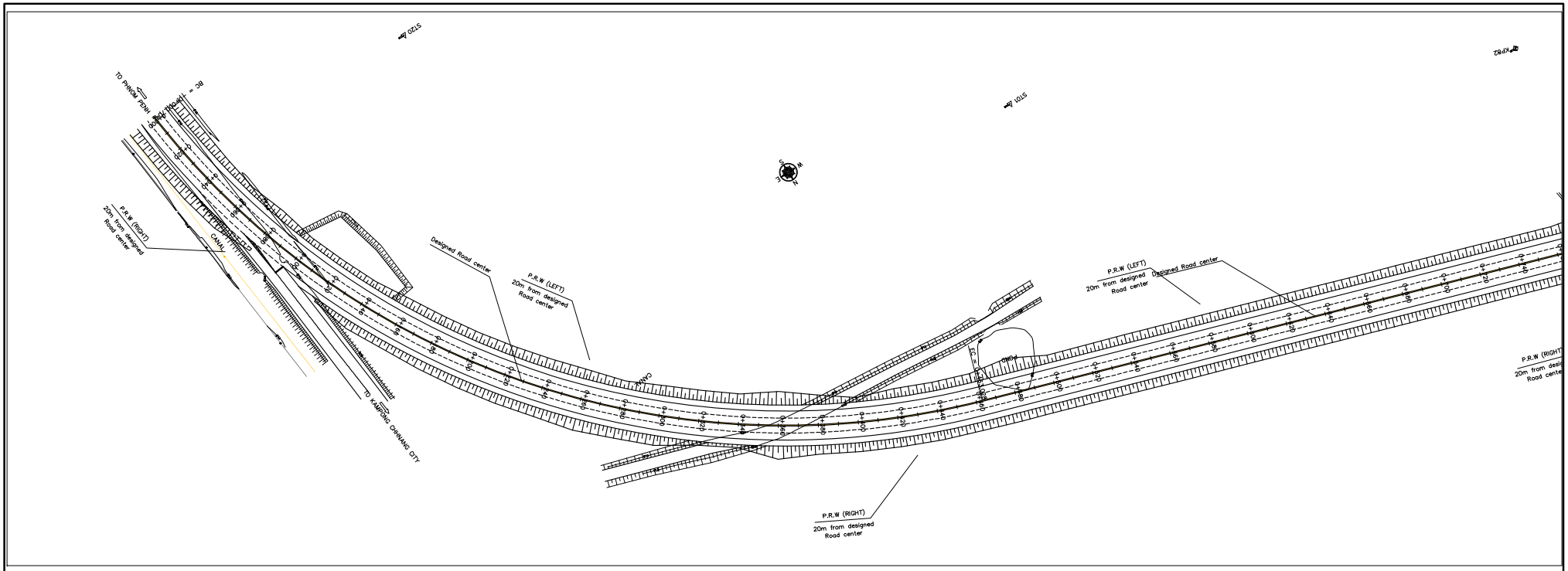
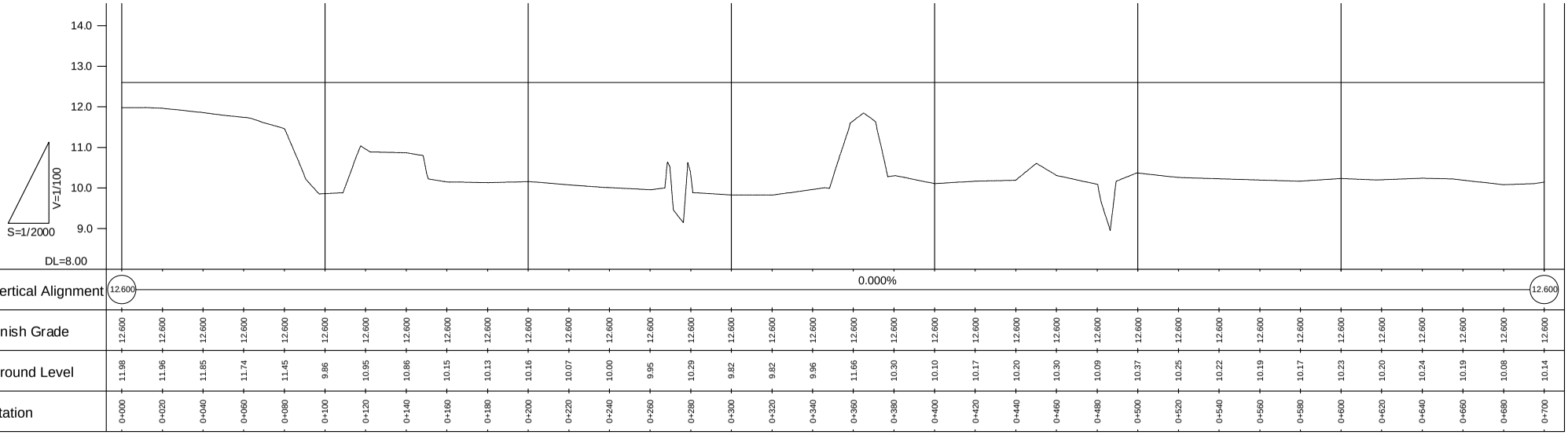
APPENDIX 9-2

