	825,900	
B. Construction Cost Total (A + 8 to 10)				9,208,783	
11 Management Fee					
11.1 Engineering and Construction Management (6% of B)	L..S.		1	552,527	
11.2 Local Administration (4% of B)	L..S.		1	368,351	
C. Construction Cost Total (B + 11)				10,129,661	
12 Land Acquisition and Compensation					
12.1 Land Acquisition residential	m ²	256	4,000	1,536,000	
12.1 Land Acquisition agricultural	m ²	63	90,000	8,505,000	
D. Sub-total (C + 12)				20,170,661	
13 Sales Tax (10% of C)				1,178,402	
E. Project Cost				12,962,420	

Clearing and Grubbing 4+(2) Lanes

STA.	Distance (m)	Cut		Embankment		Remarks
		Area (m ²)	Volume (m ³)	Area (m ²)	Volume (m ³)	
		0+000.00				
0+100.00	100.00		0	30.0	3,000	
0+166.00	66.00		0	30.0	1,980	
0+200.00	34.00		0	30.0	1,020	
0+240.00	40.00		0	30.0	1,200	
0+300.00	60.00		0	30.0	1,800	
0+327.00	27.00		0	30.0	810	
0+400.00	73.00		0	30.0	2,190	
0+473.50	73.50		0	30.0	2,205	
0+500.00	26.50		0	30.0	795	
0+600.00	100.00		0	30.0	3,000	
0+640.00	40.00		0	30.0	1,200	
0+700.00	60.00		0	30.0	1,800	
0+800.00	100.00		0	30.0	3,000	
0+840.00	40.00		0	30.0	1,200	
0+900.00	60.00		0	30.0	1,800	
0+969.30	69.30		0	30.0	2,079	
0+987.30	18.00		0	30.0	540	
1+000.00	12.70		0	30.0	381	
1+023.00	23.00		0	30.0	690	
Bridge	16.00					
1+039.00				30.0		
1+100.00	61.00		0	30.0	1,830	
1+200.00	100.00		0	30.0	3,000	
1+300.00	100.00		0	30.0	3,000	
1+400.00	100.00		0	30.0	3,000	
1+500.00	100.00		0	30.0	3,000	
1+600.00	100.00		0	30.0	3,000	
1+700.00	100.00		0	30.0	3,000	
1+800.00	100.00		0	30.0	3,000	
1+900.00	100.00		0	30.0	3,000	
2+000.00	100.00		0	30.0	3,000	
2+100.00	100.00		0	30.0	3,000	
2+200.00	100.00		0	30.0	3,000	
2+300.00	100.00		0	30.0	3,000	
2+400.00	100.00		0	30.0	3,000	
2+500.00	100.00		0	30.0	3,000	
2+600.00	100.00		0	30.0	3,000	
2+700.00	100.00		0	30.0	3,000	
2+800.00	100.00		0	30.0	3,000	
2+900.00	100.00		0	30.0	3,000	
3+000.00	100.00		0	30.0	3,000	
3+100.00	100.00		0	30.0	3,000	
3+200.00	100.00		0	30.0	3,000	
3+300.00	100.00		0	30.0	3,000	
3+400.00	100.00		0	30.0	3,000	
3+500.00	100.00		0	30.0	3,000	
3+600.00	100.00		0	30.0	3,000	
3+700.00	100.00		0	30.0	3,000	
3+800.00	100.00		0	30.0	3,000	
3+900.00	100.00		0	30.0	3,000	
4+000.00	100.00		0	30.0	3,000	
4+100.00	100.00		0	30.0	3,000	
4+200.00	100.00		0	30.0	3,000	
4+300.00	100.00		0	30.0	3,000	
4+400.00	100.00		0	30.0	3,000	
4+500.00	100.00		0	30.0	3,000	
4+600.00	100.00		0	30.0	3,000	
4+700.00	100.00		0	30.0	3,000	
Total	4700.00		0		140,520	

Cut & Embankment

4+(2) Lanes

STA.	Distance (m)	Cut		Embankment		Remarks
		Area (m ²)	Volume (m ³)	Area (m ²)	Volume (m ³)	
		0+000.00				
0+100.00	100.00	1.0	50	1.9	95	
0+166.00	66.00		33	10.9	422	
0+200.00	34.00	0.9	15	7.1	306	
0+240.00	40.00		18	30.4	750	
0+300.00	60.00		0	25.2	1,668	
0+327.00	27.00		0	29.5	738	
0+400.00	73.00		0	42.3	2,621	
0+473.50	73.50		0	16.7	2,168	
0+500.00	26.50		0	30.0	619	
0+600.00	100.00		0	36.6	3,330	
0+640.00	40.00		0	36.6	1,464	
0+700.00	60.00		0	21.6	1,746	
0+800.00	100.00		0	30.6	2,610	
0+840.00	40.00		0	30.9	1,230	
0+900.00	60.00	5.6	168	1.2	963	
0+969.30	69.30		194	7.1	288	
0+987.30	18.00		0	27.9	315	
1+000.00	12.70	7.7	49		177	
1+023.00	23.00		89	15.9	183	
Bridge						
1+039.00				15.9		
1+100.00	61.00		0	15.9	970	
1+200.00	100.00		0	21.9	1,890	
1+300.00	100.00		0	29.0	2,545	
1+400.00	100.00		0	10.8	1,990	
1+500.00	100.00		0	20.6	1,570	
1+600.00	100.00		0	14.0	1,730	
1+700.00	100.00		0	13.4	1,370	
1+800.00	100.00		0	18.4	1,590	
1+900.00	100.00		0	20.8	1,960	
2+000.00	100.00		0	13.1	1,695	
2+100.00	100.00	0.1	5	13.3	1,320	
2+200.00	100.00		5	14.9	1,410	
2+300.00	100.00		0	26.7	2,080	
2+400.00	100.00		0	27.0	2,685	
2+500.00	100.00		0	17.9	2,245	
2+600.00	100.00		0	16.3	1,710	
2+700.00	100.00		0	24.6	2,045	
2+800.00	100.00		0	31.9	2,825	
2+900.00	100.00		0	37.6	3,475	
3+000.00	100.00		0	28.6	3,310	
3+100.00	100.00		0	16.1	2,235	
3+200.00	100.00	1.0	50	9.1	1,260	
3+300.00	100.00		50	18.6	1,385	
3+400.00	100.00		0	10.3	1,445	
3+500.00	100.00		0	34.1	2,220	
3+600.00	100.00		0	36.4	3,525	
3+700.00	100.00		0	28.6	3,250	
3+800.00	100.00	0.2	10	12.4	2,050	
3+900.00	100.00		10	14.3	1,335	
4+000.00	100.00		0	10.9	1,260	
4+100.00	100.00		0	21.4	1,615	
4+200.00	100.00		0	29.3	2,535	
4+300.00	100.00		0	35.8	3,255	
4+400.00	100.00		0	28.8	3,230	
4+500.00	100.00		0	42.4	3,560	
4+600.00	100.00	5.9	295	6.3	2,435	
4+700.00	100.00		295	0.0	315	
Total			1,336		99,018	
Surplus Excavation					0	
Road Excavation					1,336	
Embankment From Borrow					97,682	

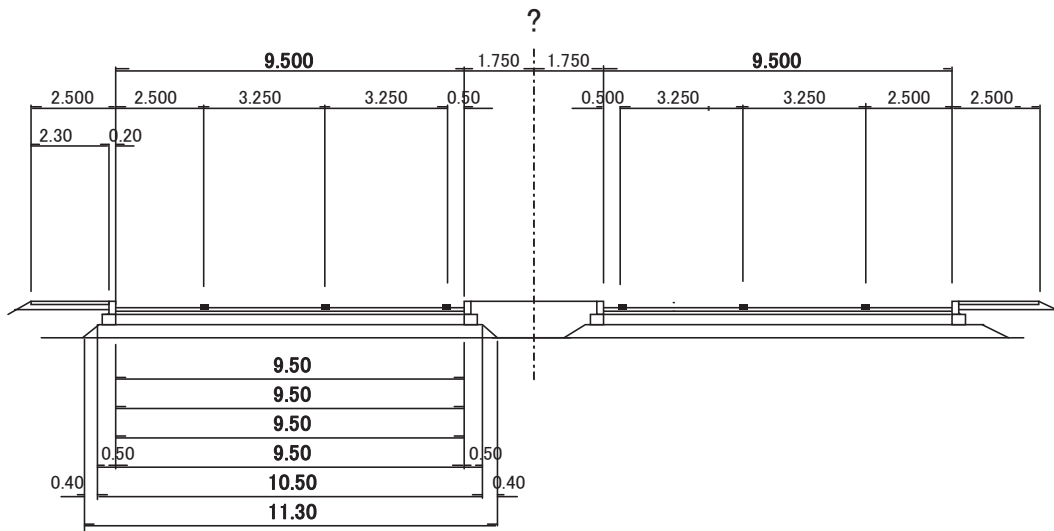
Masonry Retaining Wall 4+(2) Lanes

STA.	Distance (m)	Left Side			Right Side			Remarks
		Height (m)	Area (m ²)	Volume (m ³)	Height (m)	Area (m ²)	Volume (m ³)	
		0+000.00		0			0	
0+100.00	100.00	1.2	0.330	17	1.2	0.330	17	
0+166.00	66.00	1.6	1.050	46	1.6	1.050	46	
0+200.00	34.00	1.6	1.280	40	1	0.943	34	
0+240.00	40.00	2.1	1.596	58	2.1	1.221	43	
0+300.00	60.00	2.1	1.943	106	2	1.871	93	
0+327.00	27.00	2.1	1.943	52	2.1	1.871	51	
0+400.00	73.00	2.8	2.481	161	1.8	1.731	131	
0+473.50	73.50	1.7	2.166	171	1.7	1.466	117	
0+500.00	26.50	2.5	1.943	54	1.4	1.221	36	
0+600.00	100.00	2.5	2.563	225	1.3	0.996	111	
0+640.00	40.00	2.6	2.646	104	1.7	1.163	43	
0+700.00	60.00	2.8	2.903	166	2	1.596	83	
0+800.00	100.00	2.4	2.730	282	1.7	1.596	160	
0+840.00	40.00	2.1	2.166	98	2.5	1.943	71	
0+900.00	60.00	1.5	1.530	111	0.6	1.221	95	
0+969.30	69.30	1	0.891	84	2.5	1.221	85	
0+987.30	18.00	1.9	1.106	18	2.2	2.321	32	
1+000.00	12.70	0	0.606	11	0.8	1.163	22	
1+023.00	23.00	1.7	0.521	13	1.7	0.891	24	
Bridge								
1+039.00		1.7			1.7			
1+100.00	61.00	1.7	1.403	43	1.7	1.403	43	
1+200.00	100.00	1.9	1.530	147	1.8	1.466	143	
1+300.00	100.00	2.1	1.800	167	2.1	1.731	160	
1+400.00	100.00	1.5	1.530	167	1.7	1.663	170	
1+500.00	100.00	1.7	1.280	141	1.8	1.466	156	
1+600.00	100.00	1.5	1.280	128	1.5	1.341	140	
1+700.00	100.00	1.5	1.163	122	1.5	1.163	125	
1+800.00	100.00	1	0.891	103	1.8	1.341	125	
1+900.00	100.00	1.9	1.106	100	1.9	1.596	147	
2+000.00	100.00	1.5	1.403	125	1.4	1.341	147	
2+100.00	100.00	1.3	1.050	123	1.3	0.996	117	
2+200.00	100.00	1.7	1.163	111	1.6	1.106	105	
2+300.00	100.00	1.9	1.530	135	2.1	1.596	135	
2+400.00	100.00	2	1.731	163	2.1	1.943	177	
2+500.00	100.00	1.7	1.596	166	1.7	1.663	180	
2+600.00	100.00	1.7	1.403	150	1.6	1.341	150	
2+700.00	100.00	1.9	1.530	147	1.9	1.466	140	
2+800.00	100.00	2.3	1.943	174	2.3	1.943	170	
2+900.00	100.00	3	2.816	238	1.8	1.871	191	
3+000.00	100.00	2.1	2.646	273	2.2	1.800	184	
3+100.00	100.00	1.6	1.596	212	1.7	1.731	177	
3+200.00	100.00	0	0.480	104	1.5	1.280	151	
3+300.00	100.00	1.8	0.563	52	1.7	1.280	128	
3+400.00	100.00	1.3	1.221	89	1.8	1.466	137	
3+500.00	100.00	2.2	1.466	134	2.4	1.943	170	
3+600.00	100.00	2.4	2.243	185	2.4	2.400	217	
3+700.00	100.00	2.1	2.166	220	2.1	2.166	228	
3+800.00	100.00	1.7	1.663	191	1.3	1.403	178	
3+900.00	100.00	1.5	1.280	147	1.9	1.280	134	
4+000.00	100.00	1.5	1.163	122	1.5	1.403	134	
4+100.00	100.00	1.8	1.341	125	1.9	1.403	140	
4+200.00	100.00	2.1	1.731	154	2.2	1.871	164	
4+300.00	100.00	2.2	2.016	187	2.4	2.243	206	
4+400.00	100.00	2.2	2.090	205	2.2	2.243	224	
4+500.00	100.00	1.7	1.731	191	2.8	2.563	240	
4+600.00	100.00	1.7	1.403	157	2	2.400	248	
4+700.00	100.00	0	0.521	96	0	0.650	153	
Total	4684.00			7,311			7,228	

Masonry Retaining Wall	Concrete	14,539 m ³
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Unit Quantities of Pavement

4+(2) Lanes



per 1.00m

Item	Unit	Quantities
Granular Subbase Course t=200mm	m ³	$1/2 \times (10.50 + 11.30) \times 0.20 \times 1.00 \times 2$ 4.360
Aggregate Base Course t=150mm	m ³	$9.50 \times 0.15 \times 1.00 \times 2$ 2.850
Asphalt Concrete Binder Course t=50 mm	m ²	$9.50 \times 1.00 \times 2$ 19.000
Asphalt Concrete Wearing Course t=50 mm	m ²	$9.50 \times 1.00 \times 2$ 19.000
Prime Coat (1.2L/m ²)	L.	$9.50 \times 1.00 \times 1.20 \times 2$ 22.8
Tack Coat (0.3L/m ²)	L.	$9.50 \times 1.00 \times 0.30 \times 2$ 5.7
Traffic Paint	m ²	$0.200 \times 3 \times 1.00 \times 2$ 1.20
Subgrade Preparation	m ²	$11.300 \times 1.00 \times 2$ 22.60
Mounted median strip w=3.5m	m	1.00 1.00
Sidewalk w=2.5m	m	1.00×2 2.00

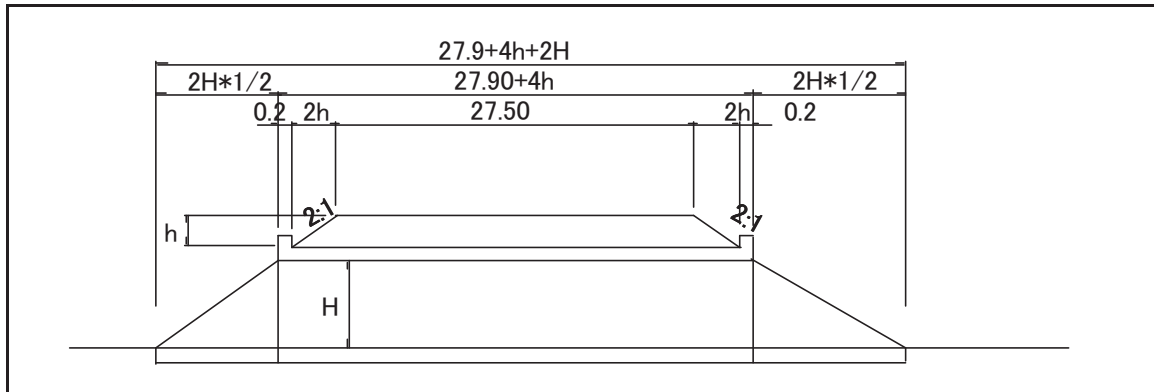
Pavement Quantities

4+(2) Lanes

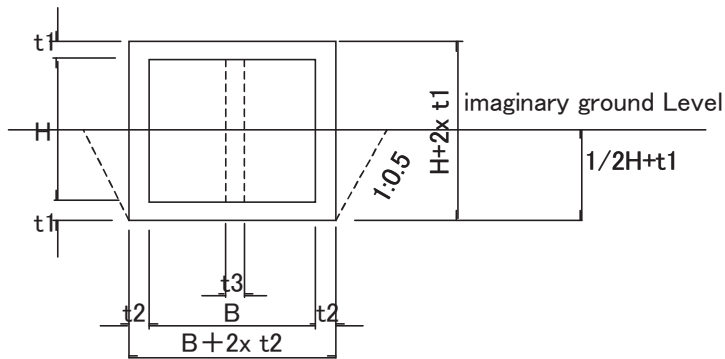
Description	Unit	Unit Quantity (per m)	Total Length (m)	Bridge Length (m)	Pavement Length (m)	Quantities	Remarks
Subgrade Preparation	sq.m	22.60	4,700.00	16.00	4,684.00	105,858.40	
Granular Subbase Course t=200mm	cu.m	4.36				20,422.24	
Aggregate Base Course t=150mm	cu.m	2.85				13,349.40	
Asphalt Concrete Binder Course t=50 mm	sq.m	19.00				88,996.00	
Asphalt Concrete Wearing Course t=50 mm	sq.m	19.00				88,996.00	
Prime Coat	L.	22.80				106,795.20	
Tack Coat	L.	5.70				26,698.80	
Traffic Paint	sq.m	1.20				5,620.80	
Mounted Median Strip w=3.5m	m	1.00				4,684.00	
Sidewalk w=2.5m	m	2.00				9,368.00	

Type of Road Structure	Section	Distance (m)	Earthwork (m)	Bridge (m)	Total (m)	Remarks
	0+000					
	1+023	1,023	1,023			
	1+039	16		16		
	4+700	3,661	3,661			
	Total	4,700	4,684	16	4,700	

RCBC Quantities 4+(2) Lanes



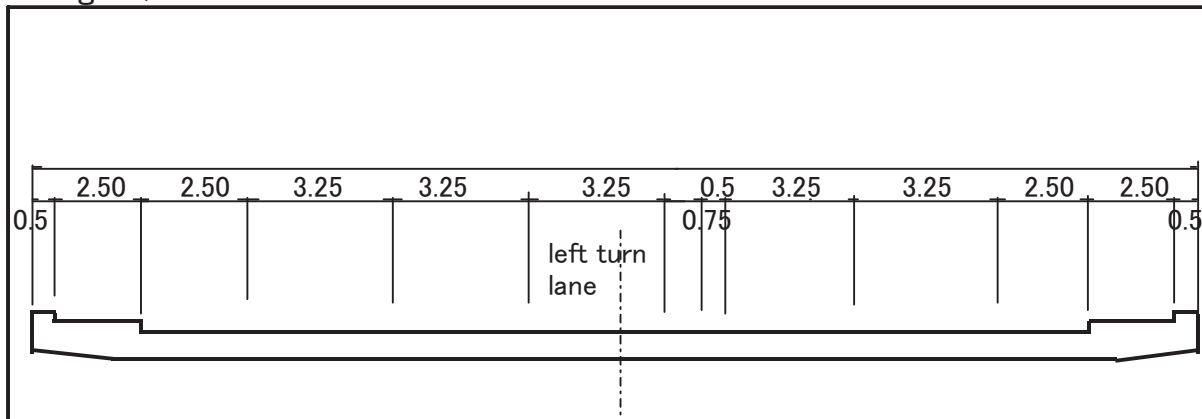
No.	STA	Type	h	Length	Remarks
			(m)	(m)	
1	2+123.00	1.50 x 1.00	0.0	29.90	
2	2+275.00	1.50 x 1.00	0.0	29.90	
3	3+236.00	3.00 x 1.50	0.3	32.10	
4	3+809.00	2.00 x 1.50	0.0	30.90	
5	4+359.00	2- 3.00 x 2.00	0.3	33.10	
Total		1.50 x 1.00		59.80	
		2.00 x 1.50		30.90	
		3.00 x 1.50		32.10	
		2- 3.00 x 2.00		33.10	



Type / Length	Dimension (m)	Concrete(m ³)	Re-bar(ton)	Excavation(m ³)
1.50 x 1.00 59.80	B = 1.50 H = 1.00 t1 = 0.25 t2 = 0.20	80.73	25% 20.18	102.03
2.00 x 1.50 30.90	B = 2.00 H = 1.50 t1 = 0.25 t2 = 0.20	55.62	25% 13.91	89.61
3.00 x 1.50 32.10	B = 3.00 H = 1.50 t1 = 0.30 t2 = 0.25	91.49	25% 22.87	135.66
2-3.00 x 2.00 33.10	B = 6.25 H = 2.00 t1 = 0.30 t2 = 0.25 t3 = 0.25	183.71	25% 45.93	318.42
Total		411.54	103.64	645.73