PLAN AND PROFILE
OF
KAMPONG CHHNANG BYPASS





Station	Ground Level	Finish Grade
0+000	11.98	12.600
0+020	11.96	12.600
0+040	11.85	12.600
0+060	11.74	12.600
0+080	11.45	12.600
0+100	9.86	12.600
0+120	10.95	12.600
0+140	10.86	12.600
0+160	10.15	12.600
0+180	10.13	12.600
0+200	10.16	12.600
0+220	10.07	12.600
0+240	10.00	12.600
0+260	9.95	12.600
0+280	10.29	12.600
0+300	9.82	12.600
0+320	9.82	12.600
0+340	9.96	12.600
0+360	11.66	12.600
0+380	10.30	12.600
0+400	10.10	12.600
0+420	10.17	12.600
0+440	10.20	12.600
0+460	10.30	12.600
0+480	10.09	12.600
0+500	10.37	12.600
0+520	10.25	12.600
0+540	10.22	12.600
0+560	10.19	12.600
0+580	10.17	12.600
0+600	10.23	12.600
0+620	10.20	12.600
0+640	10.24	12.600
0+660	10.19	12.600
0+680	10.08	12.600
0+700	10.14	12.600

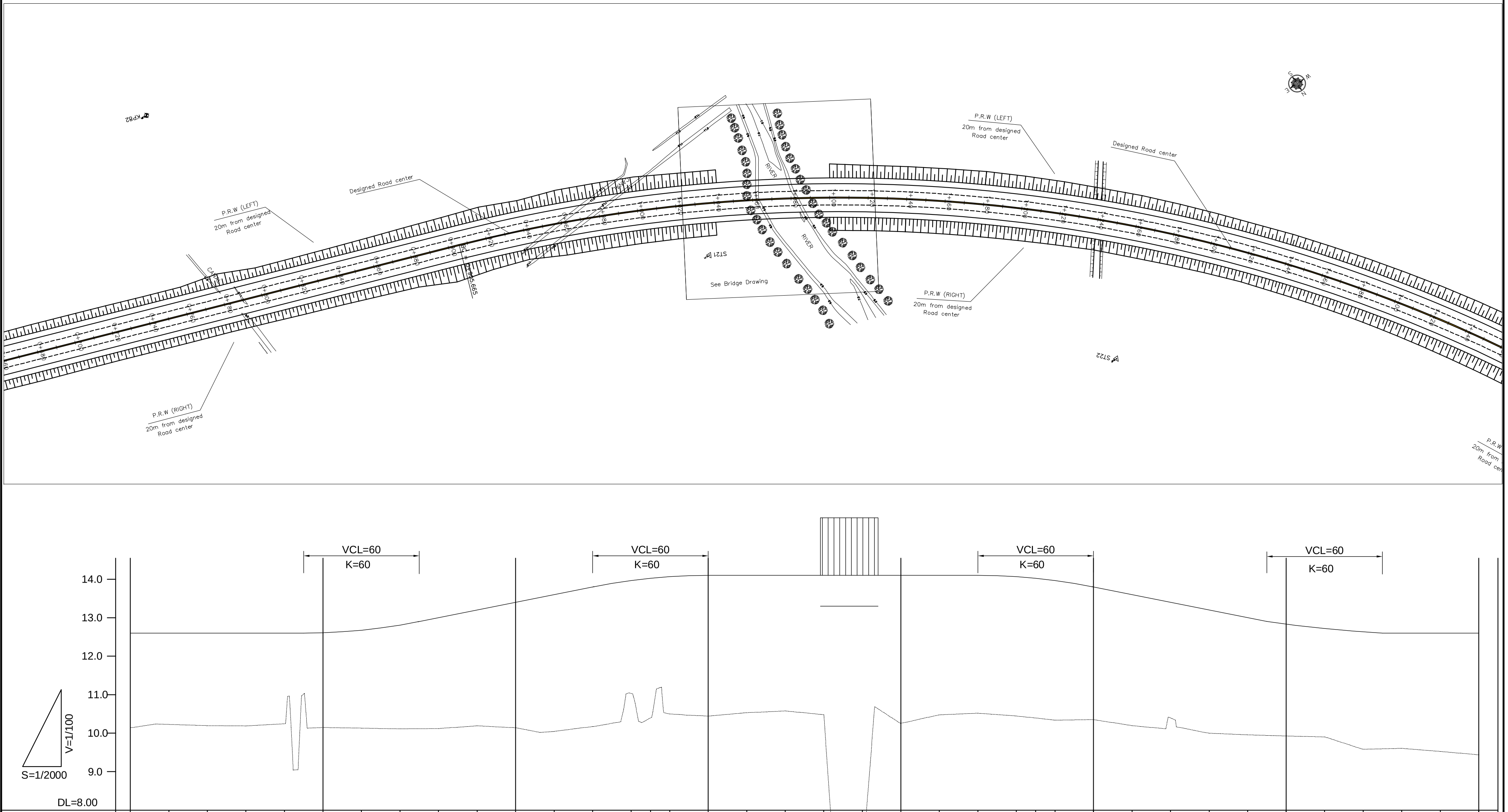
MINISTRY OF PUBLIC WORKS & TRANSPORT
KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT

TITLE : PLAN & PROFILE
Sta.0-000~Sta.0+700

Drawing No.	PL-1
Scale :	A3: 1/2000
Date :	MAR. 2013



Vertical Alignment	12.600	0.000%					12.600	+1.000%						14.100
Finish Grade	12.600	12.600	12.600	12.600	12.600	12.608	12.675	12.808	13.000	13.200	13.400	13.600	13.800	13.967
Ground Level	10.14	10.23	10.20	10.19	10.25	10.15	10.13	10.11	10.12	10.19	10.14	10.05	10.17	11.03
Station	0+700	0+720	0+740	0+760	0+780	0+800	0+820	0+840	0+860	0+880	0+900	0+920	0+940	0+960