Bridge Quantities

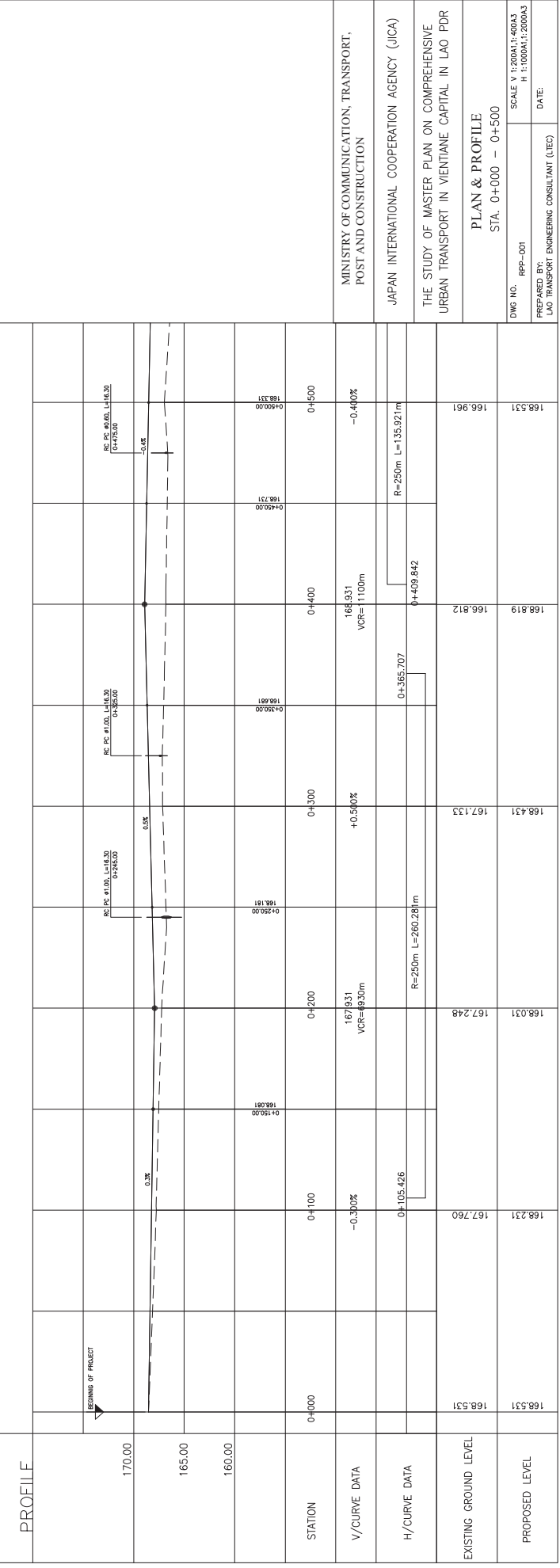
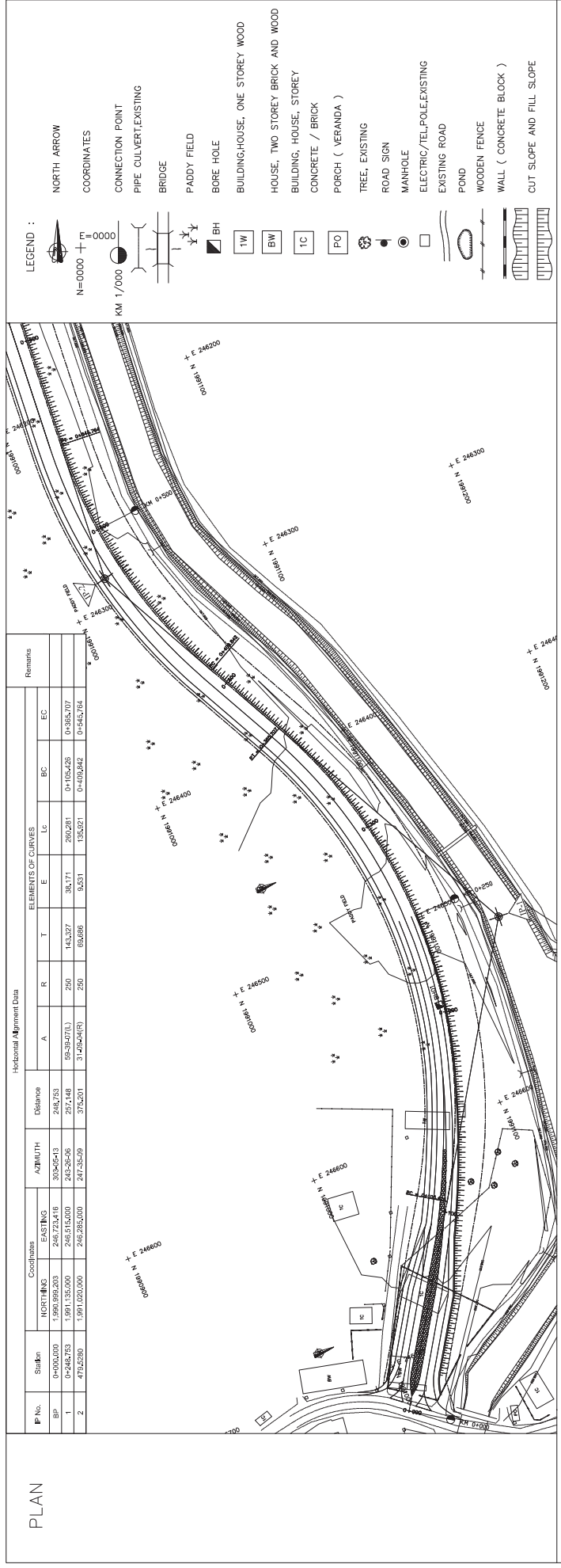
4+(2) Lanes



No.	STA	Type	L	W	Area	Remarks	
			(m)	(m)	(m ²)		
1	1+023.00	RC Multi-Beam					
	1+039.00		16.00	28.5	456.00		
Total		RC Multi-Beam			456.00		

Land Acquisition

STA	Distance	ROW Width	Area	residence	agricultural	Remarks
	(m)	(m)	(m ²)	(m ²)	(m ²)	
0+000						
0+170	170	30	5,100	5,100		
0+850	680	30	20,400		20,400	
1+025	175	30	5,250	5,250		
4+700	3,675	30	110,250		110,250	
Total	4,700		141,000	10,350	130,650	



MINISTRY OF COMMUNICATION, TRANSPORT,
POST AND CONSTRUCTION

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

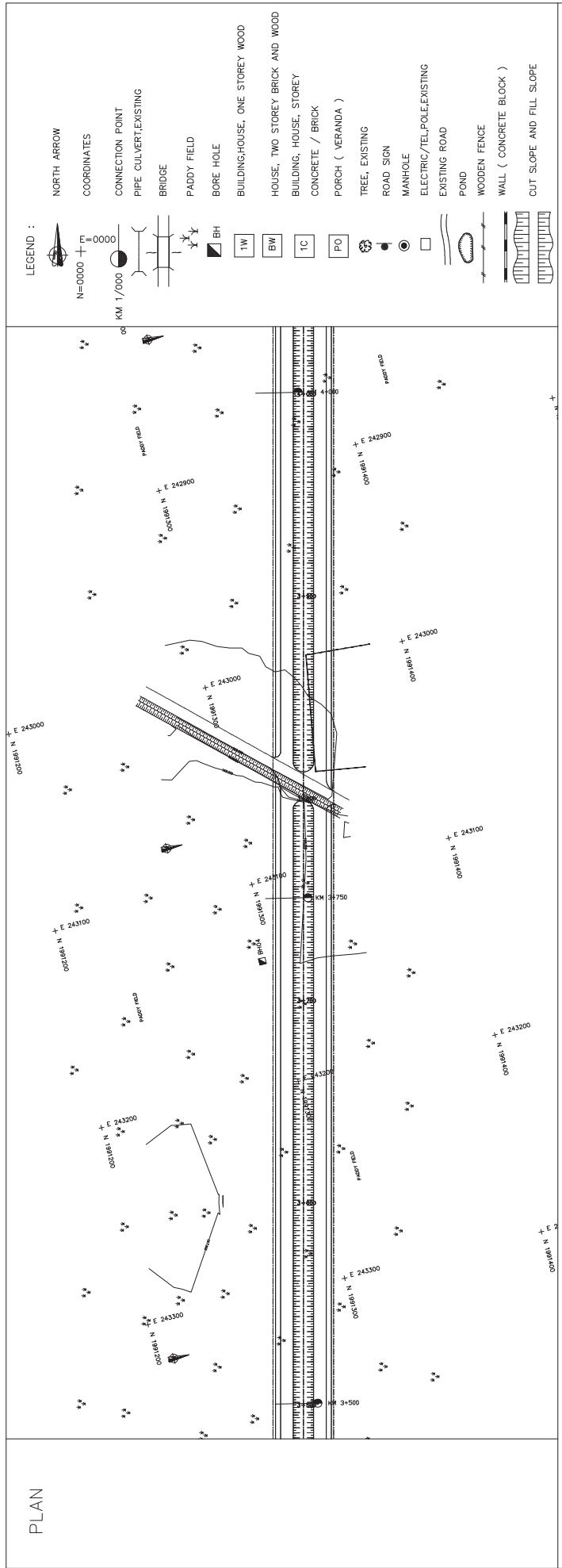
THE STUDY OF MASTER PLAN ON COMPREHENSIVE
URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR

PLAN & PROFILE
STA. 0+000 - 0+500

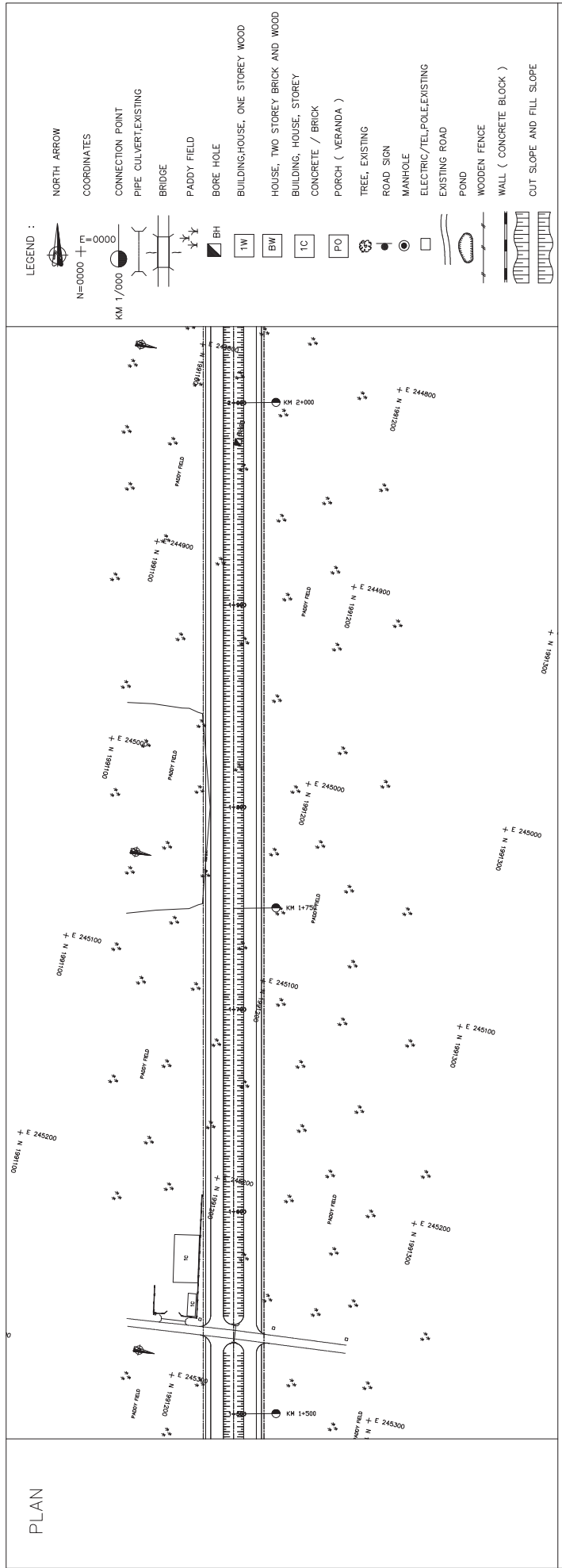
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H 1:1000A1:1:200A3

DATE: _____

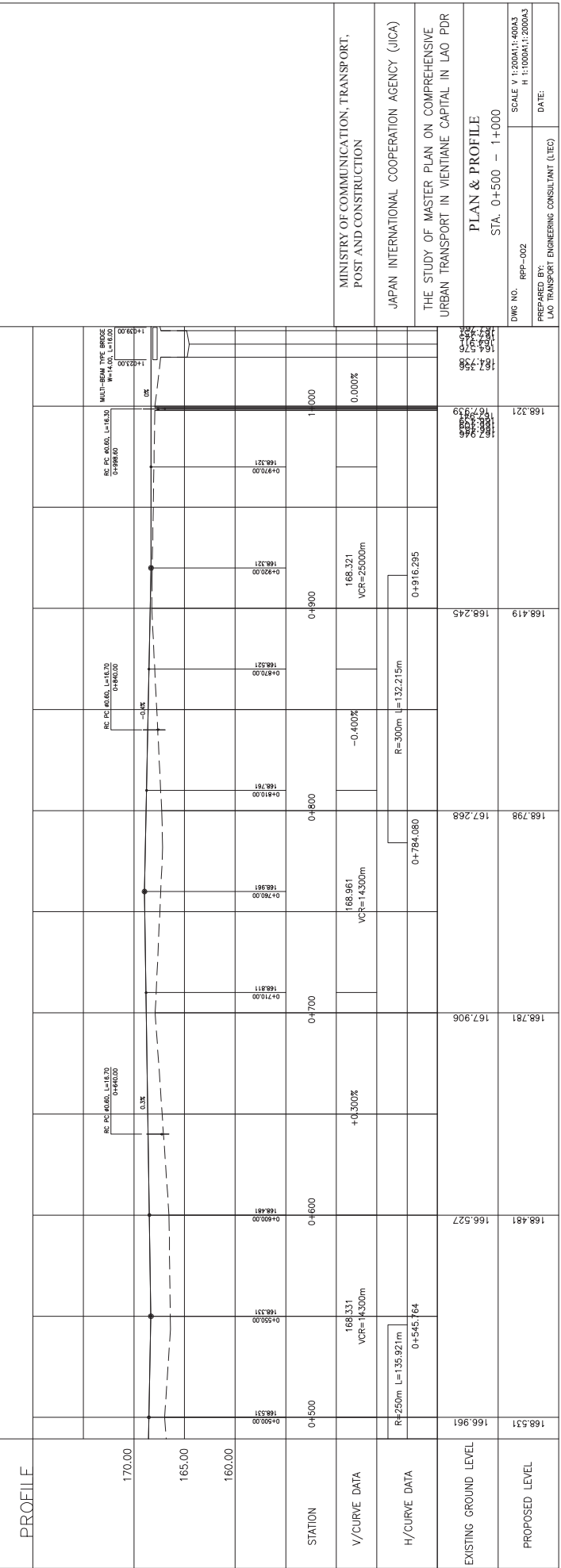
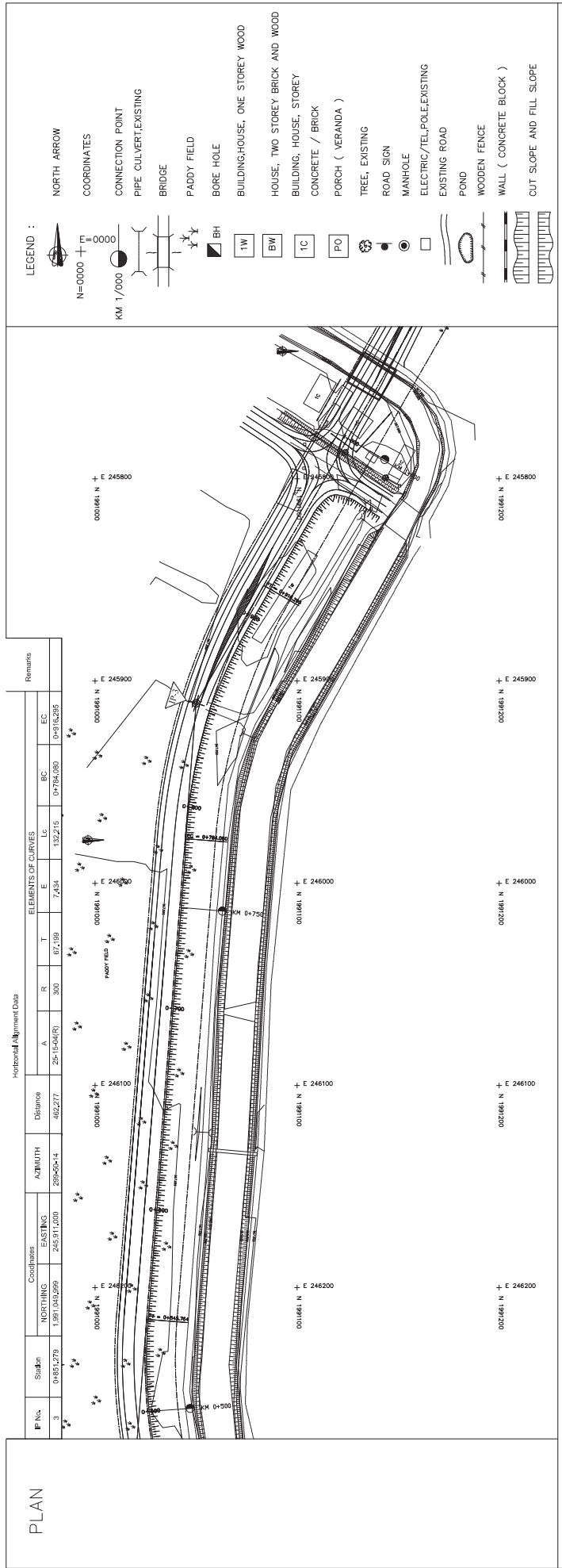
PREPARED BY:
LAO TRANSPORT ENGINEERING CONSULTANT (LTC)



PLAN & PROFILE		MINISTRY OF COMMUNICATION, TRANSPORT, POST AND CONSTRUCTION		JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)		THE STUDY OF MASTER PLAN ON COMPREHENSIVE URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR	
PLAN & PROFILE		STA. 3+500 - 4+000		DWG NO. RPP-008		SCALE V 1:200A1:1:400A3 H 1:1000A1:1:200A3	
PLAN & PROFILE		DATE:		PREPARED BY: LAO TRANSPORT ENGINEERING CONSULTANT (LTC)			
170.00	169.37	167.537	167.706	168.337	168.537	167.698	168.537
165.00	169.37	167.705	167.729	168.337	168.537	167.729	168.537
160.00	169.37	167.705	167.729	168.337	168.537	167.729	168.537
STATION	3+500	3+600	3+700	3+800	3+900	4+000	4+000
V/CURVE DATA	+0.300%	169.437 VCR=16700m	-0.300%	168.337 VCR=16700m	+0.300%		
H/CURVE DATA							
EXISTING GROUND LEVEL	167.533	167.621	167.705	167.729	167.706	167.698	168.537
PROPOSED LEVEL	169.137	169.362	169.137	169.337	169.137	169.337	169.337



MINISTRY OF COMMUNICATION, TRANSPORT, POST AND CONSTRUCTION		JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)		THE STUDY OF MASTER PLAN ON COMPREHENSIVE URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR		PLAN & PROFILE		STA. 1+500 - 2+000	
DWG NO. RPP-004		SCALE V 1:200A1:400A3		H 1:1000A1:1:200A3		DATE:			
PREPARED BY: LAO TRANSPORT ENGINEERING CONSULTANT (LTC)									
170.00	165.00	160.00	14500	14600	14700	14800	14900	14900	24000
V/CURVE DATA		+0.300%		168171 VCR=16700m		+0.300%		168171 VCR=16700m	
H/CURVE DATA									
EXISTING GROUND LEVEL	167.455	167.409	167.424	167.419	167.462	168.621	167.447	168.321	167.447
PROPOSED LEVEL	167.455	167.409	167.424	167.419	167.462	168.621	167.447	168.321	167.447