Vertical Alignment	14.100					0.000%						14.100
Finish Grade	14.025	14.067	14.100	14.100	14.100	14.100	14.100	14.100	14.100	14.100	14.067	14.025
Ground Level		10.50	10.45	10.53	10.58	10.48	7.19	10.26	10.48	10.52	10.45	
Station	0+970	0+980	1+000	1+020	1+040	1+060	1+080	1+100	1+120	1+140	1+160	1+170

Vertical Alignment				-1.000%				12.600				12.600
Finish Grade	13.967	13.800	13.600	13.400	13.200	13.000	12.808	12.675	12.608	12.600	12.600	12.600
Ground Level	10.34	10.35	10.20	10.37	10.00	9.96	9.93	9.91	9.58	9.60	9.53	9.44
Station	1+180	1+200	1+220	1+240	1+260	1+280	1+300	1+320	1+340	1+360	1+380	1+400

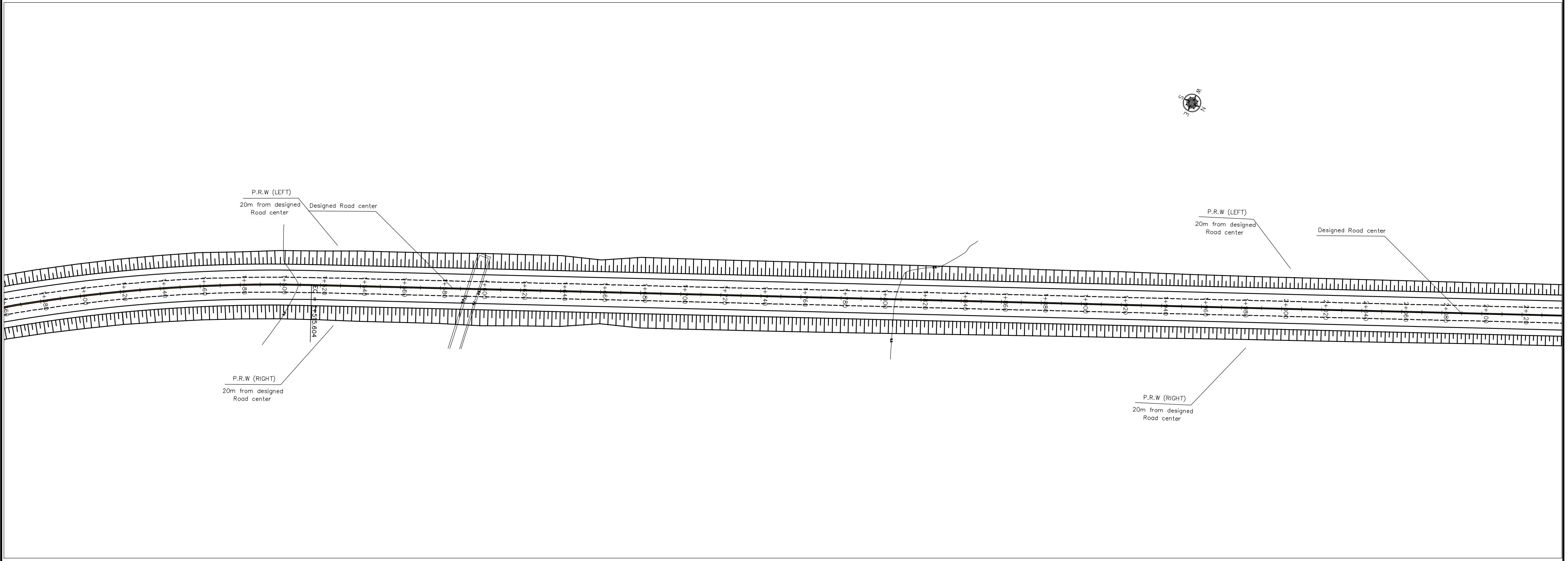
MINISTRY OF PUBLIC WORKS & TRANSPORT
KINGDOM OF CAMBODIA

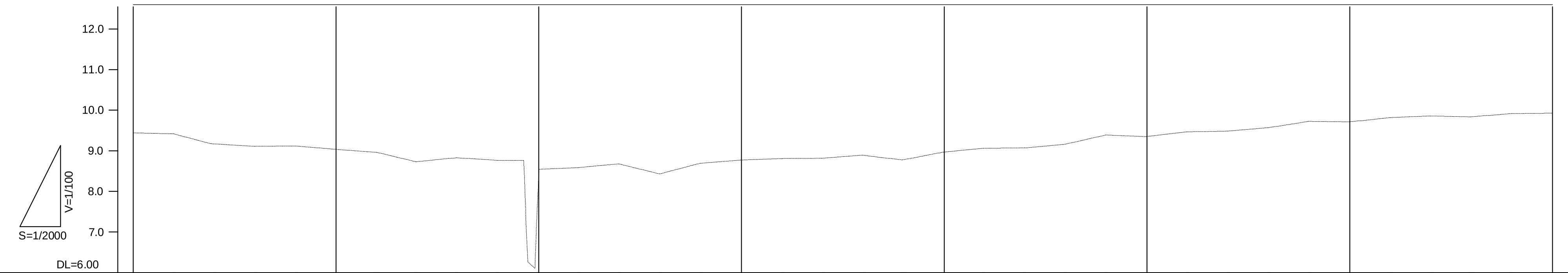
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

PREPARATORY SURVEY FOR NATIONAL
ROAD NO.5 (SOUTH SECTION)
IMPROVEMENT PROJECT

TITLE : PLAN & PROFILE
Sta.0+700~Sta.1+400

Drawing No.	PL-2
Scale :	A3: 1/2000
Date :	MAR. 2013





Vertical Alignment	12.600	0.000%	12.600

Station	1+400	1+420	1+440	1+460	1+480	1+500	1+520	1+540	1+560	1+580	1+600	1+620	1+640	1+660	1+680	1+700	1+720	1+740	1+760	1+780	1+800	1+820	1+840	1+860	1+880	1+900	1+920	1+940	1+960	1+980	2+000	2+020	2+040	2+060	2+080	2+100
Finish Grade	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600
Ground Level	9.44	9.42	9.17	9.11	9.12	9.03	8.96	8.73	8.82	8.76	8.22	8.59	8.67	8.43	8.69	8.77	8.80	8.82	8.89	8.78	8.97	9.06	9.07	9.16	9.39	9.35	9.46	9.48	9.57	9.72	9.71	9.81	9.85	9.83	9.91	9.92

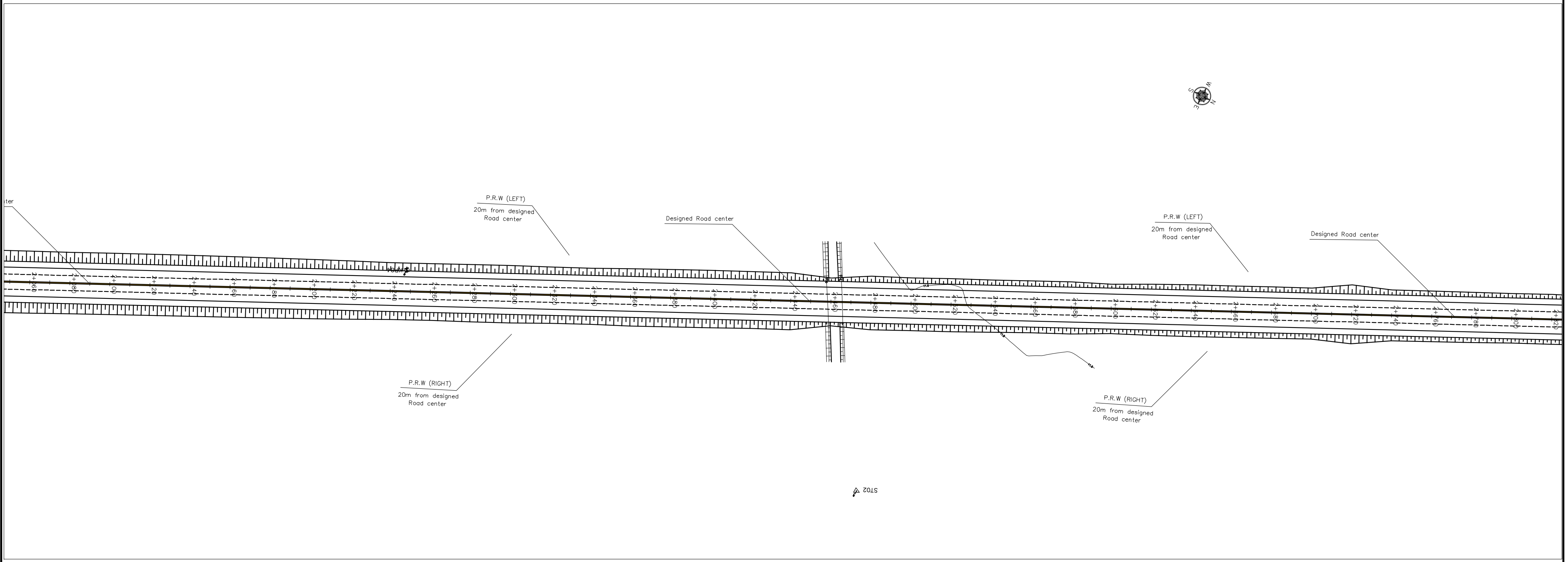
MINISTRY OF PUBLIC WORKS & TRANSPORT
KINGDOM OF CAMBODIA

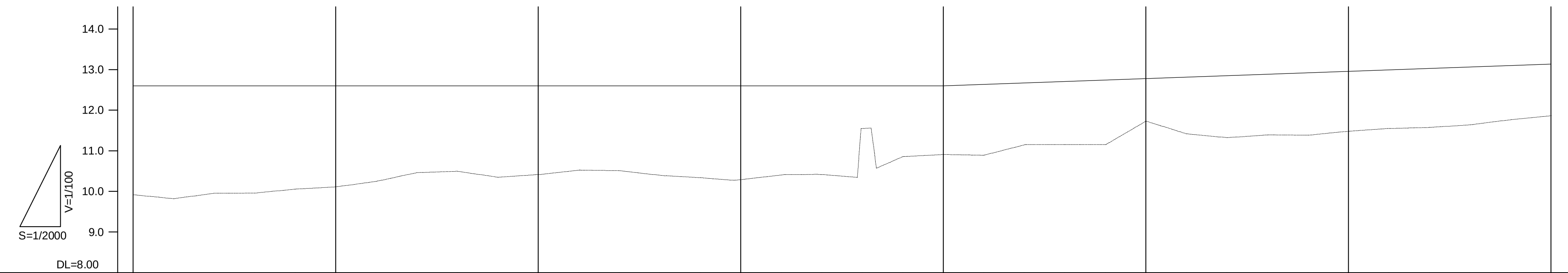
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT

TITLE : PLAN & PROFILE
Sta.1+400~Sta.2+100

Drawing No.	PL-3
Scale :	A3: 1/2000
Date :	MAR. 2013

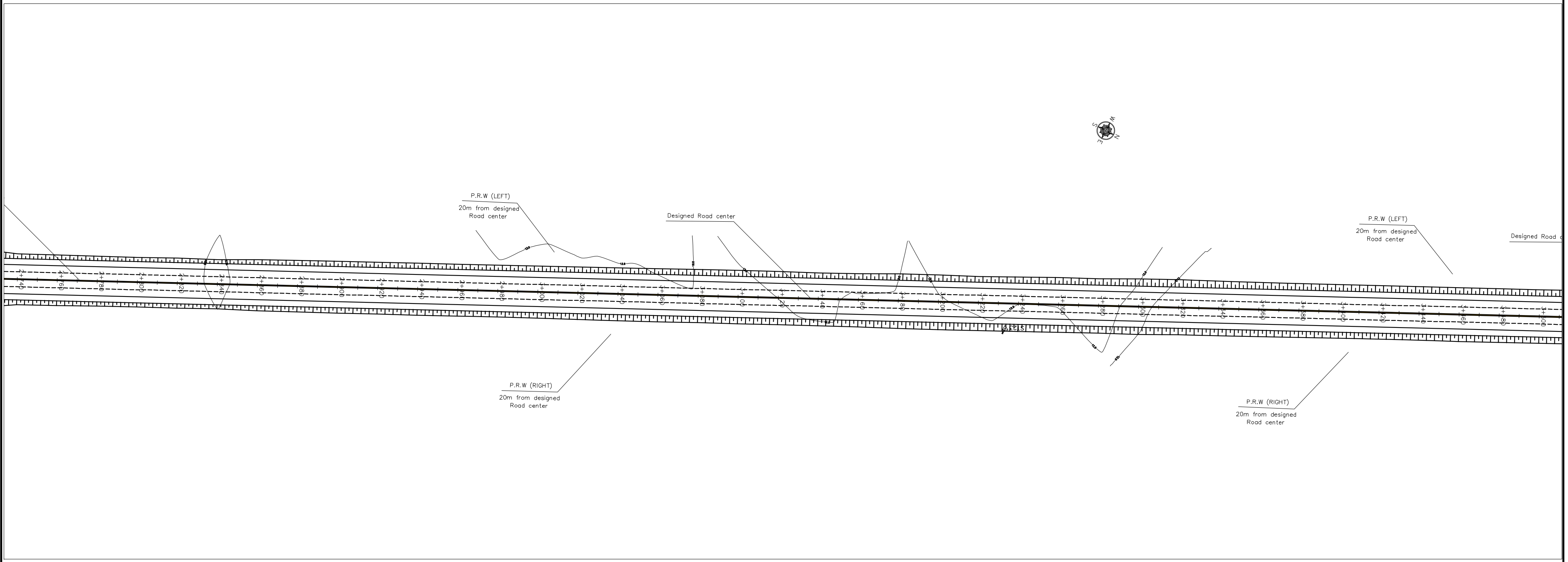


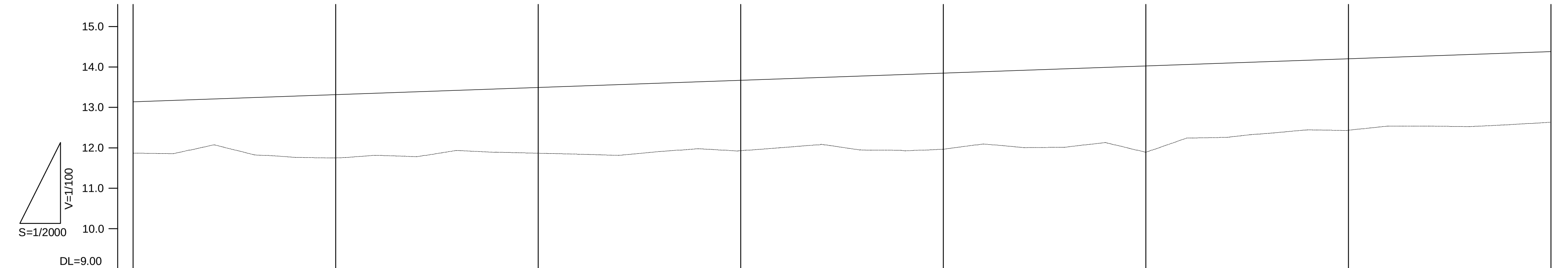


	2+100	2+120	2+140	2+160	2+180	2+200	2+220	2+240	2+260	2+280	2+300	2+320	2+340	2+360	2+380	2+400	2+420	2+440
Vertical Alignment	12.600										0.000%							
Finish Grade	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600	12.600
Ground Level	9.92	9.82	9.96	9.96	10.06	10.12	10.25	10.47	10.50	10.35	10.42	10.53	10.51	10.40	10.34	10.30	10.41	10.42
Station	2+100	2+120	2+140	2+160	2+180	2+200	2+220	2+240	2+260	2+280	2+300	2+320	2+340	2+360	2+380	2+400	2+420	2+440