MINISTRY OF COMMUNICATION, TRANSPORT,
POST AND CONSTRUCTION

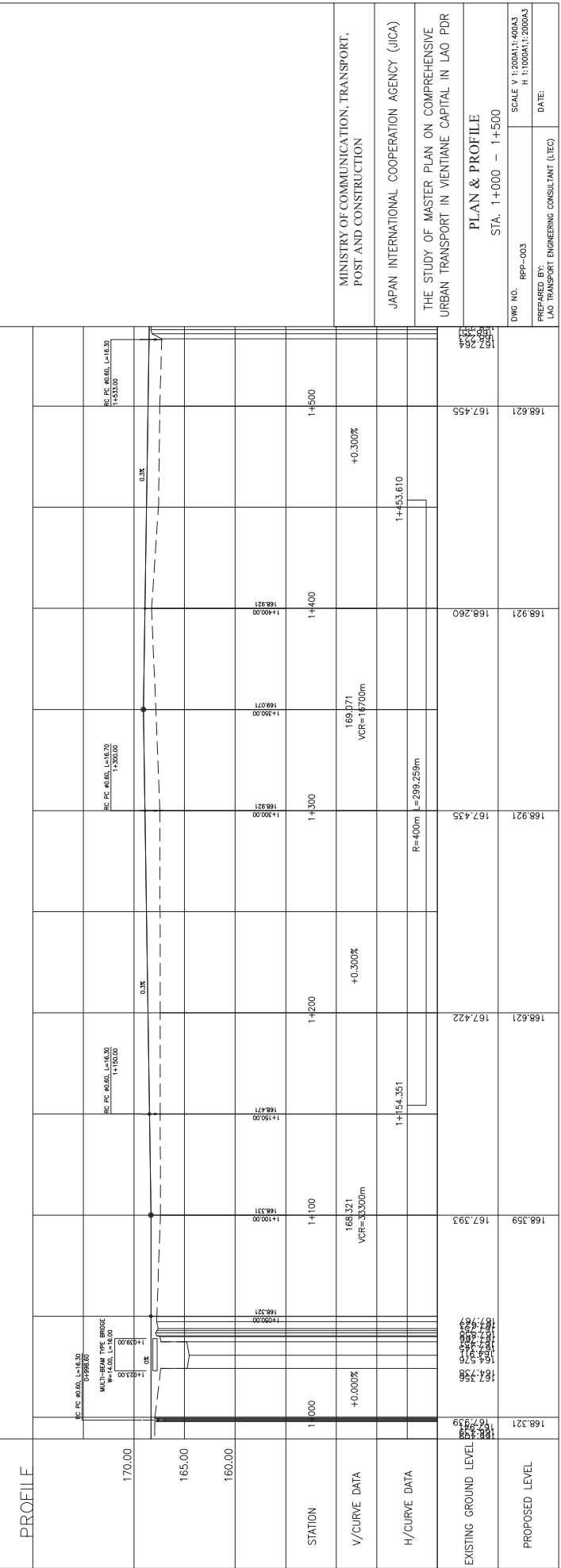
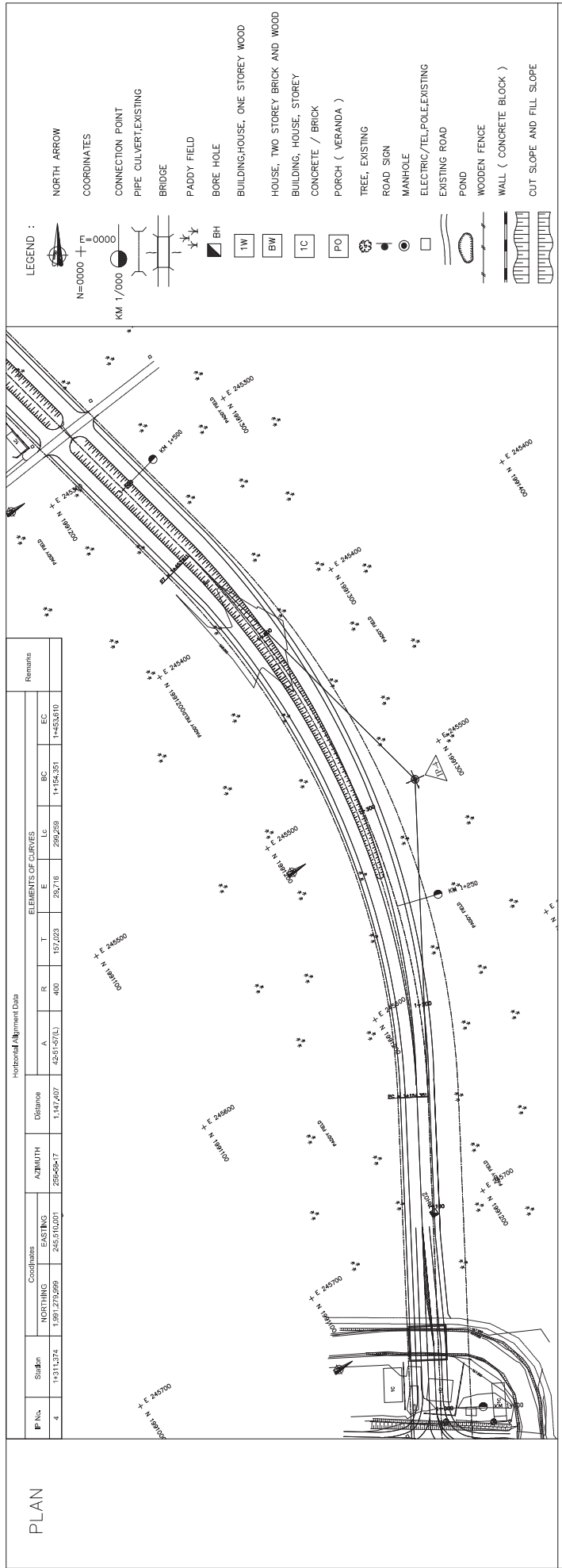
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY OF MASTER PLAN ON COMPREHENSIVE
URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR

PLAN & PROFILE
STA. 0+500 - 1+000

DWG NO. RPP-002
SCALE V 1:200A1:1:400A3
H 1:1000A1:1:200A3
DATE: _____

PREPARED BY:
LAO TRANSPORT ENGINEERING CONSULTANT (LTC)



MINISTRY OF COMMUNICATION, TRANSPORT,
POST AND CONSTRUCTION

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

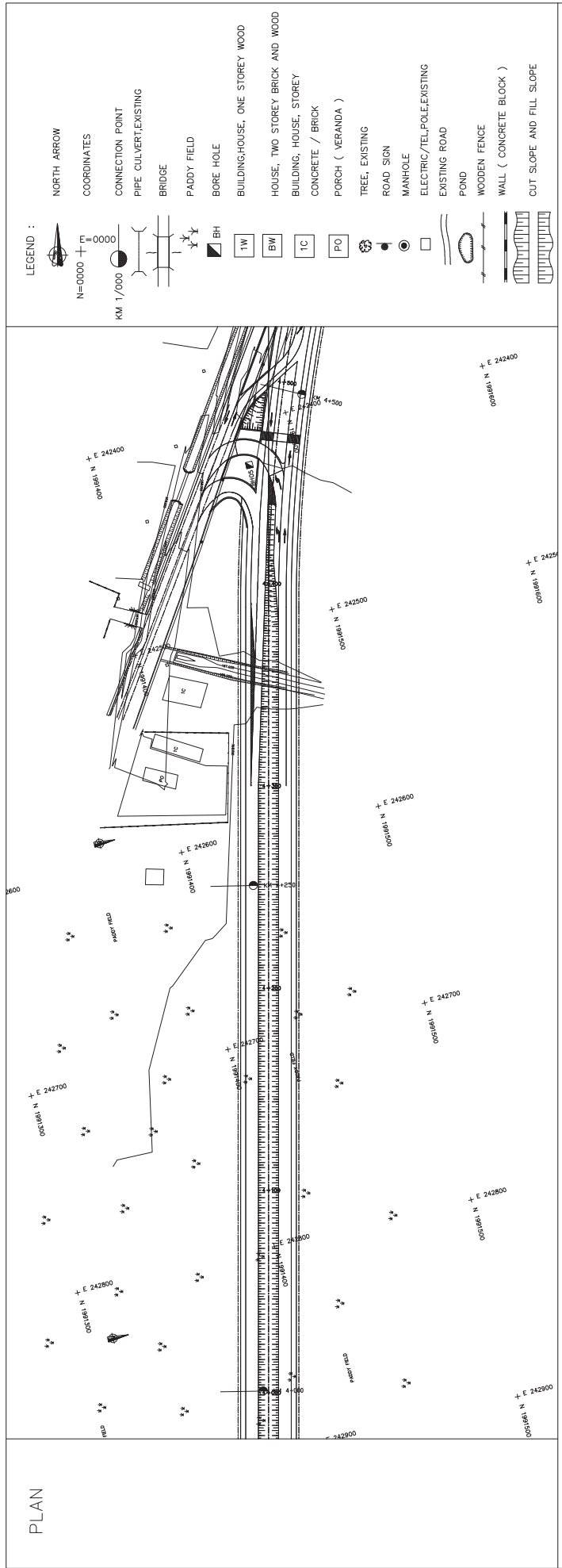
THE STUDY OF MASTER PLAN ON COMPREHENSIVE
URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR

PLAN & PROFILE
STA. 1+000 - 1+500

DWG NO. RPP-003
SCALE V 1:200A1:400A3
H 1:1000A1:200A3

PREPARED BY:
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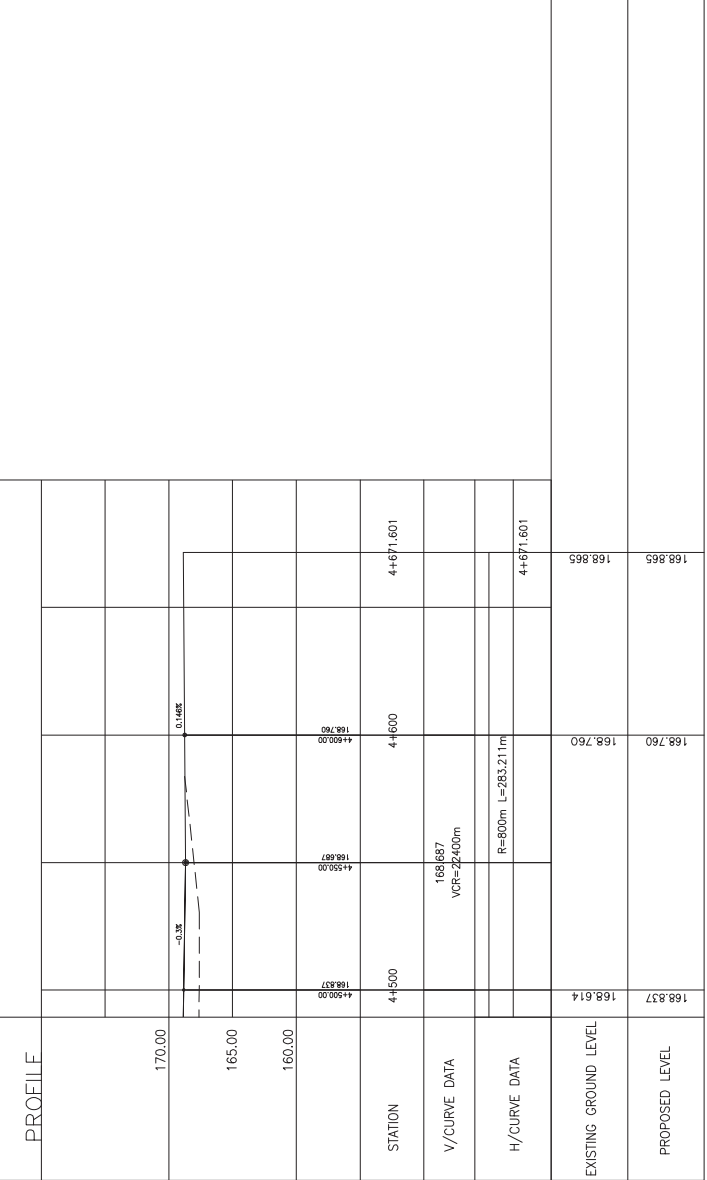
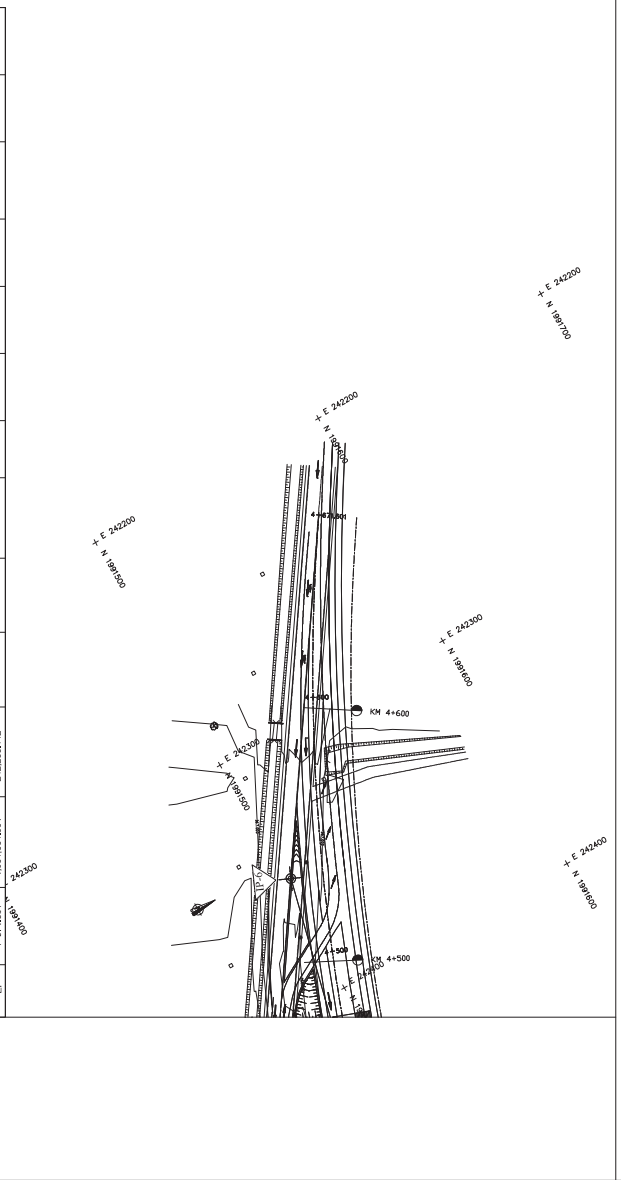
DATE:



PLAN

PROFIE	170.00	165.00	160.00	STATION	V/CURVE DATA	H/CURVE DATA	EXISTING GROUND LEVEL	PROPOSED LEVEL
				4+000	+0.300%		167.698	168.537
				4+100	+0.300%		167.741	168.837
				4+200			167.712	169.137
				4+300			168.903	169.362
				4+400			168.710	169.137
				4+500			168.614	169.837
				4+600				
				4+700				
				4+800				
				4+900				
				4+1000				
				4+1100				
				4+1200				
				4+1300				
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				14+800				
				14+900				
				15+000				
				15+100				
				15+200				

PLAN		Horizontal Alignment Data				ELEMENTS OF CURVES				Remarks	
P No.	Stake	Coordinates	Distance	A	R	T	E	Lc	BC	EC	
B	4+531.483 4+671.601	NORTHING 1,981,602.658 1,981,581.664	EASTING 242,352.293 242,233.142	300x350	20+720(R)	800	143,103	12,888	283,211	4+588,930	4+671,601



LEGEND :

- NORTH ARROW
- COORDINATES
- CONNECTION POINT
- PIPE CULVERT, EXISTING
- BRIDGE
- PADDY FIELD
- BORE HOLE
- BUILDING; HOUSE, ONE STOREY WOOD
- HOUSE, TWO STOREY BRICK AND WOOD
- BUILDING, HOUSE, STOREY CONCRETE / BRICK
- PORCH (VERANDA)
- TREE, EXISTING
- ROAD SIGN
- MANHOLE
- ELECTRIC/TEL-POLE, EXISTING
- EXISTING ROAD
- POND
- WOODEN FENCE
- WALL (CONCRETE BLOCK)
- CUT SLOPE AND FILL SLOPE

MINISTRY OF COMMUNICATION, TRANSPORT, POST AND CONSTRUCTION

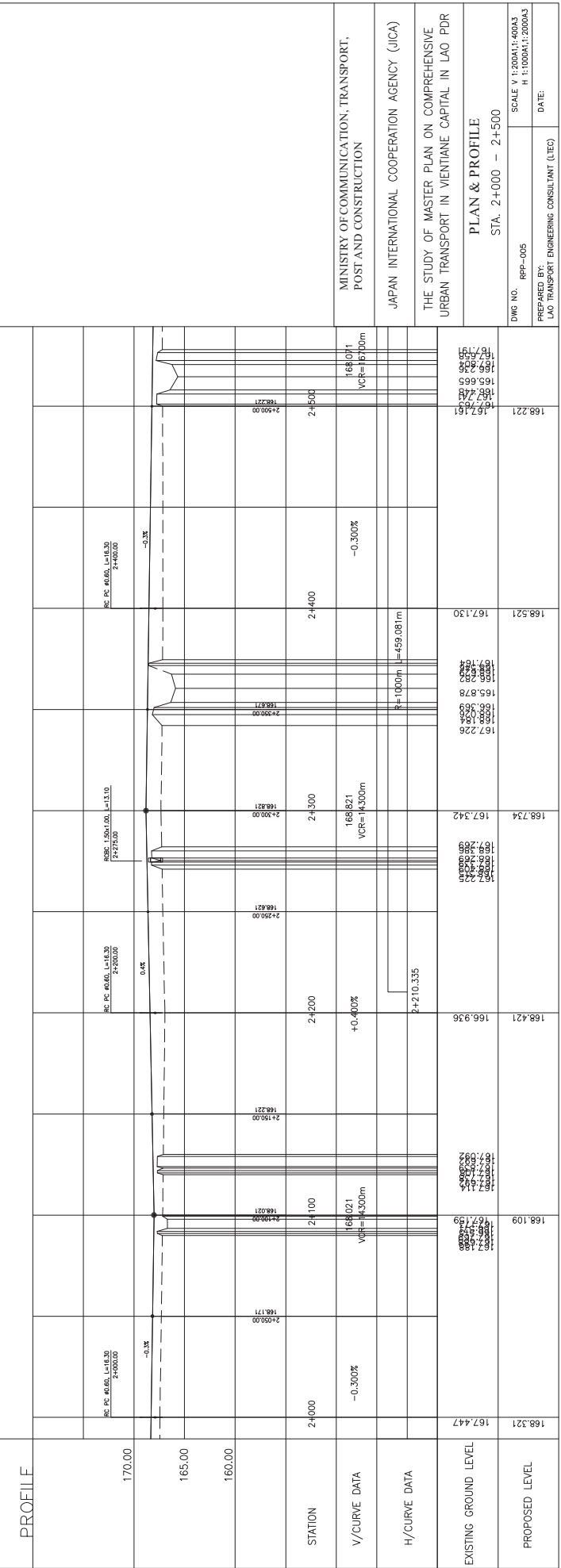
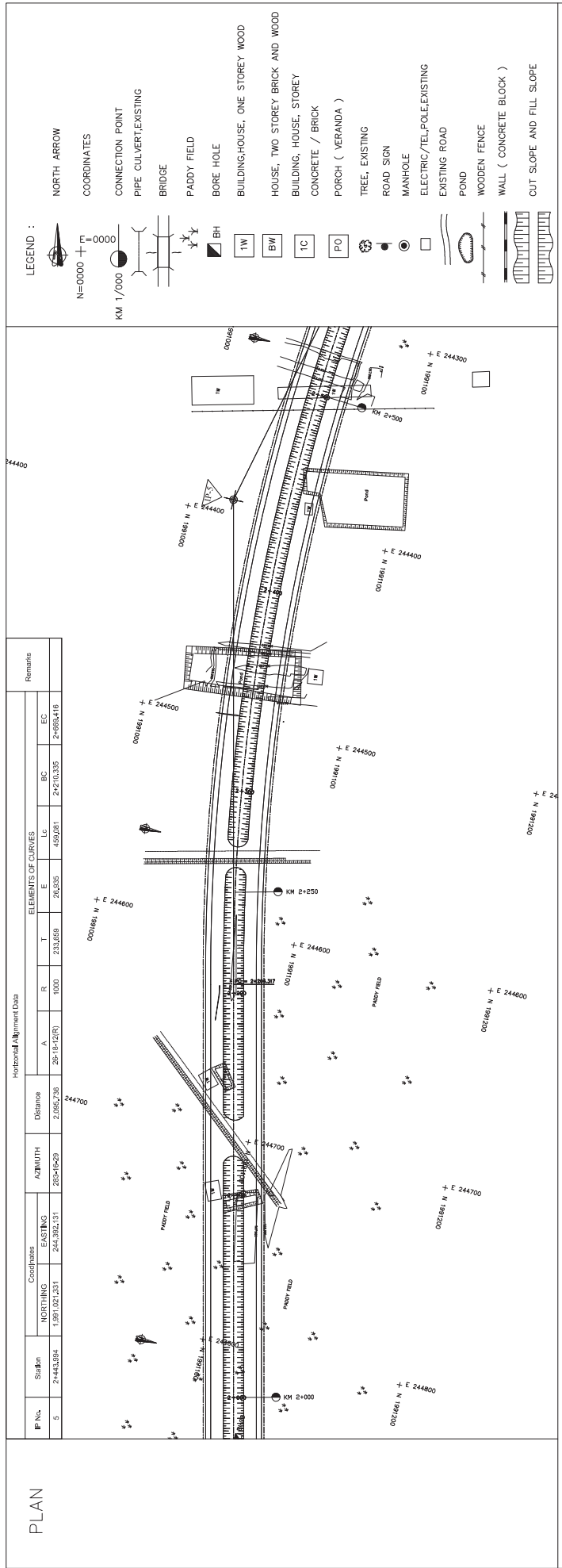
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THE STUDY OF MASTER PLAN ON COMPREHENSIVE URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR

PLAN & PROFILE

STA. 4+500 - 4+671.601

DWG NO. RPP-010 SCALE V 1:200A1:400A3
PREPARED BY: LAO TRANSPORT ENGINEERING CONSULTANT (LTC) H 1:1000A1:1:200A3
DATE:



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THE STUDY OF MASTER PLAN ON COMPREHENSIVE
URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR

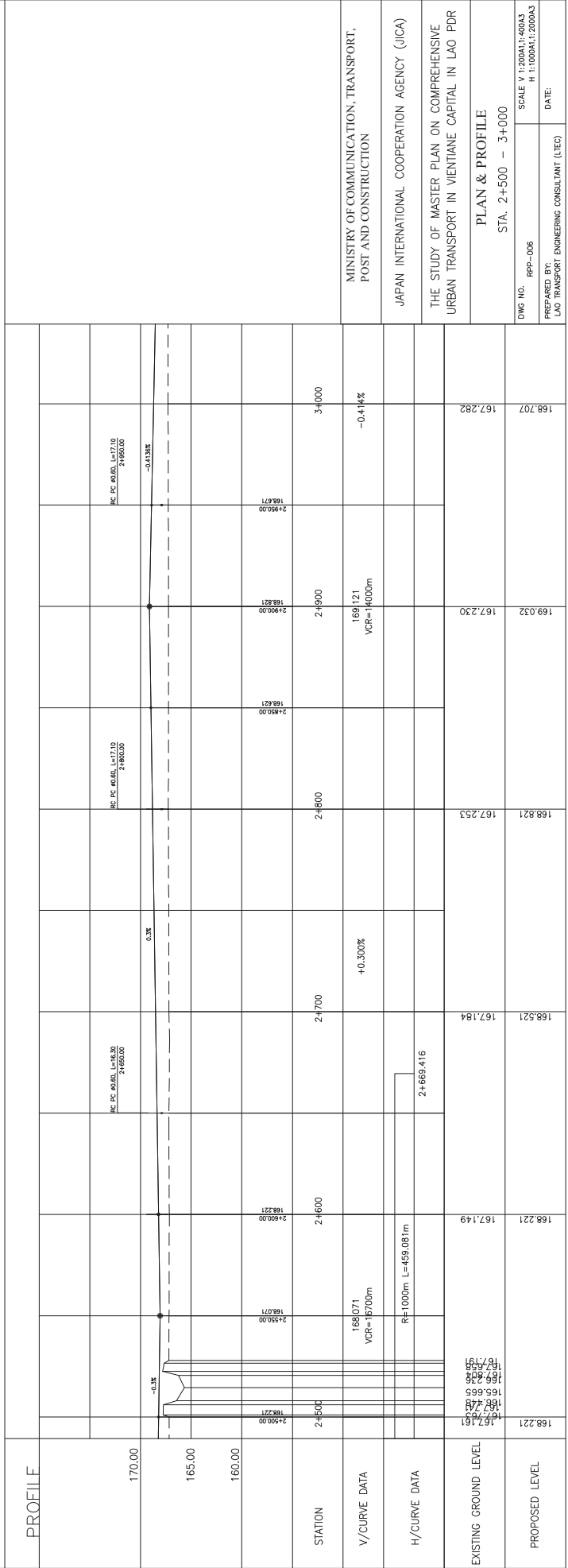
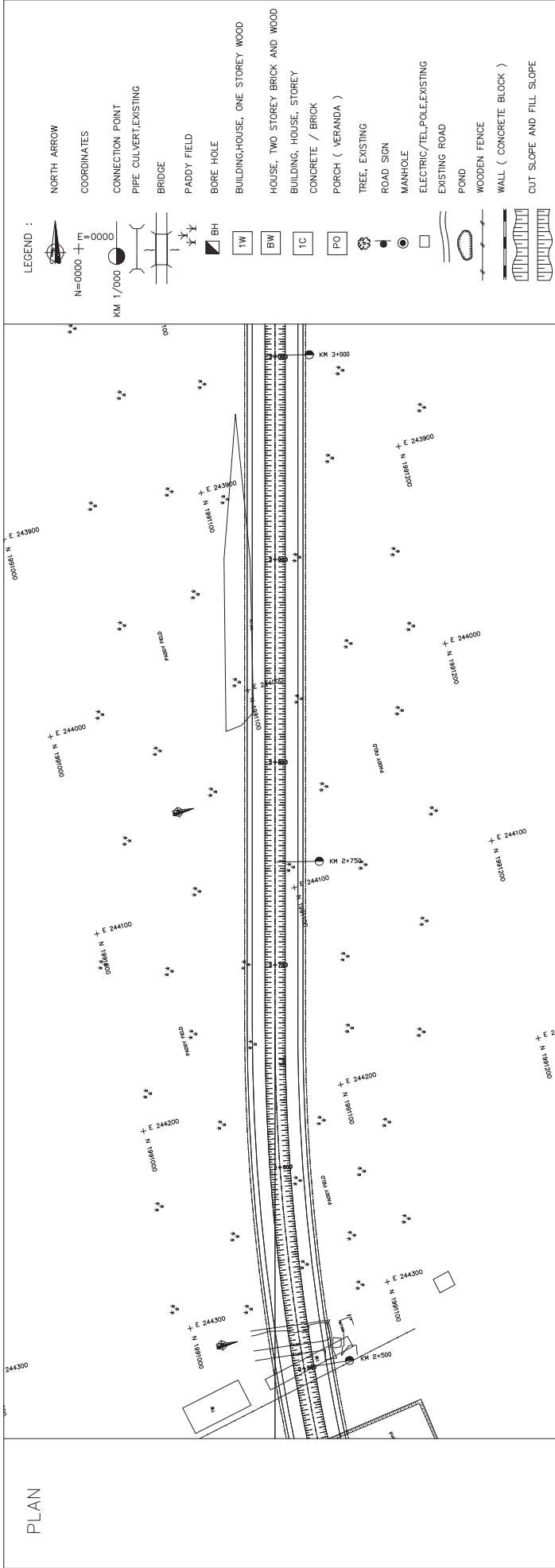
PLAN & PROFILE

STA. 2+000 - 2+500

DWG NO. RPP-005
SCALE V 1:200A1:1:400A3
H 1:1000A1:1:200A3

PREPARED BY:
LAO TRANSPORT ENGINEERING CONSULTANT (LTC)

DATE:



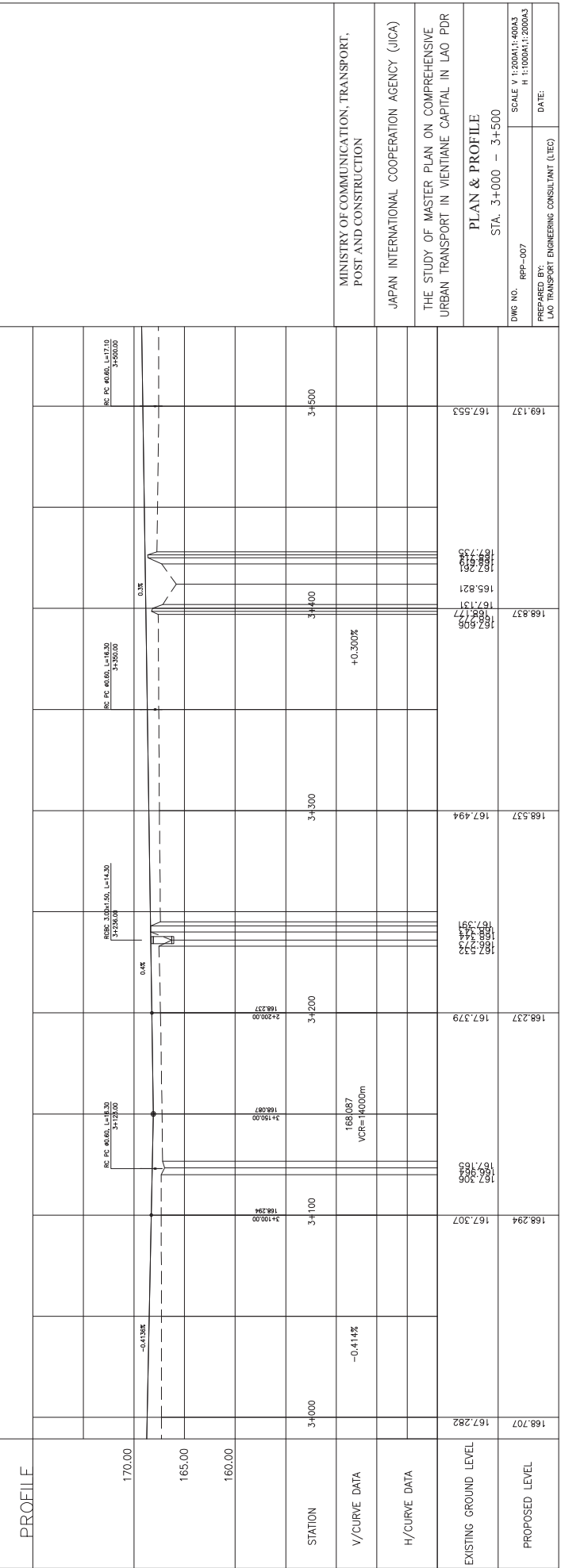
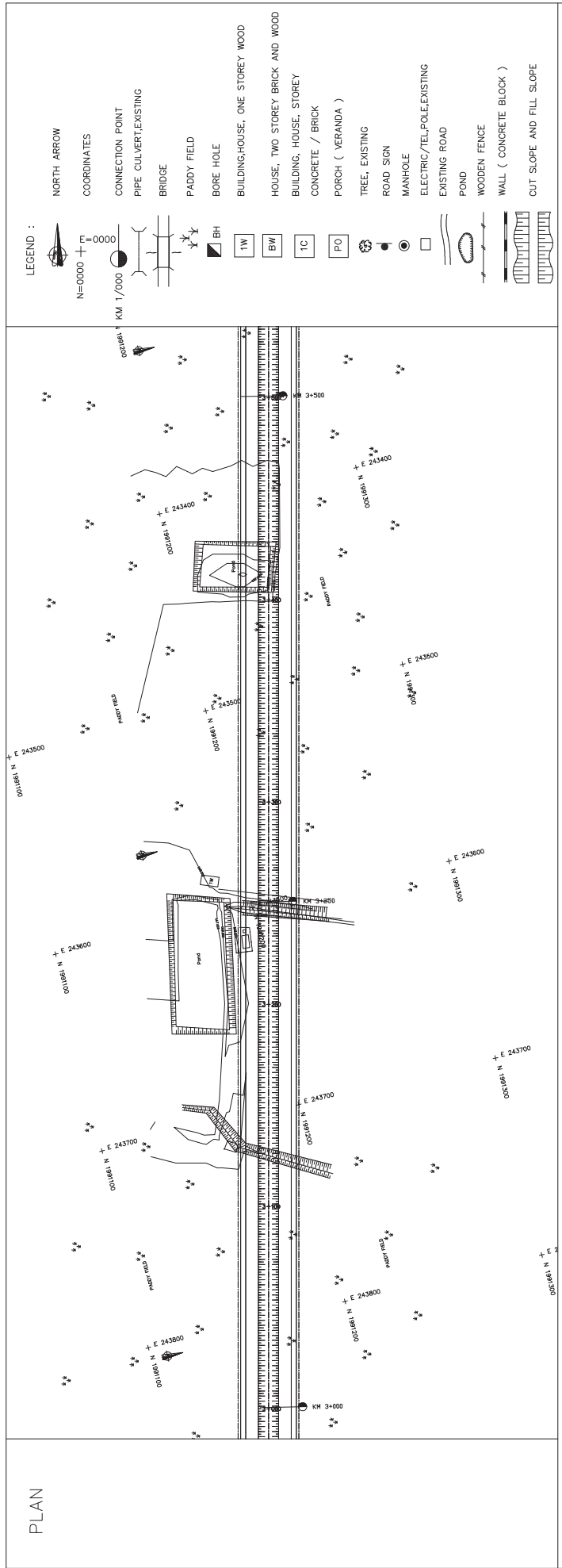
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POST AND CONSTRUCTION

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY OF MASTER PLAN ON COMPREHENSIVE
URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR

PLAN & PROFILE
STA. 2+500 - 3+000

DWG NO. RPP-006
SCALE V 1:2000 A1: 400A3
H 1:1000 A1: 200A3
PREPARED BY:
LAO TRANSPORT ENGINEERING CONSULTANT (LTC)
DATE:



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THE STUDY OF MASTER PLAN ON COMPREHENSIVE
URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR

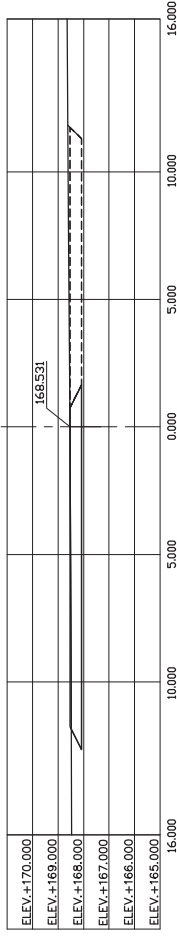
PLAN & PROFILE
STA. 3+000 - 3+500

DWG NO. RPP-007
SCALE V 1:200A11:400A3
H 1:1000A11:2000A3

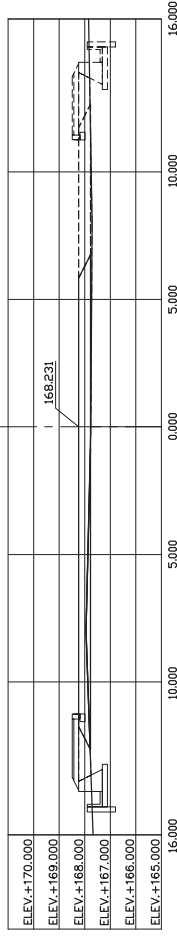
PREPARED BY:
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DATE:

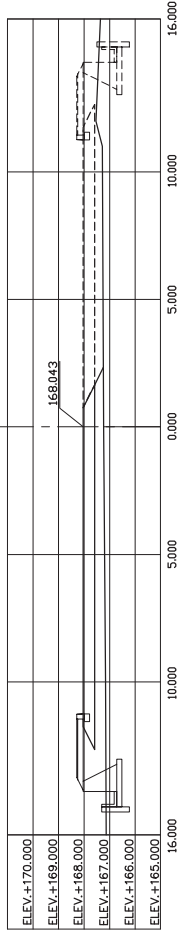
4+(2)LANE	
CUT	m ²
EMBANKMENT	m ²
SLOPE	m
L	m
R	m



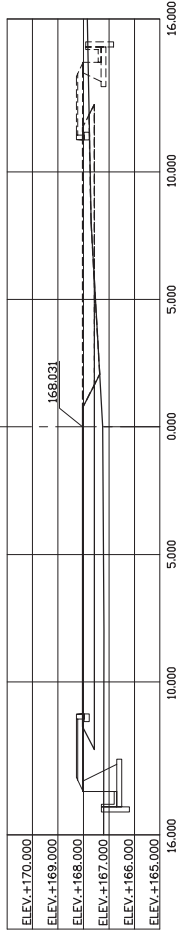
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CUT	m ²
EMBANKMENT	m ²
SLOPE	m
L	m
R	m



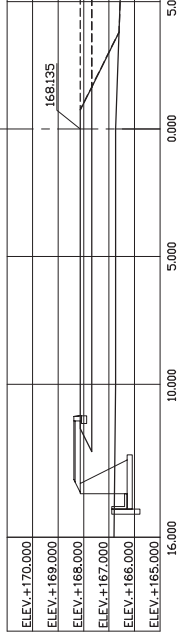
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CUT	m ²
EMBANKMENT	m ²
SLOPE	m
L	m
R	m



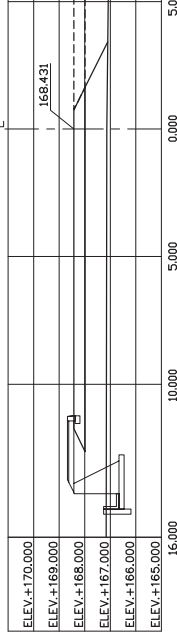
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CUT	m ²
EMBANKMENT	m ²
SLOPE	m
L	m
R	m



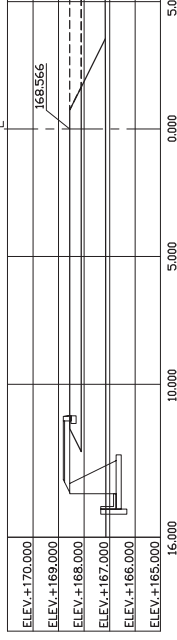
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CUT	m ²
EMBANKMENT	m ²
SLOPE	m
L	m
R	m



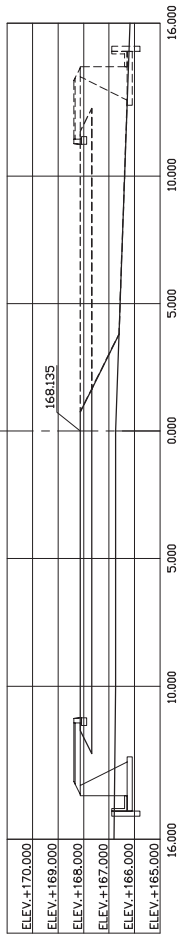
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CUT	m ²
EMBANKMENT	m ²
SLOPE	m
L	m
R	m



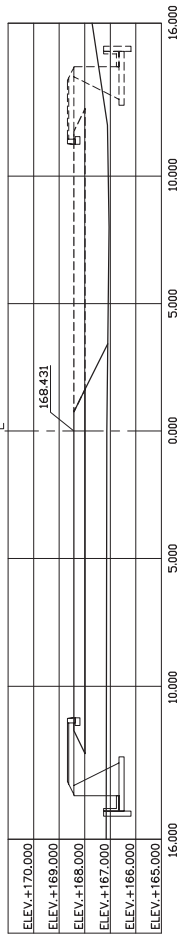
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CUT	m ²
EMBANKMENT	m ²
SLOPE	m
L	m
R	m



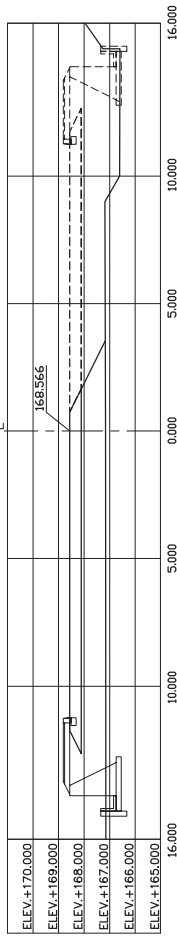
4+(2)LANE	
CUT	m ²
EMBANKMENT	m ²
SLOPE	m
L	m
R	m



4+(2)LANE	
CUT	m ²
EMBANKMENT	m ²
SLOPE	m
L	m
R	m

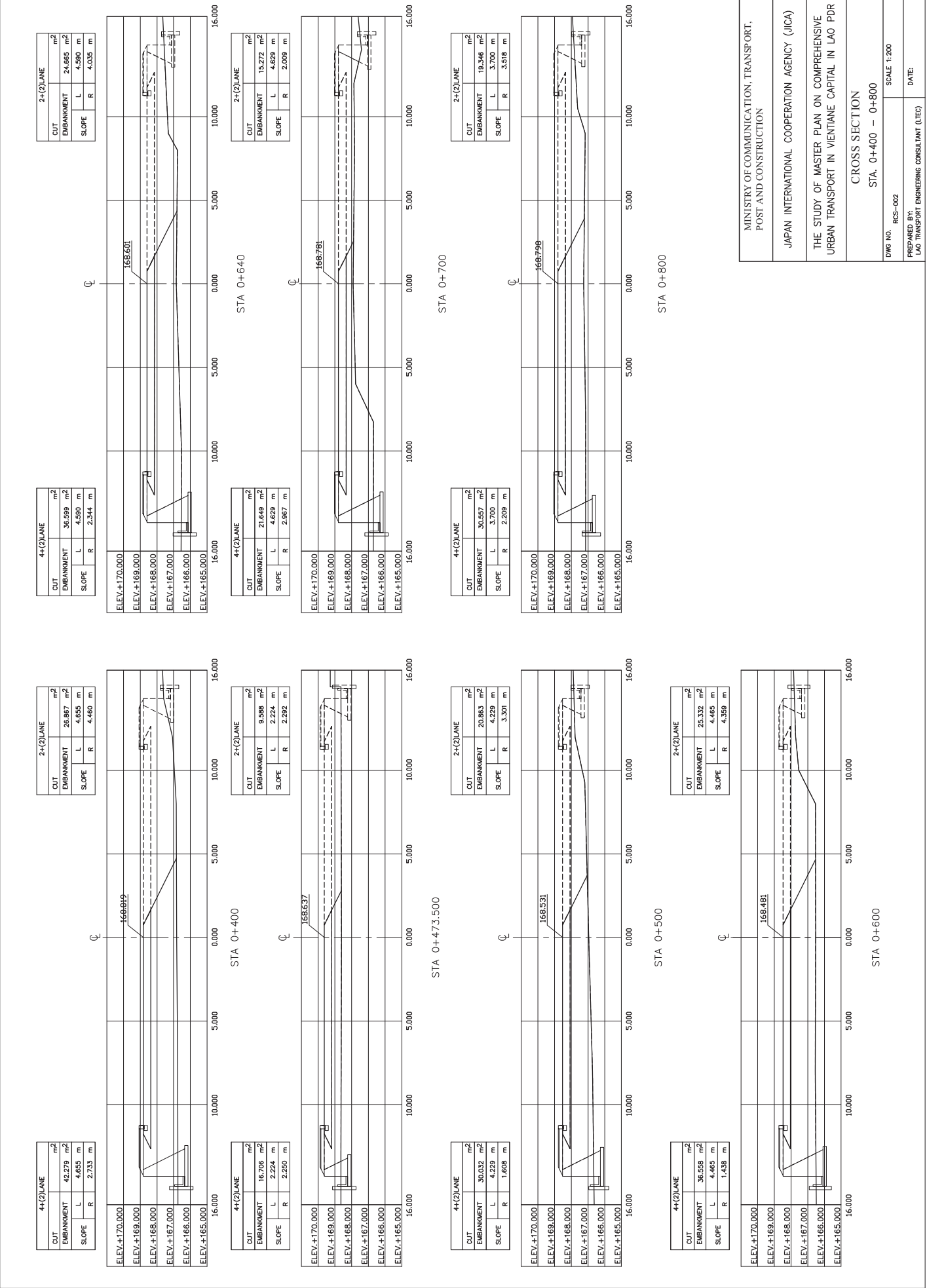


2+(2)LANE	
CUT	m ²
EMBANKMENT	m ²
SLOPE	m
L	m
R	m



2+(2)LANE	
CUT	m ²
EMBANKMENT	m ²
SLOPE	m
L	m
R	m

MINISTRY OF COMMUNICATION, TRANSPORT, POST AND CONSTRUCTION	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY OF MASTER PLAN ON COMPREHENSIVE URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR	
CROSS SECTION	
STA. 0+000 - 0+327	
DWG NO.	SCALE 1:200
RCS-001	
PREPARED BY:	DATE:
LAO TRANSPORT ENGINEERING CONSULTANT (LTEC)	



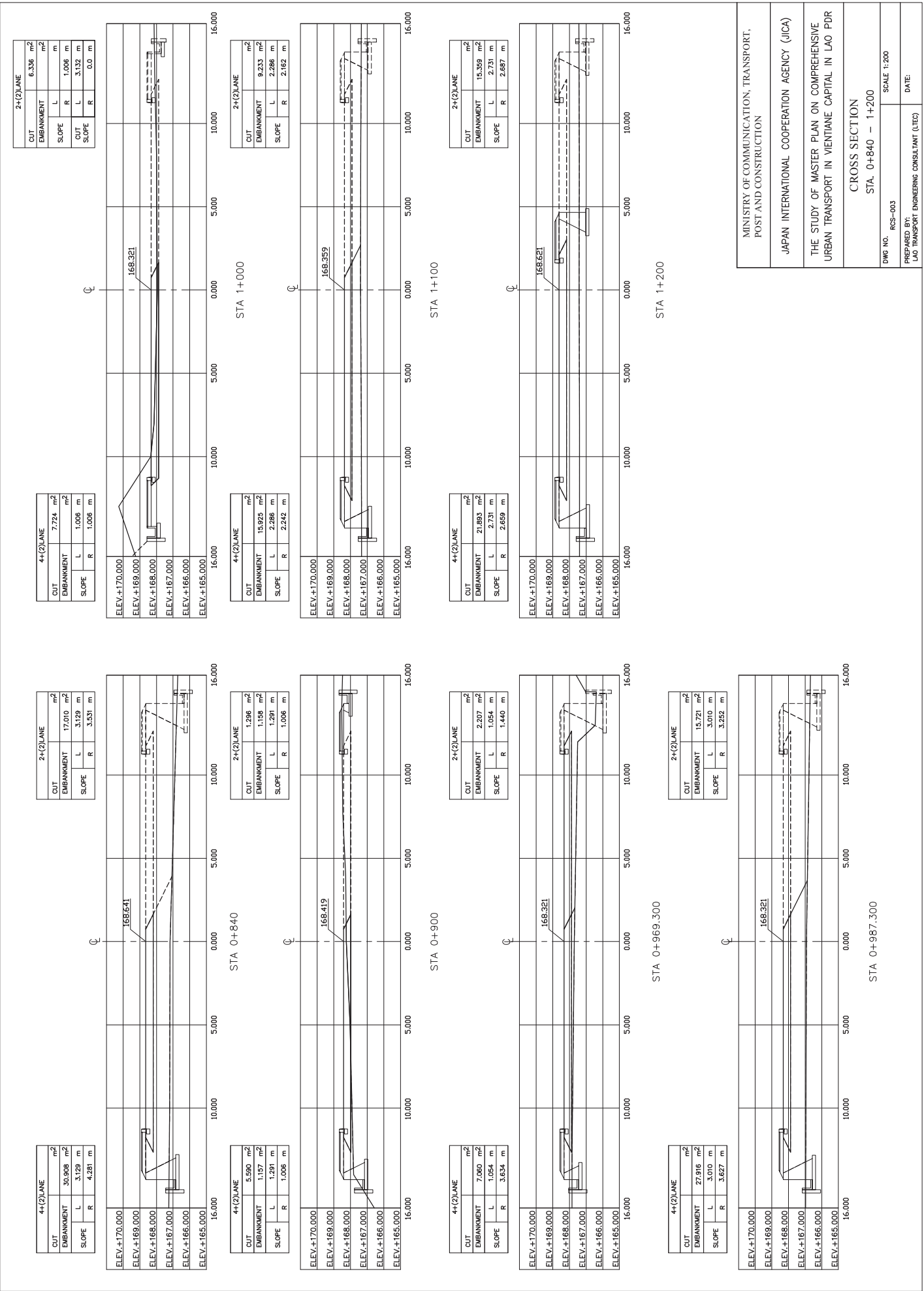
MINISTRY OF COMMUNICATION, TRANSPORT,
POST AND CONSTRUCTION

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY OF MASTER PLAN ON COMPREHENSIVE
URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR

CROSS SECTION
STA. 0+400 - 0+800

DWG NO. RCS-002 SCALE 1:200
PREPARED BY: LAO TRANSPORT ENGINEERING CONSULTANT (LTEC) DATE:



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POST AND CONSTRUCTION

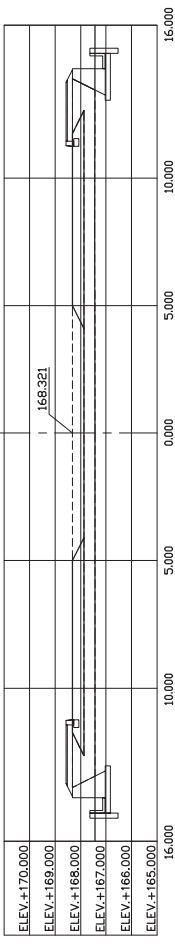
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY OF MASTER PLAN ON COMPREHENSIVE
URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR

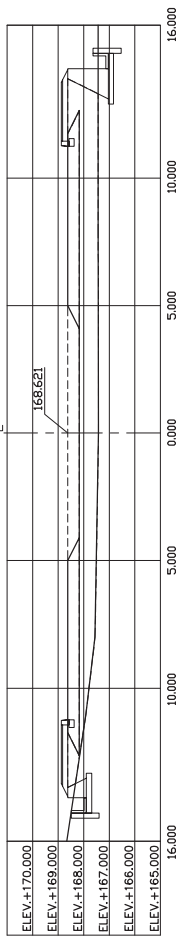
CROSS SECTION
STA. 0+840 - 1+200

DWG NO. RCS-003 SCALE 1:200
PREPARED BY: LAO TRANSPORT ENGINEERING CONSULTANT (LTEC) DATE:

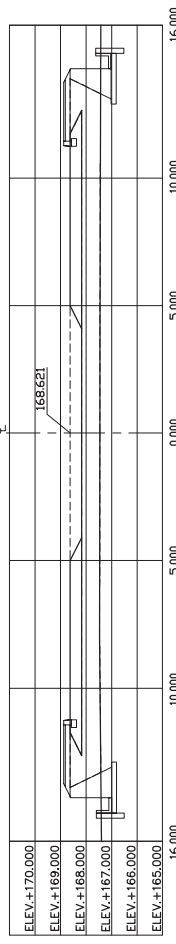
4+(2)LANE	
CUT	m ²
EMBANKMENT	13,426 m ²
SLOPE	L 1,997 m R 1,991 m



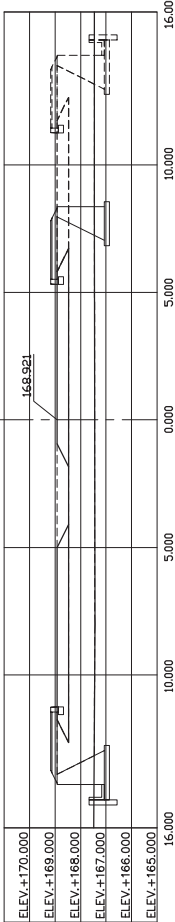
4+(2)LANE	
CUT	m ²
EMBANKMENT	18,263 m ²
SLOPE	L 1,020 m R 2,642 m



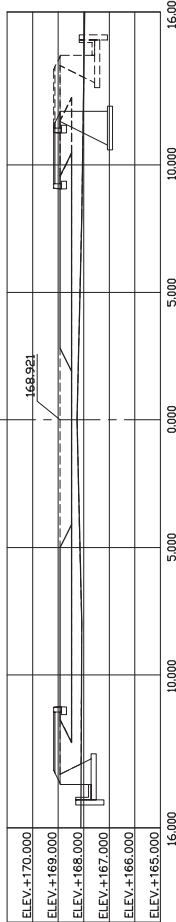
4+(2)LANE	
CUT	m ²
EMBANKMENT	20,770 m ²
SLOPE	L 2,701 m R 2,664 m



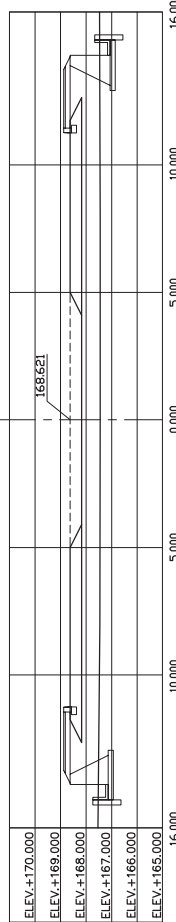
2+(2)LANE	
CUT	m ²
EMBANKMENT	22,959 m ²
SLOPE	L 2,909 m R 3,278 m



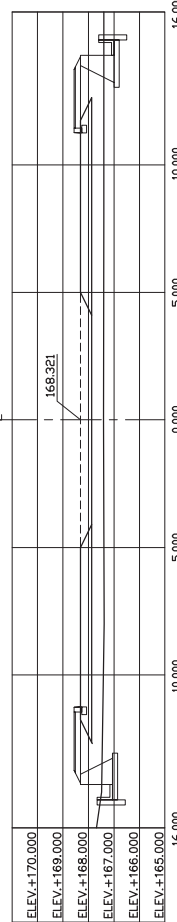
2+(2)LANE	
CUT	m ²
EMBANKMENT	9,754 m ²
SLOPE	L 1,820 m R 1,993 m



4+(2)LANE	
CUT	m ²
EMBANKMENT	20,576 m ²
SLOPE	L 2,457 m R 2,589 m



4+(2)LANE	
CUT	m ²
EMBANKMENT	14,021 m ²
SLOPE	L 1,908 m R 2,055 m



MINISTRY OF COMMUNICATION, TRANSPORT,
POST AND CONSTRUCTION

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY OF MASTER PLAN ON COMPREHENSIVE
URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR

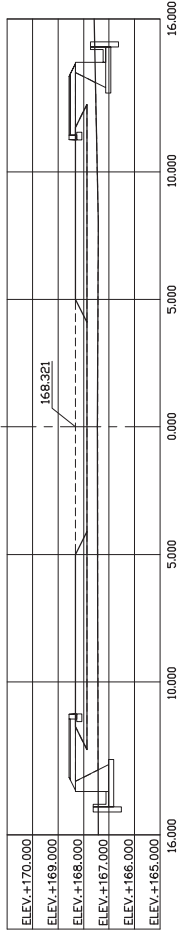
CROSS SECTION

STA. 0+237 - 0+473.500

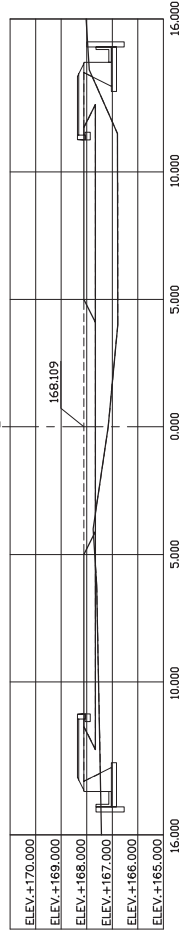
DWG NO. RCS-004 SCALE 1:200

PREPARED BY: LAO TRANSPORT ENGINEERING CONSULTANT (LTEC) DATE:

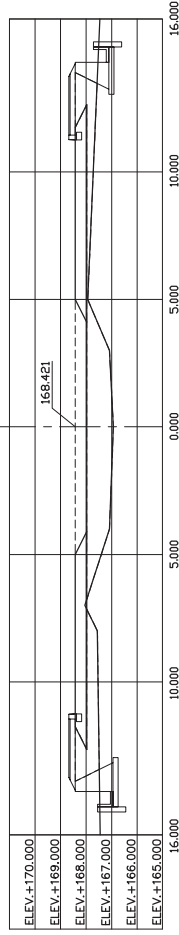
4+(2)LANE	
CUT	13.074 m ²
EMBANKMENT	26.978 m ²
SLOPE	L 2.011 m R 1.777 m



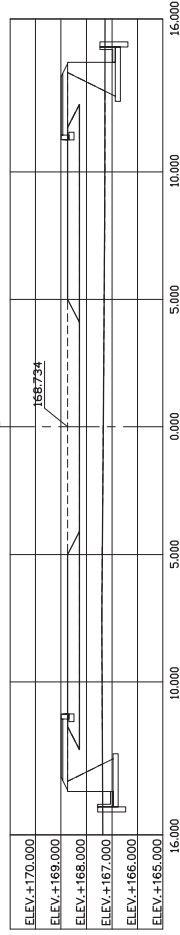
4+(2)LANE	
CUT	0.092 m ²
EMBANKMENT	13.303 m ²
SLOPE	L 1.413 m R 1.431 m



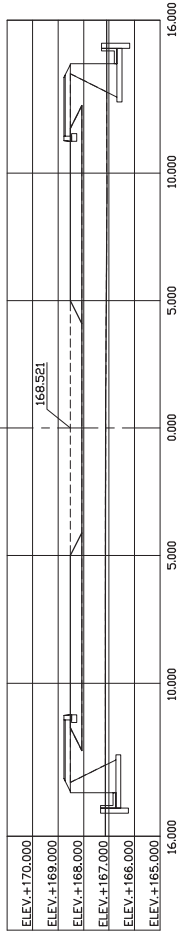
4+(2)LANE	
CUT	0.016 m ²
EMBANKMENT	14.874 m ²
SLOPE	L 2.093 m R 1.902 m



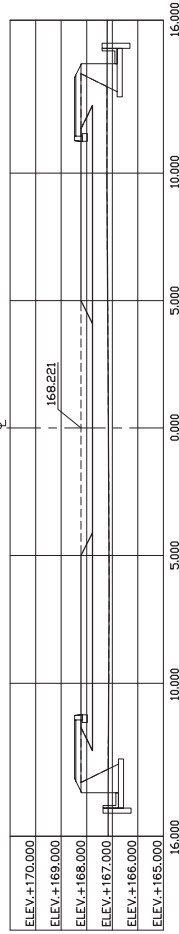
4+(2)LANE	
CUT	26.742 m ²
EMBANKMENT	3.052 m ²
SLOPE	L 3.263 m R 3.263 m



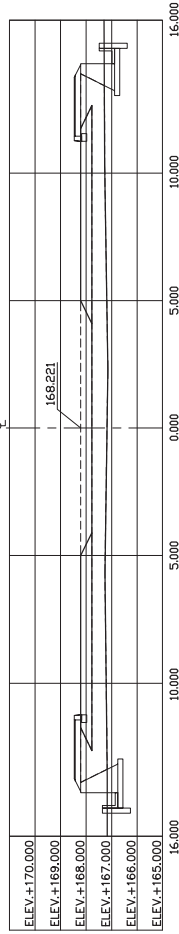
4+(2)LANE	
CUT	26.978 m ²
EMBANKMENT	3.098 m ²
SLOPE	L 3.098 m R 3.185 m



4+(2)LANE	
CUT	17.885 m ²
EMBANKMENT	2.362 m ²
SLOPE	L 2.270 m R 2.270 m

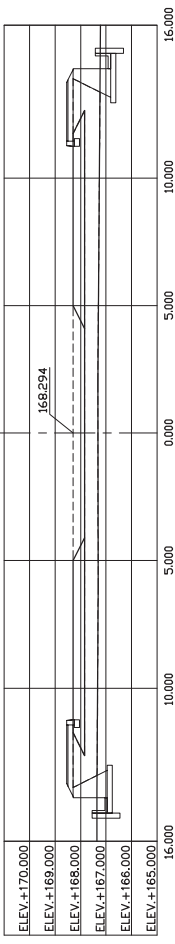


4+(2)LANE	
CUT	16.327 m ²
EMBANKMENT	2.354 m ²
SLOPE	L 2.087 m R 2.087 m

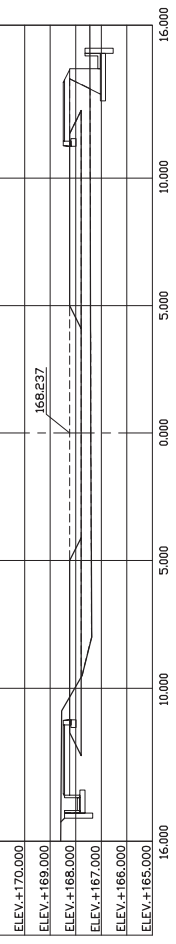


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THE STUDY OF MASTER PLAN ON COMPREHENSIVE URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR	
CROSS SECTION	
STA. 2+000 - 2+600	
DWG. NO.	RCS-005
SCALE	1:200
PREPARED BY:	LAO TRANSPORT ENGINEERING CONSULTANT (LTEC)
DATE:	