	2+460	2+480	2+500	2+520	2+540	2+560	2+580	2+600	2+620	2+640	2+660	2+680	2+700	2+720	2+740	2+760	2+780	2+800
Vertical Alignment			12.600							+0.178%								13.134
Finish Grade	12.600	12.600	12.600	12.636	12.671	12.707	12.742	12.778	12.814	12.849	12.885	12.920	12.956	12.992	13.027	13.063	13.098	13.134
Ground Level	11.55	10.86	10.91	10.90	11.15	11.16	11.15	11.73	11.42	11.33	11.40	11.39	11.49	11.55	11.58	11.64	11.77	11.87
Station	2+460	2+480	2+500	2+520	2+540	2+560	2+580	2+600	2+620	2+640	2+660	2+680	2+700	2+720	2+740	2+760	2+780	2+800

MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : PLAN & PROFILE Sta.2+100~Sta.2+800	Drawing No. PL-4 Scale : A3: 1/2000 Date : MAR. 2013





Vertical Alignment: 13.134 — +0.178% — 14.380

Station	2+800	2+820	2+840	2+860	2+880	2+900	2+920	2+940	2+960	2+980	3+000	3+020	3+040	3+060	3+080	3+100	3+120	3+140
Finish Grade	13.134	13.169	13.205	13.241	13.276	13.312	13.347	13.383	13.419	13.454	13.490	13.525	13.561	13.597	13.632	13.668	13.703	13.739
Ground Level	11.87	11.85	12.07	11.82	11.76	11.75	11.81	11.78	11.93	11.89	11.86	11.84	11.81	11.90	11.97	11.92	12.00	12.08

Station	3+160	3+180	3+200	3+220	3+240	3+260	3+280	3+300	3+320	3+340	3+360	3+380	3+400	3+420	3+440	3+460	3+480	3+500
Finish Grade	13.775	13.810	13.846	13.881	13.917	13.953	13.988	14.024	14.059	14.095	14.131	14.166	14.202	14.237	14.273	14.308	14.344	14.380
Ground Level	11.95	11.93	11.96	12.09	12.00	12.01	12.13	11.89	12.23	12.26	12.35	12.44	12.43	12.54	12.53	12.52	12.57	12.63