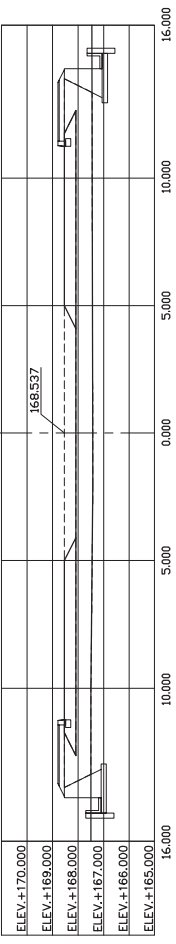
4+(2)LANE	
CUT	16,092 m ²
EMBANKMENT	16,092 m ²
SLOPE	L 2,109 m R 2,133 m



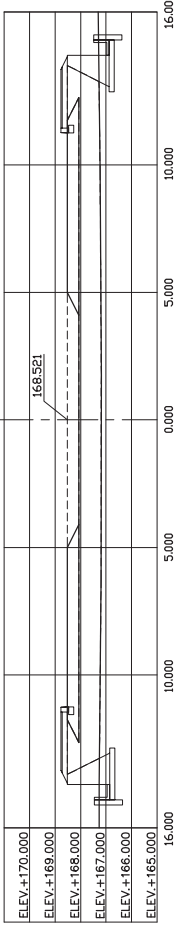
4+(2)LANE	
CUT	1,008 m ²
EMBANKMENT	9,113 m ²
SLOPE	L 1,008 m R 1,788 m
CUT	L 1,092 m R 0.0 m



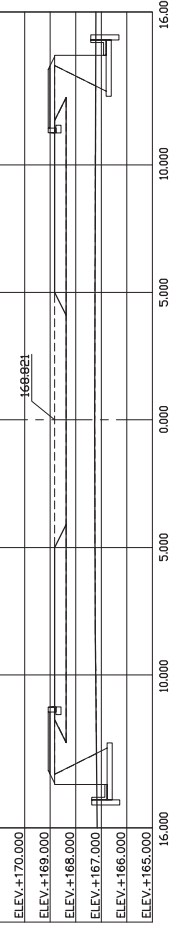
4+(2)LANE	
CUT	18,608 m ²
EMBANKMENT	18,608 m ²
SLOPE	L 2,325 m R 2,418 m



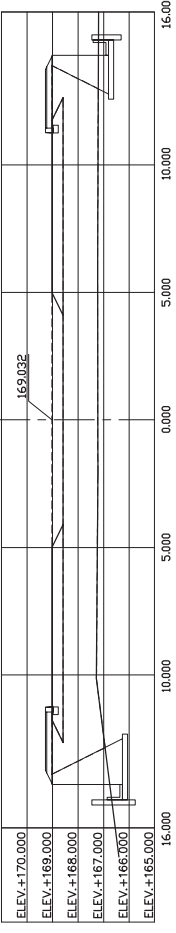
4+(2)LANE	
CUT	24,579 m ²
EMBANKMENT	24,579 m ²
SLOPE	L 2,810 m R 2,760 m



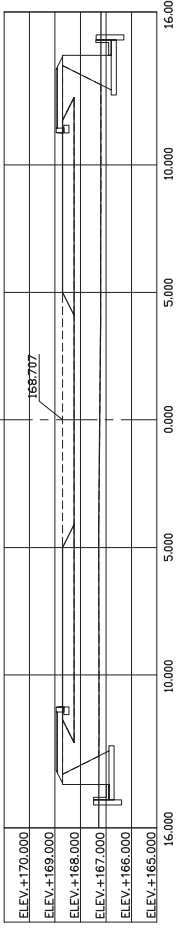
4+(2)LANE	
CUT	31,895 m ²
EMBANKMENT	31,895 m ²
SLOPE	L 3,697 m R 3,598 m



4+(2)LANE	
CUT	37,598 m ²
EMBANKMENT	37,598 m ²
SLOPE	L 5,832 m R 4,088 m



4+(2)LANE	
CUT	28,625 m ²
EMBANKMENT	28,625 m ²
SLOPE	L 3,183 m R 3,379 m



MINISTRY OF COMMUNICATION, TRANSPORT,
POST AND CONSTRUCTION

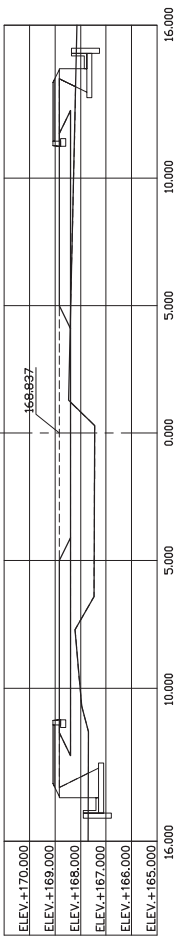
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY OF MASTER PLAN ON COMPREHENSIVE
URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR

CROSS SECTION
STA. 2+700 – 3+300

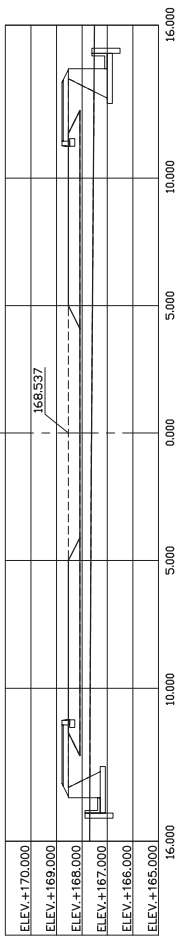
DWG NO. RCS-006 SCALE 1:200
PREPARED BY: LAO TRANSPORT ENGINEERING CONSULTANT (LTEC) DATE:

4+(2)LANE	
CUT	0.170 m ²
EMBANKMENT	12.368 m ²
SLOPE	L 2.540 m
	R 1.469 m



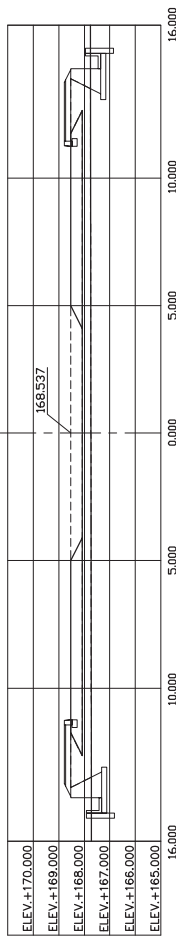
STA 3+800

4+(2)LANE	
CUT	14.250 m ²
EMBANKMENT	1.908 m ²
SLOPE	L 2.275 m
	R 1.908 m



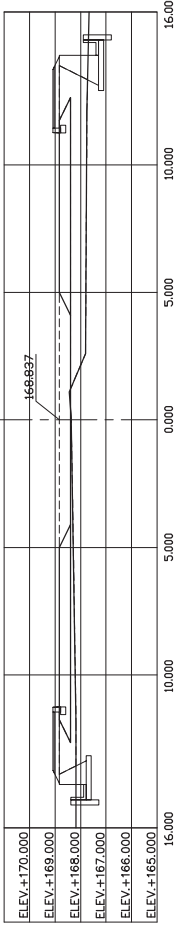
STA 3+900

4+(2)LANE	
CUT	10.882 m ²
EMBANKMENT	1.822 m ²
SLOPE	L 1.741 m
	R 1.822 m



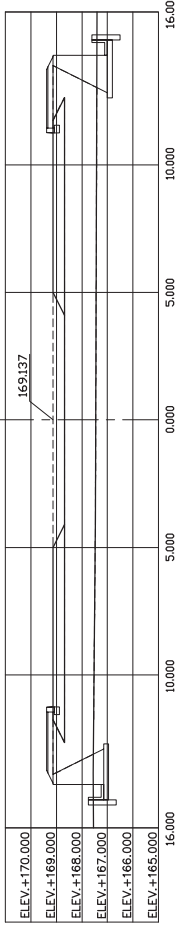
STA 4+000

4+(2)LANE	
CUT	0.022 m ²
EMBANKMENT	10.308 m ²
SLOPE	L 1.470 m
	R 2.515 m



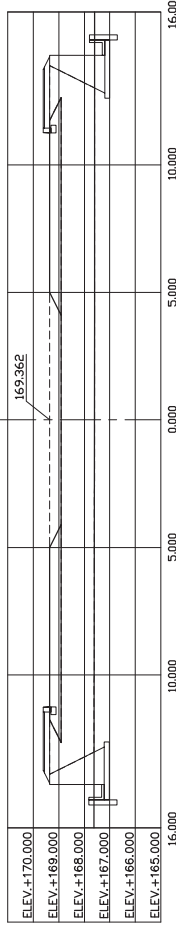
STA 3+400

4+(2)LANE	
CUT	34.128 m ²
EMBANKMENT	3.558 m ²
SLOPE	L 3.875 m
	R 3.875 m



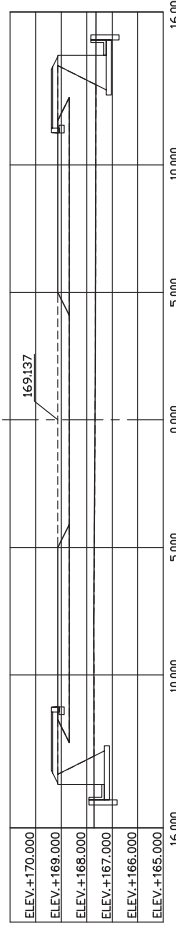
STA 3+500

4+(2)LANE	
CUT	36.362 m ²
EMBANKMENT	3.895 m ²
SLOPE	L 3.942 m
	R 3.942 m



STA 3+600

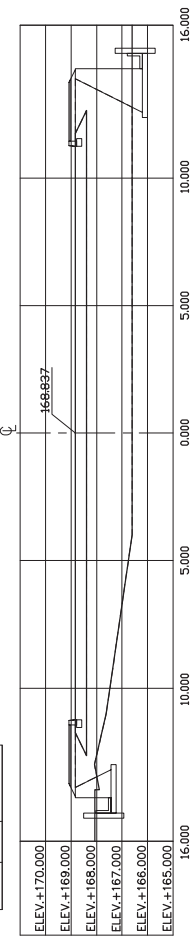
4+(2)LANE	
CUT	28.570 m ²
EMBANKMENT	3.196 m ²
SLOPE	L 3.358 m
	R 3.196 m



STA 3+700

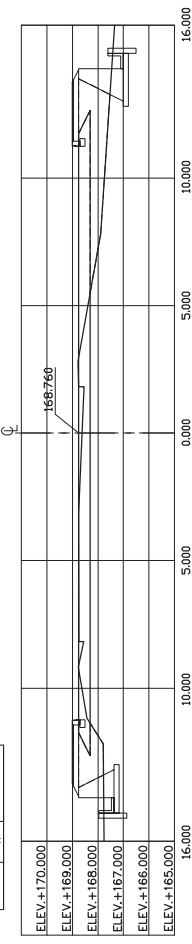
MINISTRY OF COMMUNICATION, TRANSPORT, POST AND CONSTRUCTION	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY OF MASTER PLAN ON COMPREHENSIVE URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR	
CROSS SECTION	
STA. 3+400 - 4+000	
DWG NO.	RCS-007
SCALE	1:200
PREPARED BY:	LAO TRANSPORT ENGINEERING CONSULTANT (LTEC)
DATE:	

4+(2)LANE	
CUT	m ²
EMBANKMENT	42.375 m ²
SLOPE	L 1.873 m
	R 3.008 m



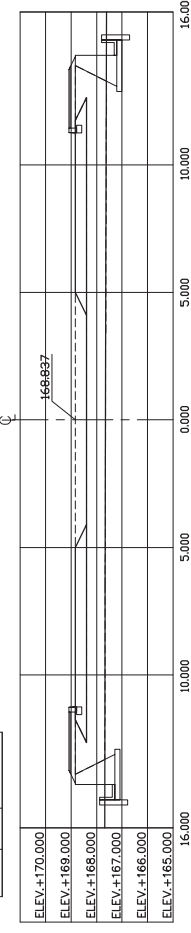
STA 4+500

4+(2)LANE	
CUT	m ²
EMBANKMENT	6.269 m ²
SLOPE	L 2.187 m
	R 2.927 m



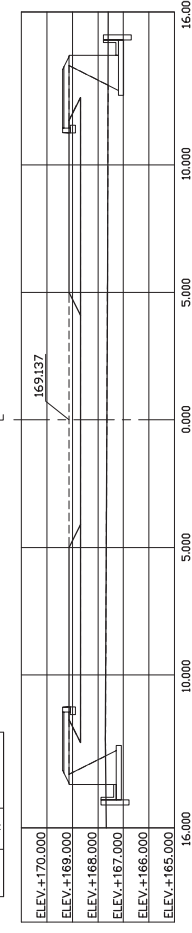
STA 4+600

4+(2)LANE	
CUT	m ²
EMBANKMENT	21.442 m ²
SLOPE	L 2.589 m
	R 2.755 m



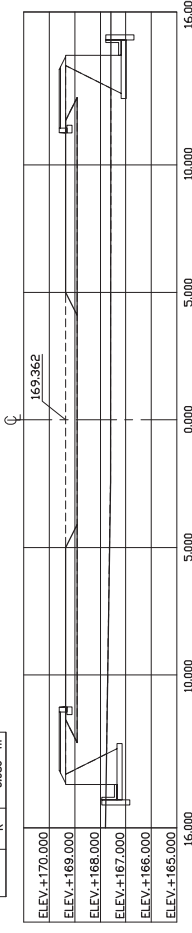
STA 4+100

4+(2)LANE	
CUT	m ²
EMBANKMENT	29.316 m ²
SLOPE	L 3.257 m
	R 3.489 m



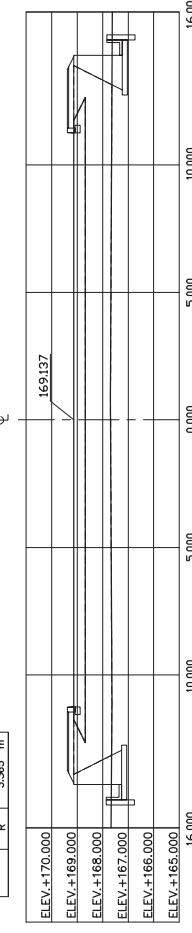
STA 4+200

4+(2)LANE	
CUT	m ²
EMBANKMENT	35.773 m ²
SLOPE	L 3.542 m
	R 3.986 m



STA 4+300

4+(2)LANE	
CUT	m ²
EMBANKMENT	28.838 m ²
SLOPE	L 3.257 m
	R 3.365 m



STA 4+400

MINISTRY OF COMMUNICATION, TRANSPORT, POST AND CONSTRUCTION	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY OF MASTER PLAN ON COMPREHENSIVE URBAN TRANSPORT IN VIENTIANE CAPITAL IN LAO PDR	
CROSS SECTION	
STA. 4+100 - 4+600	
DWG NO.	RCS-008
SCALE	1:200
PREPARED BY:	LAO TRANSPORT ENGINEERING CONSULTANT (LTEC)
DATE:	

Cost Estimation Sheets

Inner Ring Road : 2 Lanes + 2 Bike Lanes with section "Out of Project"

Cash Flow Analysis
On
2 Lanes + 2 Bike Lanes with section “Out of Project”

EIRR= 14.14% B/C ratio= 1.17 NPV= 2,738

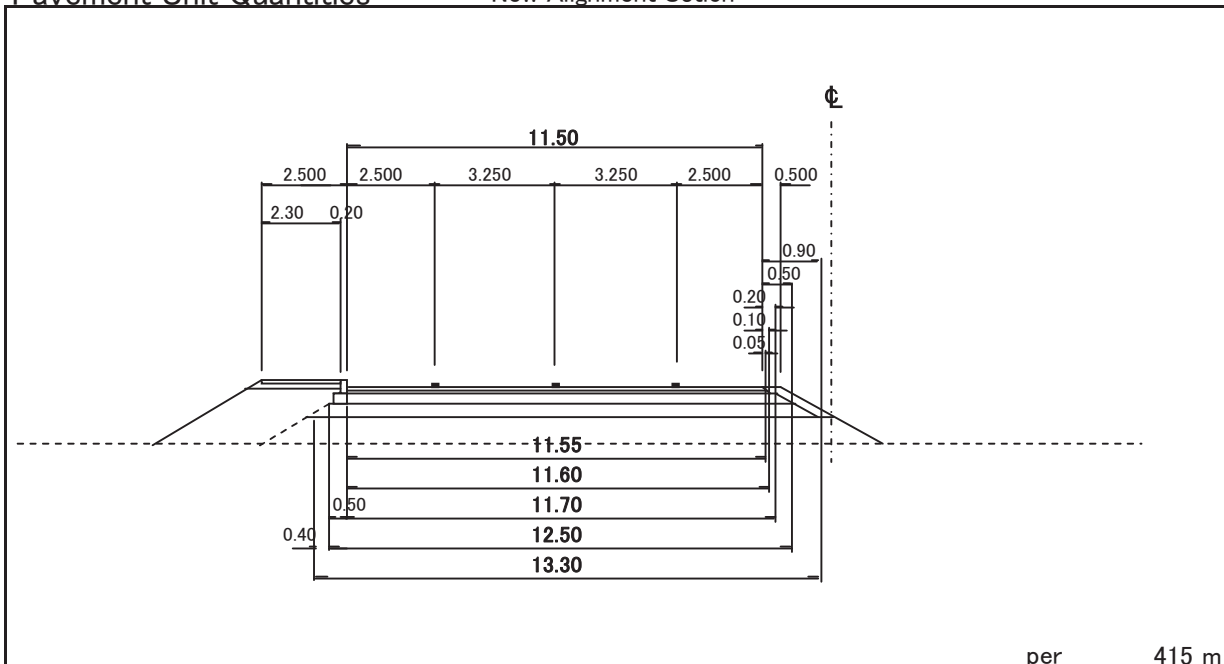
	year	Costs				Benefit				Benefit - Cost
		Const'on Cost	OM Cost	Total Cost	discount rate :12%	VOC	TTC	Total Benefit	discount rate :12%	
0	2010	9,120		9,120	9,120					-9,120
1	2011	3,016		3,016	2,693			0	0	-3,016
2	2012	3,016		3,016	2,404			0	0	-3,016
3	2013		302	302	215	2,162	524	2,686	1,912	2,385
4	2014		302	302	192	2,206	563	2,769	1,760	2,467
5	2015		302	302	171	2,249	604	2,853	1,619	2,551
6	2016		302	302	153	2,289	648	2,937	1,488	2,636
7	2017		302	302	136	2,328	695	3,023	1,368	2,722
8	2018		302	302	122	2,364	745	3,109	1,256	2,808
9	2019		302	302	109	2,300	811	3,111	1,122	2,809
10	2020		302	302	97	2,232	882	3,113	1,002	2,812
11	2021		302	302	87	2,158	959	3,117	896	2,815
12	2022		302	302	77	2,078	1,044	3,123	802	2,821
13	2023		302	302	69	1,994	1,137	3,131	718	2,830
14	2024		302	302	62	1,904	1,239	3,144	643	2,842
15	2025		302	302	55	1,810	1,350	3,160	577	2,859
16	2026		302	302	49	1,810	1,336	3,145	513	2,844
17	2027		302	302	44	1,810	1,336	3,145	458	2,844
18	2028		302	302	39	1,810	1,336	3,145	409	2,844
19	2029		302	302	35	1,810	1,336	3,145	365	2,844
20	2030		302	302	31	1,810	1,336	3,145	326	2,844
21	2031		302	302	28	1,810	1,336	3,145	291	2,844
22	2032		302	302	25	1,810	1,336	3,145	260	2,844
23	2033		302	302	22	1,810	1,336	3,145	232	2,844
24	2034		302	302	20	1,810	1,336	3,145	207	2,844
25	2035		302	302	18	1,810	1,336	3,145	185	2,844
26	2036		302	302	16	1,810	1,336	3,145	165	2,844
27	2037		302	302	14	1,810	1,336	3,145	148	2,844
28	2038		302	302	13	1,810	1,336	3,145	132	2,844
	Total	15,152	7,842	22,994	16,116	51,599	28,569	80,168	18,853	57,174

Summary of Construction Cost 2+(2) Lanes with section "Out of Project"

Item	Unit	Unit Price (USD)	Quantity	Construction Cost (USD)	Remarks
1 Earthwork					
1.1 Clearing & Graving	ha	12,900	9.5	122,690	
1.2 Embankment From Road Excavation	m ³	19.38	804.0	15,582	
1.3 Embankment From Borrow	m ³	4.21	77,422.9	325,951	
2 Slope Protection					
2.1 Slope Protection on Embankment Slope (Sodding)	m ²	2.44	17,707.7	43,207	
2.2 Masonry Retaining Wall	m ³	103.5	0.0	0	
3 Pavement					
3.1 Subgrade Preparation	m ²	0.35	74,001.2	25,900	
3.2 Granular Sub-base Course (t=20cm)	m ³	5.59	13,155.4	73,539	
3.3 Aggregate Base Course (t=15cm)	m ³	5.94	10,098.7	59,986	
3.4 Bituminous Concrete Binder Course (t=5cm)	m ²	9.61	64,264.2	617,579	
3.5 Bituminous Concrete Surface Course (t=5cm)	m ²	9.56	63,986.0	611,706	
3.6 Prime Coat	L.	1.66	71,674.1	118,979	
3.7 Tack Coat	L.	1	4,421.6	4,422	
4 Drainage					
4.1 Longitudinal Drainage	m	106	10340.0	1,096,040	
4.2 Excavation for RCPC & RCBC	m ³	15.8	441.4	6,974	
4.3 Cross Drainage (RCPC φ0.600)	m	101.67	479.8	48,781	
4.3 Cross Drainage (RCPC φ1.000)	m	213.7	18.1	3,868	
4.4 Concrete for RCPC & RCBC	m ³	235.7	374.2	88,206	
4.5 Re-bar for RCPC & RCBC	ton	1,010.87	26.2	26,451	
5 Bridge					
5.1 RC Multi-Beam	m ²	2,300.00	240.0	552,000	
5.2 RC Multi-Beam	m ²	2,300.00	517.5	1,190,250	
6 Public Utility Relocation/Protection					
6.1 Public Utility Relocation/Protection	L.S.	1	150,000	150,000	
7 Miscellaneous					
7.1 Sidewalk w=2.5m	m	82	5,564.0	456,248	
7.2 Traffic Sign each100m ×2	No.	129.53	112	14,507	
7.3 Guide Sign 4 Intersection	No.	259.36	21	5,447	
7.4 Pavement Marking	m ²	11.9	3,338.4	39,727	
7.5 Km. Post	No.	60.4	10	604	
7.6 Guard Rail	m	150	80.0	12,000	
7.7 Road Lighting	set	2,055.73	113	232,297	per km
A. Sub-total (1 to 7)				5,942,941	1,264,456
8 Engineer's Facility					
8.1 Engineer's Facility (1% of A)	L..S.		1	59,429	
9 Mobilization/Demobilization					
9.1 Mobilization/Demobilization (0.5% of A)	L..S.		1	29,715	
10 Contingency					
10.1 Contingency (10% of A)	L..S.		1	594,294	
B. Construction Cost Total (A + 8 to 10)				6,626,379	
11 Management Fee					
11.1 Engineering and Construction Management (6% of B)	L..S.		1	397,583	
11.2 Local Administration (4% of B)	L..S.		1	265,055	
C. Construction Cost Total (B + 11)				7,289,017	
12 Land Acquisition and Compensation					
12.1 Land Acquisition residential	m ²	256	9,390	2,403,712	
12.1 Land Acquisition agricultural	m ²	63	96,090	6,053,670	
D. Sub-total (C + 12)				15,746,399	
13 Sales Tax (10% of C)				1,574,640	
E. Project Cost				17,321,039	

Pavement Unit Quantities

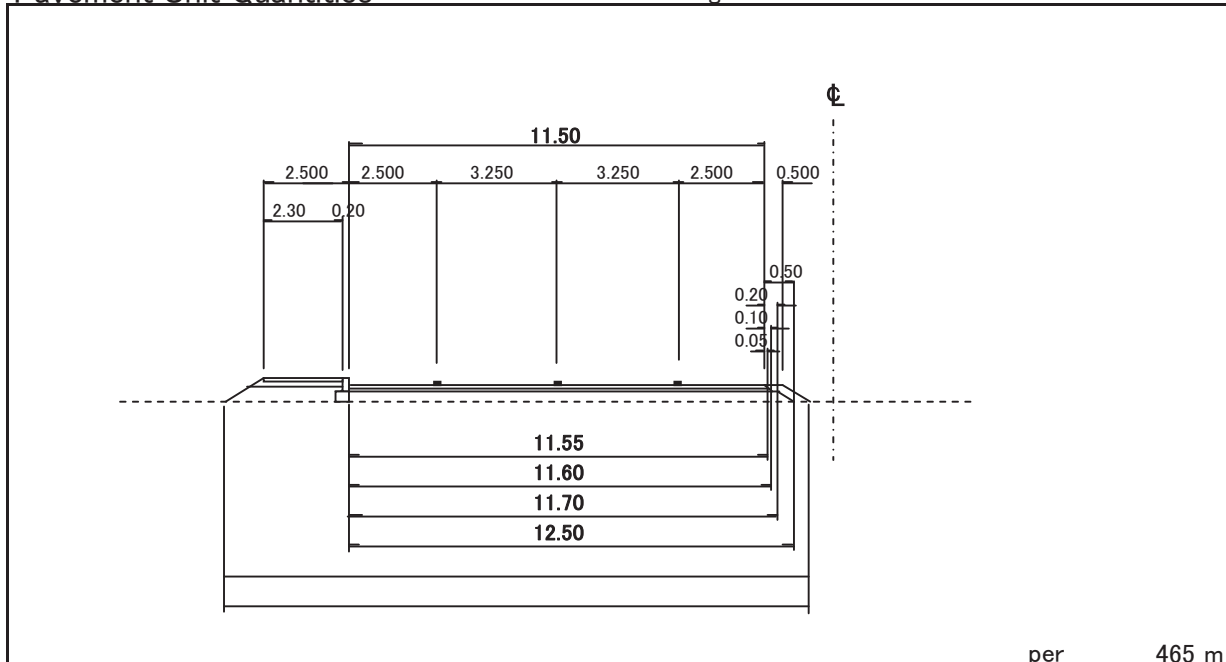
New Alignment Section



			per	415 m
工種	Unit		Quantities	
Clearing & Graving	m ²	21.00 x 1.00	0.87	
Embankment From Borrow	m ²		8,795.93	
Slope Protection on Embankment Slope (Sodding)	m ²		2,780.50	
Granular Subbase Course t=200mm	m ³	$1/2 \times (12.50 + 13.30) \times 0.20 \times 1.00$	1,070.70	
Aggregate Base Course t=150mm	m ³	$1/2 \times (11.70 + 12.50) \times 0.15 \times 1.00$	753.23	
Asphalt Concrete Binder Course t=50 mm	m ²	11.55 x 1.00	4,793.25	
Asphalt Concrete Wearing Course t=50 mm	m ²	11.50 x 1.00	4,772.50	
Prime Coat (1.2L/m ²)	L.	11.60 x 1.00 x 1.20	5,776.80	
Tack Coat (0.3L/m ²)	L.	11.55 x 1.00 x 0.30	1,437.98	
Traffic Paint	m ²	0.200 x 3 x 1.00	249.00	
Subgrade Preparation	m ²	13.300 x 1.00	5,519.50	
Sidewalk w=2.5m	m	1.00 x 1.00	415.00	

Pavement Unit Quantities

Extention of Existing Road



per 465 m

工種	Unit		Quantities
Clearing & Graving	m ²	15.90 x 1.00	0.74
Embankment From Borrow	m ²		558.00
Slope Protection on Embankment Slope (Sodding)	m ²		727.73
Granular Subbase Course t=200mm	m ³		0.00
Aggregate Base Course t=150mm	m ³	1/2 x (11.70 + 12.50) x 0.15 x 1.00	843.98
Asphalt Concrete Binder Course t=50 mm	m ²	11.55 x 1.00	5,370.75
Asphalt Concrete Wearing Course t=50 mm	m ²	11.50 x 1.00	5,347.50
Prime Coat (1.2L/m ²)	L.	11.60 x 1.00 x 1.20	6,472.80
Tack Coat (0.3L/m ²)	L.	11.55 x 1.00 x 0.30	1,611.23
Traffic Paint	m ²	0.200 x 3 x 1.00	279.00
Subgrade Preparation	m ²	13.300 x 1.00	6,184.50
Sidewalk w=2.5m	m	1.00 x 1.00	465.00

Pavement Quantities

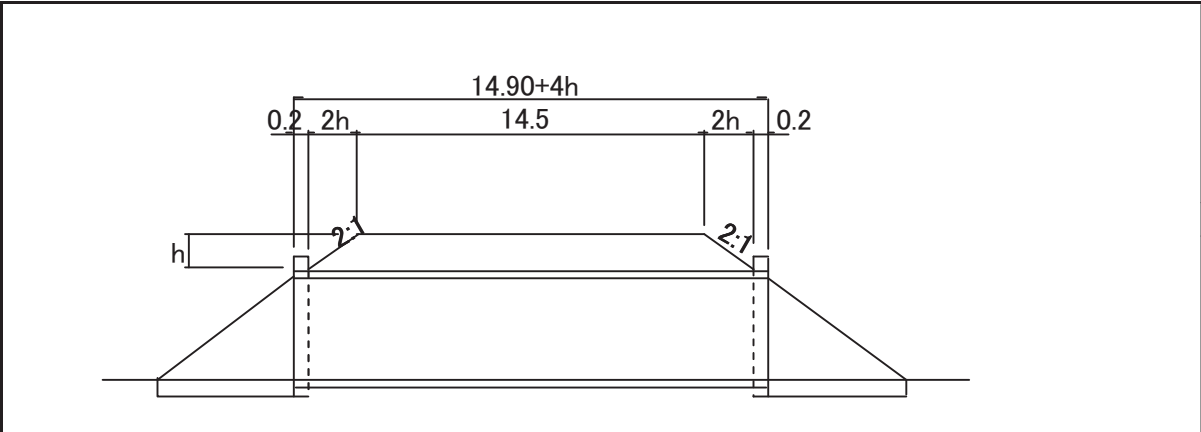
2+(2) Lanes

Description		Unit	Unit Quantity (per m)	Total Length (m)	Bridge Length (m)	Pavement Length (m)	Quantities	Remarks
Subgrade Preparation		m ⁰	0.87	900.00	50.00	850.00	740.78	
Subgrade Preparation		m ¹	8,795.93				7,476,536.25	
Subgrade Preparation		m ²	5,519.50				4,691,575.00	
Granular Subbase Course t=200mm		m ³	1,070.70				910,095.00	
Aggregate Base Course t=150mm		m ³	753.23				640,241.25	
Asphalt Concrete Binder Course t=50 mm		m ²	4,793.25				4,074,262.50	
Asphalt Concrete Binder Course t=50 mm		m ²	4,772.50				4,056,625.00	
Prime Coat		L.	5,776.80				4,910,280.00	
Tack Coat		L.	1,437.98				1,222,278.75	
Traffic Paint		sq.m	249.00				211,650.00	
Sidewalk	Concrete Curb	m ³	415.00				352,750.00	

Type of Road Structure	Section	Distance (m)	Earthwork (m)	Bridge (m)	Total (m)	Remarks
	0+000					
	1+023	1,023	1,023			
	1+039	16		16		
	4+700	3,661	3,661			
	Total	4,700	4,684	16	4,700	

RCPC Quantities

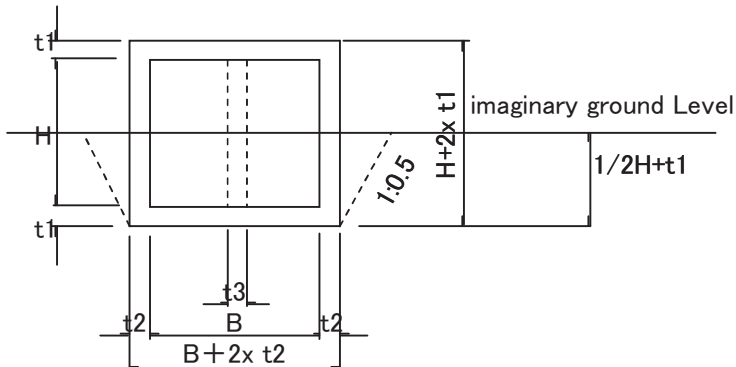
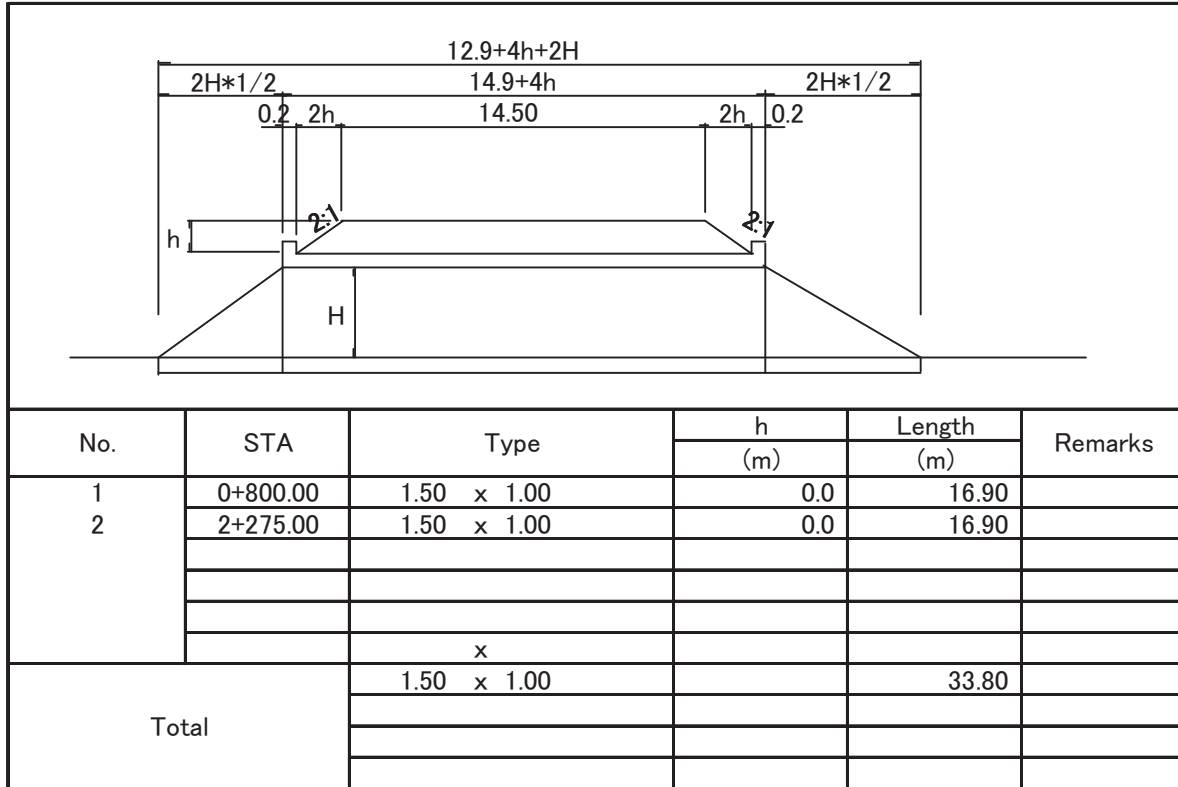
2+(2) Lanes



No.	STA	Type	h	Length	Remarks
			(m)	(m)	
2	0+325.00	0.60m	0.8	18.10	
3	0+475.00	0.60m	1.4	20.50	
Total		diameter 1.00m		0.00	
		diameter 0.60m		38.60	

Inlet & outlet	Concrete	Re-bar
diameter 0.60r 24 locations	0.8 m ³ /one wingwall 38.4 m ³	31kg/one wingwall 1,488 kg
diameter 1.00r 1 location	2.0 m ³ /one wingwall 4.0 m ³	85.76kg/one wingwall 172 kg
Total	42.4 m ³	1.7 ton

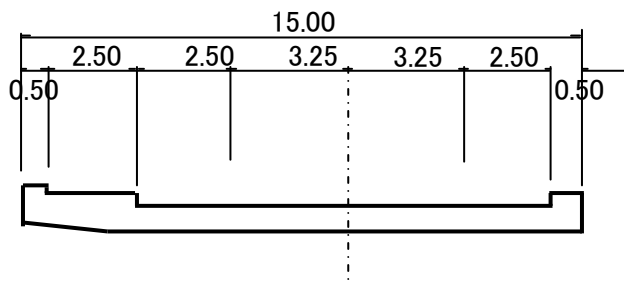
RCBC Quantities 2+(2) Lanes



Type / Length	Dimension (m)	Concrete(m ³)	Re-bar(ton)	Excavation(m ³)
1.50 x 1.00 33.80	B = 1.50 H = 1.00 t1 = 0.25 t2 = 0.20	45.63	11.41	57.67
2.00 x 1.50 0.00	B = 2.00 H = 1.50 t1 = 0.25 t2 = 0.20	0.00	0.00	0.00
3.00 x 1.50 0.00	B = 3.00 H = 1.50 t1 = 0.30 t2 = 0.25	0.00	0.00	0.00
2-3.00 x 2.00 0.00	B = 6.25 H = 2.00 t1 = 0.30 t2 = 0.25 t3 = 0.25	0.00	0.00	0.00
Total		45.63	11.41	57.67

Bridge Quantities

2+(2) Lanes



No.	STA	Type	L	W	Area	Remarks	
			(m)	(m)	(m ²)		
1	0+765.00	RC Multi-Beam					
	0+815.00		50.00	15.0	750.00		
Total		RC Multi-Beam			750.00		

APPENDIX 18

PUBLIC TRANSPORT

18-1	Bus Traffic Flow and OD in 2013, 2018 and 2025	A18-1
18-2	Calculation of Bus Numbers Required by Route Segment	A18-7

Bus Traffic Flow and OD in 2013, 2018 and 2025



Figure 18.1-1 Bus traffic volume in 2013 (100veh./day)