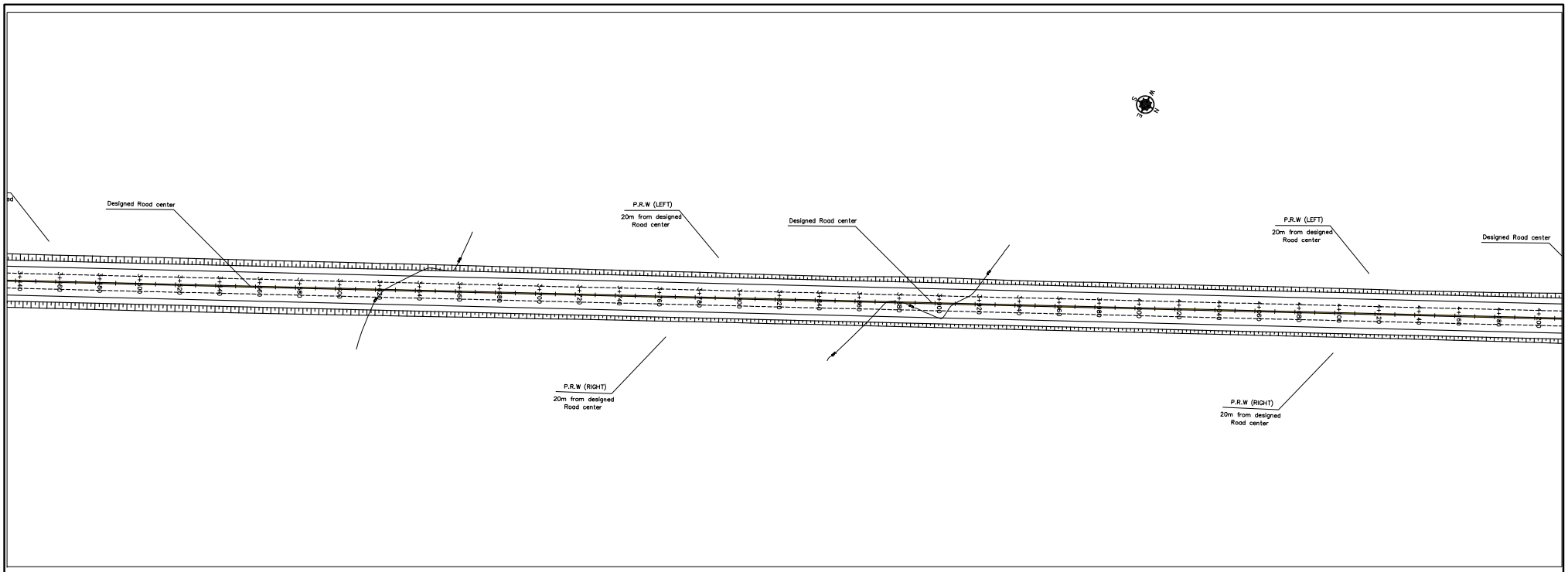
MINISTRY OF PUBLIC WORKS & TRANSPORT
KINGDOM OF CAMBODIA

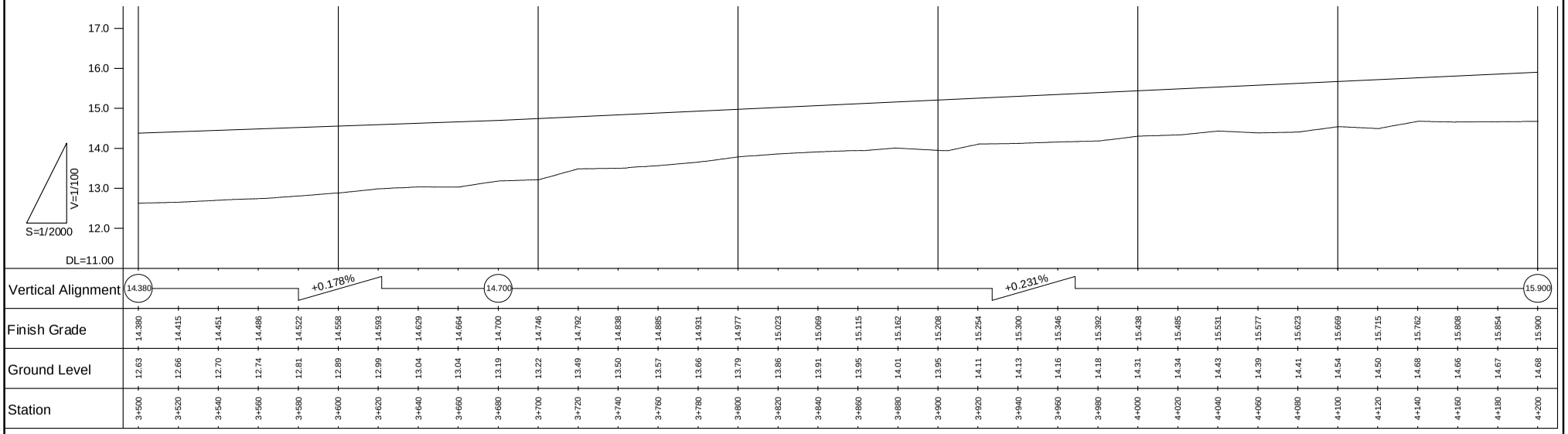
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT

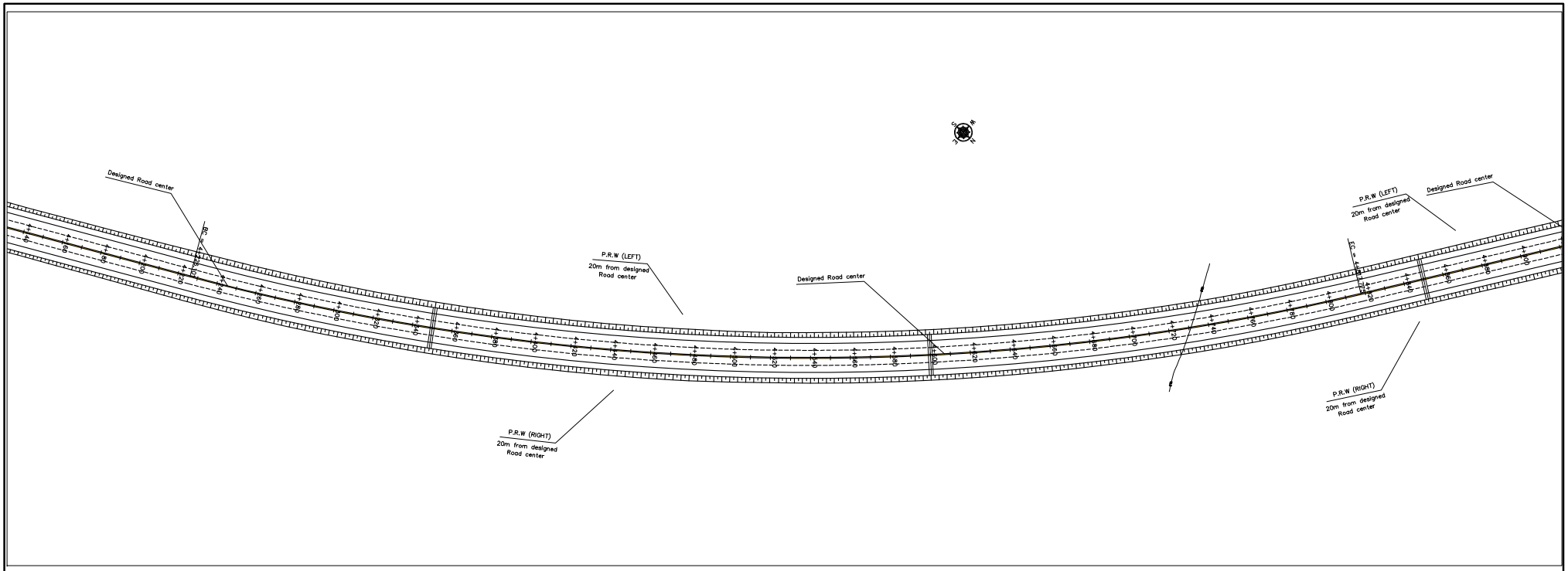
TITLE : PLAN & PROFILE
Sta.2+800~Sta.3+500