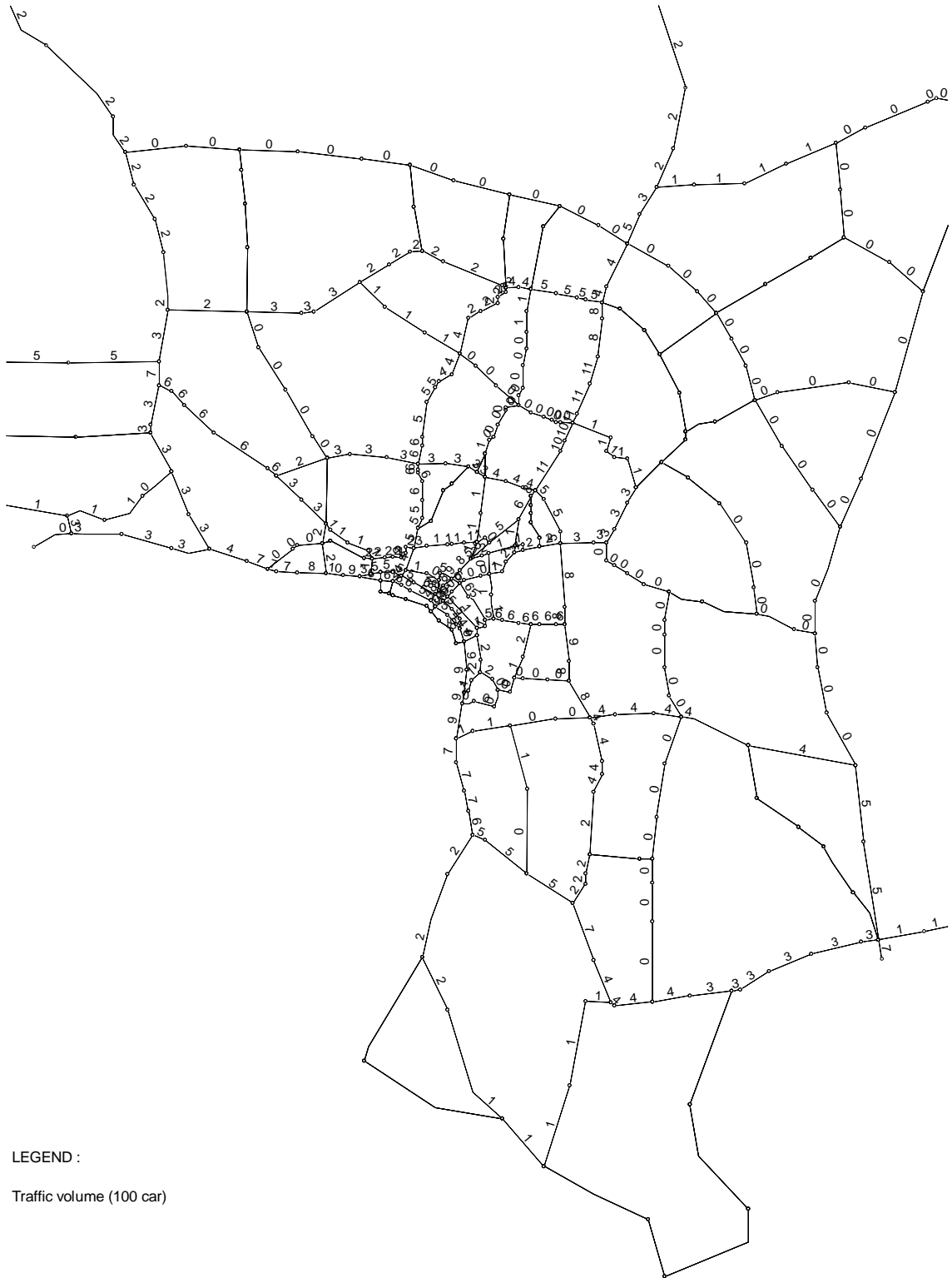
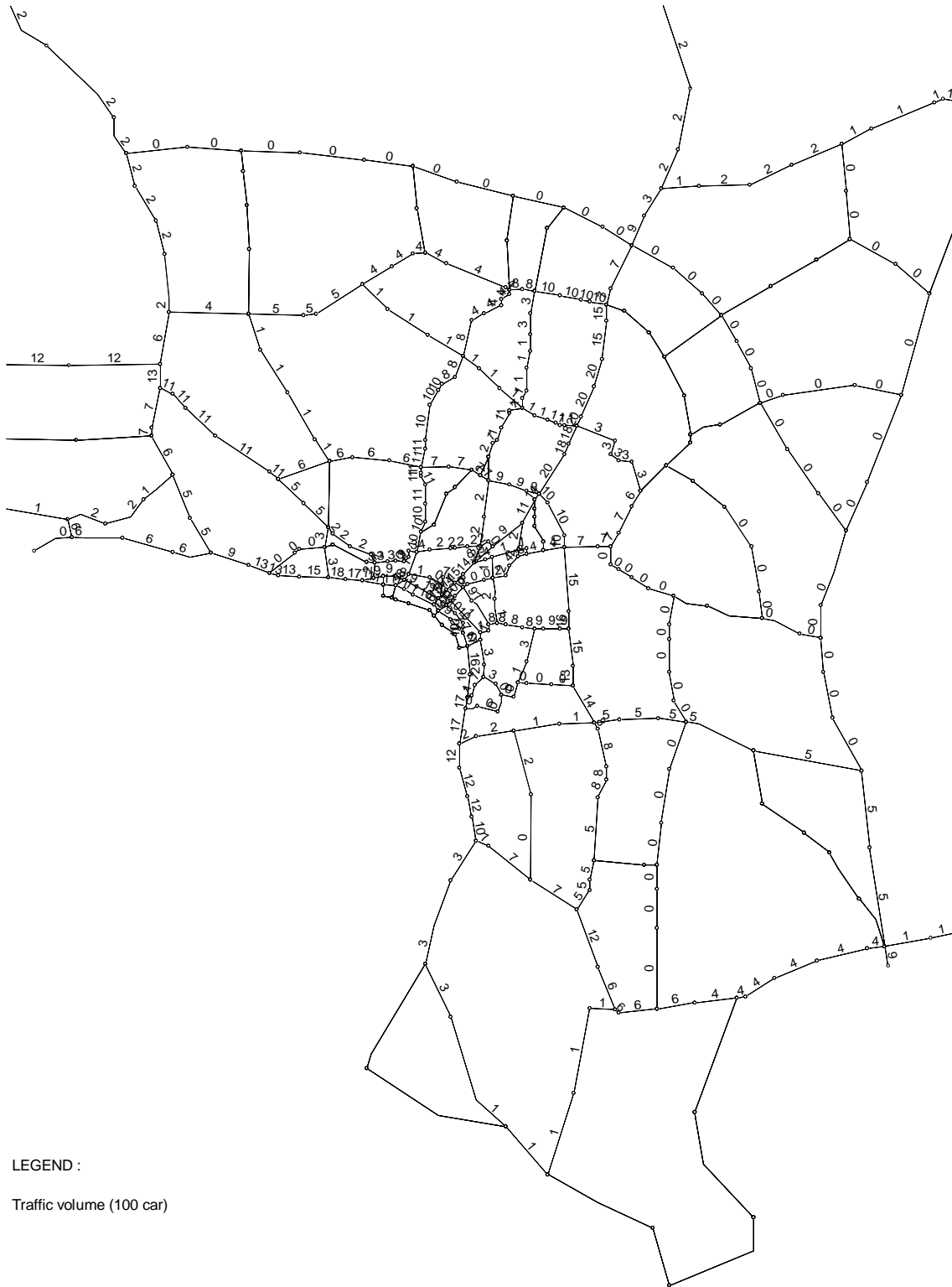


Figure 18.1-2 Bus traffic volume in 2018 (100veh./day)



LEGEND :

Traffic volume (100 car)

Figure 18.1-3 Bus traffic volume in 2025 (100veh./day)

Calculation of Bus Numbers Required by Route Segment

Calculation Flow

- (1) Demand of hourly units is obtained by dividing bus flow on each segment by 12 hours.
- (2) Hourly passenger demand is obtained by multiplying 50 passengers by (1).
- (3) Travel time of round trip is obtained by dividing double distance between origin and destination by bus operation speed, assuming at 20km/h which includes dwelling time and all other times.
- (4) Hourly frequency of bus operation is obtained from (3).
- (5) Bus head time or waiting time is assumed at 5 minutes. 12 units will be maximum numbers per hour.
- (6) Required number of bus for round trip is obtained by (4) and (5).
- (7) Bus capacity is obtained by 6 times 50 passengers.
- (8) Demand and Capacity ratio is obtained by 2 by 7.
- (9) Use Table 18.2.5 Public Mode and Capacity to adjust type of vehicles.
- (10) Efficient combination will be determined.
- (11) Calculation of supply capacity by the combination and compared by demand.
- (12) Each segment ridership is mentioned by (11).

Table 18.2-1 Bus Calculation in 2013

Segment	Hourly Unit	H.Pass.Demand	Travel Time	Max. H. Freq	R No of Bus RT	Capacity	Demand /Capacity	Adjust by SB	Type	Plan No.	H. Passen	Two Ways	Ridership
	12	50	20		12	50		1			50	2	
	Unit/h/s	pa/h/s	Hour/RT	Times/h	5mnit	pass/h				Unit	pass/h	pass/h	
E1	16	800	1.17	0.85	14	598	1.34	1.60	BB/SB	14	650	1299	123%
E2									(E1)				
E2-1	12	600	0.239	4.18	3	628	0.96	1.00	SB/SMB	3	628	1255	96%
E3	4	200	0.746	1.34	9	603	0.33	0.30	SMB	8	161	322	124%
E4	12	600	0.356	2.81	4	562	1.07	1.00	SB/SMB	4	506	1011	119%
E5	11	550	1.484	0.67	18	606	0.91	1.00	SB/SMB	18	445	889	124%
E6	9	450	1.207	0.83	14	580	0.78	1.00	SB/SMB	14	398	795	113%
E7	10	500	1.09	0.92	13	596	0.84	1.00	SB/SMB	13	450	899	111%
E7-1	16	800	0.376	2.66	5	665	1.20	1.00	SB/SMB	5	665	1330	120%
E8	14	700	1.936	0.52	23	594	1.18	1.60	BB/SB	23	610	1219	115%
E8-1	4	200	0.471	2.12	6	637	0.31	0.30	SMB	6	191	382	105%
E9	9	450	1.317	0.76	16	607	0.74	1.00	SB/SMB	16	607	1215	74%
S1	9	450	0.986	1.01	12	609	0.74	1.00	SB/SMB	12	406	811	111%
S2	3	150	0.874	1.14	10	572	0.26	0.30	SMB	9	154	309	97%
L1-1	4	200	0.928	1.08	11	593	0.34	0.60	SMB/MB	11	210	420	95%
L1-2	0	0	0.878	1.14	11	626	0.00	0.00	SMB	0	0	0	-
L2	2	100	1.005	1.00	12	597	0.17	0.30	SMB	7	104	209	96%
L3	6	300	0.443	2.26	5	564	0.53	0.60	SMB/MB	5	271	542	111%
L3-1	2	100	0.298	3.36	4	671	0.15	0.30	SMB	2	101	201	99%
L4	8	400	0.567	1.76	7	617	0.65	0.60	SMB/MB	7	370	741	108%
L5	4	200	0.851	1.18	10	588	0.34	0.30	SMB	9	159	317	126%
L6-1	2	100	1.291	0.77	15	581	0.17	0.30	SMB	9	105	209	96%
L6-2	2	100	1.097	0.91	13	593	0.17	0.30	SMB	8	109	219	91%
L7	3	150	0.96	1.04	12	625	0.24	0.30	SMB	10	156	313	96%
L8	2	100	2.014	0.50	24	596	0.17	0.30	SMB	14	104	209	96%
F1	0	0	0.488	2.05	6	615	0.00	0.00	SMB	0	0	0	-
F1-1	2	100	0.344	2.91	4	581	0.17	0.30	SMB	3	131	262	76%
F2	0	0	0.809	1.24	10	618	0.00	0.00	SMB/MM	0	0	0	-
F2-1	2	100	0.4	2.50	5	625	0.16	0.30	SMB	3	113	225	89%
F3	0	0	0.178	5.62	2	562	0.00	0.00	SMB	0	0	0	-
F4-1	2	100	0.332	3.01	4	602	0.17	0.30	SMB	3	136	271	74%
F4-2	2	100	0.168	5.95	2	595	0.17	0.30	SMB	2	179	357	56%
F4-3	2	100	0.171	5.85	2	585	0.17	0.30	SMB	2	175	351	57%
F4-4	4	200	0.268	3.73	3	560	0.36	0.60	SMB/MB	3	224	448	89%
F5-1	7	350	0.375	2.67	5	667	0.53	0.60	SMB/MB	5	320	640	109%
F5-2	2	100	0.536	1.87	6	560	0.18	0.30	SMB	4	112	224	89%
F6	0	0	0.589	1.70	7	594	0.00	0.00	SMB	0	0	0	-
F6-1	2	100	0.534	1.87	6	562	0.18	0.30	SMB	4	112	225	89%
F7	0	0	0.487	2.05	6	616	0.00	0.00	SMB	0	0	0	-
F8	0	0	0.16	6.25	2	625	0.00	0.00	SMB	0	0	0	-
F9	2	100	0.611	1.64	7	573	0.17	0.30	SMB	5	123	245	81%
F9-1	0	0	1.48	0.68	18	608	0.00	0.00	SMB	0	0	0	-
F10	1	50	0.442	2.26	5	566	0.09	0.30	SMB	3	102	204	49%
	185	9,600				25,221	0.38			264	9,284	18,568	
								daily			12	222,815	
								daily				187,655	
												84.2%	

Table 18.2-2 Bus Calculation in 2018

Segment	Hourly Unit	H.Pass.Demand	Travel Time	Max. H. Freq	R No of Bus RT	Capacity	Demand /Capacity	Adjust by SB	Type	Plan No.	H. Passen	Two Ways	Ridership
	12	50	20		12	50		1			50	2	
	Unit/h/s	pa/h/s	Hour/R	Times/h	5mmit	pass/h				Unit	pass/h	pass/h	
E1	39	1950	1.17	0.85	14	598	3.26	6.00	BB/BRT	14	1709	3419	114%
E2									(E1)				
E2-1	25	1250	0.239	4.18	3	628	1.99	6.00	BB/BRT	3	1925	3849	65%
E3	8	400	0.746	1.34	9	603	0.66	0.60	SMB/MB	9	362	724	111%
E4	17	850	0.356	2.81	4	562	1.51	1.60	BB	4	899	1798	95%
E5	28	1400	1.484	0.67	18	606	2.31	6.00	BB/BRT	18	1267	2534	111%
E6	24	1200	1.207	0.83	14	580	2.07	6.00	BB/BRT	14	1110	2220	108%
E7	23	1150	1.09	0.92	13	596	1.93	6.00	BB/BRT	13	1156	2312	99%
E7-1	22	1100	0.376	2.66	5	665	1.65	1.60	BB/SB	5	984	1968	112%
E8	27	1350	1.936	0.52	23	594	2.27	6.00	BB/BRT	23	1291	2583	105%
E8-1	5	250	0.471	2.12	6	637	0.39	0.60	SMB/MB	6	287	573	87%
E9	15	750	1.317	0.76	16	607	1.23	1.60	BB	16	972	1944	77%
S1	20	1000	0.986	1.01	12	609	1.64	1.60	BB/SB	12	852	1704	117%
S2	4	200	0.874	1.14	10	572	0.35	0.60	SMB/MB	10	206	412	97%
L1-1	12	600	0.928	1.08	11	593	1.01	1.00	SB/SMB	11	550	1099	109%
L1-2	0	0	0.878	1.14	11	626	0.00	0.30	SMB	0	0	0	-
L2	3	150	1.005	1.00	12	597	0.25	0.30	SMB	11	164	328	91%
L3	15	750	0.443	2.26	5	564	1.33	1.60	BB/SB	5	700	1400	107%
L3-1	3	150	0.298	3.36	4	671	0.22	0.30	SMB	3	151	302	99%
L4	10	500	0.567	1.76	7	617	0.81	1.00	SB/SMB	7	476	952	105%
L5	8	400	0.851	1.18	10	588	0.68	0.60	SMB/MB	10	353	705	113%
L6-1	3	150	1.291	0.77	15	581	0.26	0.30	SMB	13	151	302	99%
L6-2	3	150	1.097	0.91	13	593	0.25	0.30	SMB	11	150	301	100%
L7	4	200	0.96	1.04	12	625	0.32	0.60	SMB/MB	12	203	406	98%
L8	3	150	2.014	0.50	24	596	0.25	0.30	SMB	21	156	313	96%
F1	0	0	0.488	2.05	6	615	0.00	0.30	SMB	0	0	0	-
F1-1	5	250	0.344	2.91	4	581	0.43	0.60	SMB/MB	4	218	436	115%
F2	0	0	0.809	1.24	10	618	0.00	0.60	SMB/MM	10	371	742	0%
F2-1	5	250	0.4	2.50	5	625	0.40	0.60	SMB/MM	5	263	525	95%
F3	0	0	0.178	5.62	2	562	0.00	0.30	SMB	0	0	0	-
F4-1	5	250	0.332	3.01	4	602	0.42	0.60	SMB/MM	4	271	542	92%
F4-2	3	150	0.168	5.95	2	595	0.25	0.30	SMB	2	179	357	84%
F4-3	3	150	0.171	5.85	2	585	0.26	0.30	SMB	2	175	351	86%
F4-4	5	250	0.268	3.73	3	560	0.45	0.60	SMB/MM	3	280	560	89%
F5-1	15	750	0.375	2.67	5	667	1.13	1.00	SB/SMB	5	667	1333	113%
F5-2	3	150	0.536	1.87	6	560	0.27	0.30	SMB	6	168	336	89%
F6	0	0	0.589	1.70	7	594	0.00	0.30	SMB	0	0	0	-
F6-1	3	150	0.534	1.87	6	562	0.27	0.30	SMB	6	169	337	89%
F7	0	0	0.487	2.05	6	616	0.00	0.30	SMB	0	0	0	-
F8	0	0	0.16	6.25	2	625	0.00	0.30	SMB	0	0	0	-
F9	5	250	0.611	1.64	7	573	0.44	0.60	SMB/MM	7	270	540	93%
F9-1	0	0	1.48	0.68	18	608	0.00	0.30	SMB	0	0	0	-
F10	8	400	0.442	2.26	5	566	0.71	1.00	SB/SMB	5	385	769	104%
	369	19,050				25,221	0.76			310	19,488	38,976	
								daily			12	467,711	
								daily				382,615	
												81.8%	

Table 18.2-3 Bus Calculation in 2025

Segment	Hourly Unit	H.Pass. Demand	Travel Time	Max. H. Freq	R No of Bus RT	Capacity	Demand/ Capacity	Adjust by SB	Type	Plan No.	H. Passen	Two Ways	Ridership
	12	50	20		12	50		1			50	2	
	Unit/h/s	pa/h/s	hour/R	Times/h	5mnit	pass/h				Unit	pass/h	pass/h	
E1	81	4050	1.17	0.85	14	598	6.77	6.00	BRT	14	3590	7179	113%
E2									(E1)				
E2-1	55	2750	0.239	4.18	3	628	4.38	6.00	BRT	3	3766	7531	73%
E3	12	600	0.746	1.34	9	603	0.99	1.00	SB	9	603	1206	99%
E4	29	1450	0.356	2.81	4	562	2.58	6.00	BB/BRT	4	1517	3034	96%
E5	60	3000	1.484	0.67	18	606	4.95	6.00	BB/BRT	18	2898	5795	104%
E6	47	2350	1.207	0.83	14	580	4.05	6.00	BB/BRT	14	2204	4408	107%
E7	50	2500	1.09	0.92	13	596	4.19	6.00	BB/BRT	13	2367	4734	106%
E7-1	46	2300	0.376	2.66	5	665	3.46	6.00	BB/BRT	5	2234	4468	103%
E8	47	2350	1.936	0.52	23	594	3.96	6.00	BB/BRT	23	2314	4628	102%
E8-1	6	300	0.471	2.12	6	637	0.47	0.60	SMB/MB	6	287	573	105%
E9	19	950	1.317	0.76	16	607	1.56	1.60	BB	16	972	1944	98%
S1	48	2400	0.986	1.01	12	609	3.94	6.00	BRT	12	2312	4625	104%
S2	9	450	0.874	1.14	10	572	0.79	1.00	SB/SMB	10	435	870	104%
L1-1	24	1200	0.928	1.08	11	593	2.02	6.00	BB/BRT	11	1185	2371	101%
L1-2	3	150	0.878	1.14	11	626	0.24	0.30	SMB	11	188	376	80%
L2	3	150	1.005	1.00	12	597	0.25	0.30	SMB	12	179	358	84%
L3	33	1650	0.443	2.26	5	564	2.92	6.00	BB/BRT	5	1896	3792	87%
L3-1	3	150	0.298	3.36	4	671	0.22	0.30	SMB	4	201	403	75%
L4	11	550	0.567	1.76	7	617	0.89	1.00	SB/SMB	7	547	1093	101%
L5	16	800	0.851	1.18	10	588	1.36	1.60	BB/SB	10	729	1457	110%
L6-1	3	150	1.291	0.77	15	581	0.26	0.30	SMB	15	174	349	86%
L6-2	3	150	1.097	0.91	13	593	0.25	0.30	SMB	13	178	356	84%
L7	8	400	0.96	1.04	12	625	0.64	1.00	SB/SMB	12	396	792	101%
L8	3	150	2.014	0.50	24	596	0.25	0.30	SMB	24	179	357	84%
F1	3	150	0.488	2.05	6	615	0.24	0.30	SMB	6	184	369	81%
F1-1	9	450	0.344	2.91	4	581	0.77	1.00	SB/SMB	4	465	930	97%
F2	6	300	0.809	1.24	10	618	0.49	0.60	SMB/MM	10	315	630	95%
F2-1	6	300	0.4	2.50	5	625	0.48	0.60	SMB/MM	5	263	525	114%
F3	1	50	0.178	5.62	2	562	0.09	0.30	SMB	2	169	337	30%
F4-1	6	300	0.332	3.01	4	602	0.50	0.60	SMB/MM	4	316	633	95%
F4-2	6	300	0.168	5.95	2	595	0.50	0.60	SMB	2	357	714	84%
F4-3	6	300	0.171	5.85	2	585	0.51	0.60	SMB	2	351	702	86%
F4-4	17	850	0.268	3.73	3	560	1.52	1.60	BB	3	896	1791	95%
F5-1	37	1850	0.375	2.67	5	667	2.78	6.00	BB/BRT	5	2240	4480	83%
F5-2	3	150	0.536	1.87	6	560	0.27	0.30	SMB	6	168	336	89%
F6	1	50	0.589	1.70	7	594	0.08	0.30	SMB	2	51	102	98%
F6-1	3	150	0.534	1.87	6	562	0.27	0.30	SMB	6	169	337	89%
F7	3	150	0.487	2.05	6	616	0.24	0.30	SMB	6	185	370	81%
F8	1	50	0.16	6.25	2	625	0.08	0.30	SMB	1	94	188	53%
F9	6	300	0.611	1.64	7	573	0.52	0.60	SMB	7	344	687	87%
F9-1	1	50	1.48	0.68	18	608	0.08	0.30	SMB	5	51	101	99%
F10	13	650	0.442	2.26	5	566	1.15	1.00	SB/SMB	5	475	950	137%
	728	37,350				25,221	1.48			352	38,440	76,881	
								daily			12	922,571	
								daily				766,675	
												83.1%	