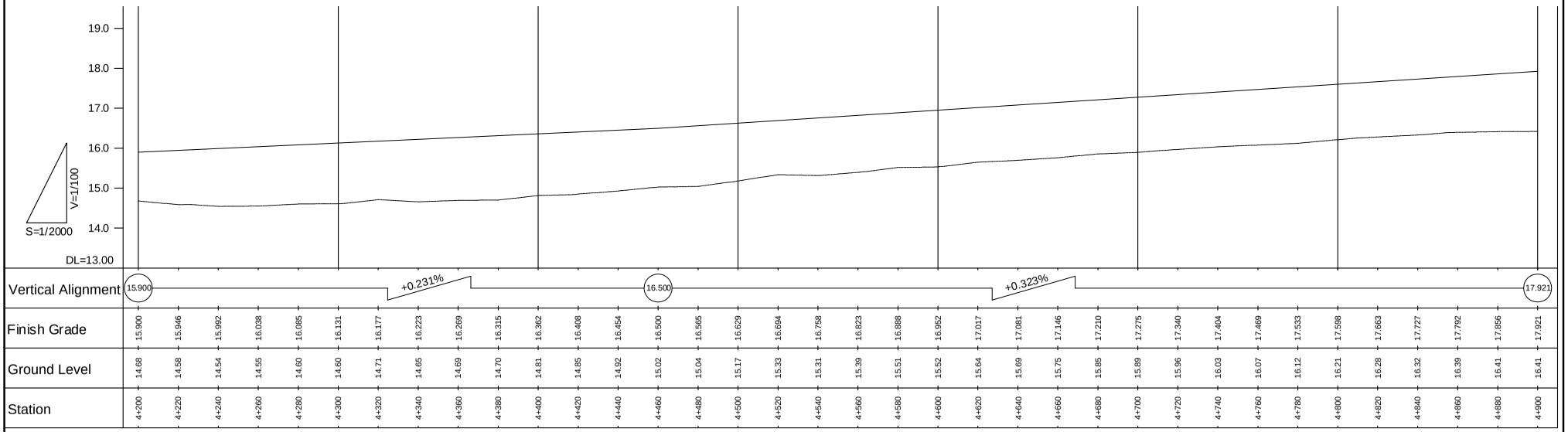
Drawing No.	PL-5
Scale :	A3: 1/2000
Date :	MAR. 2013



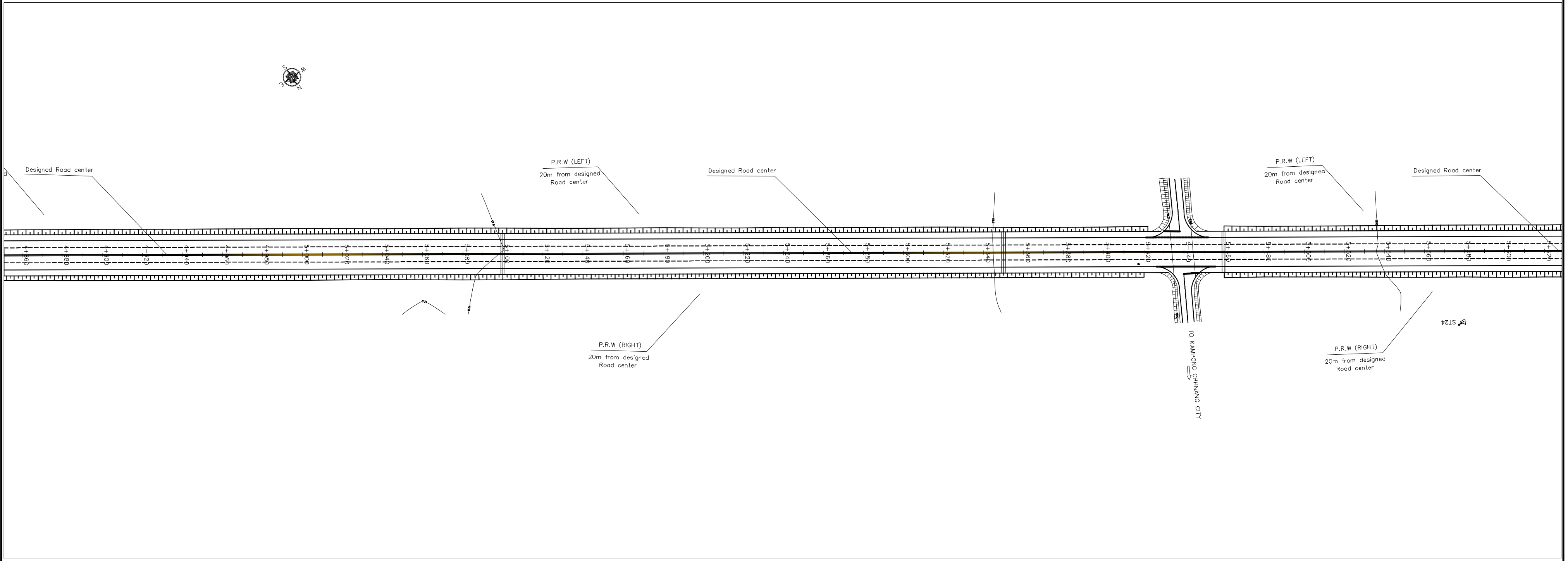


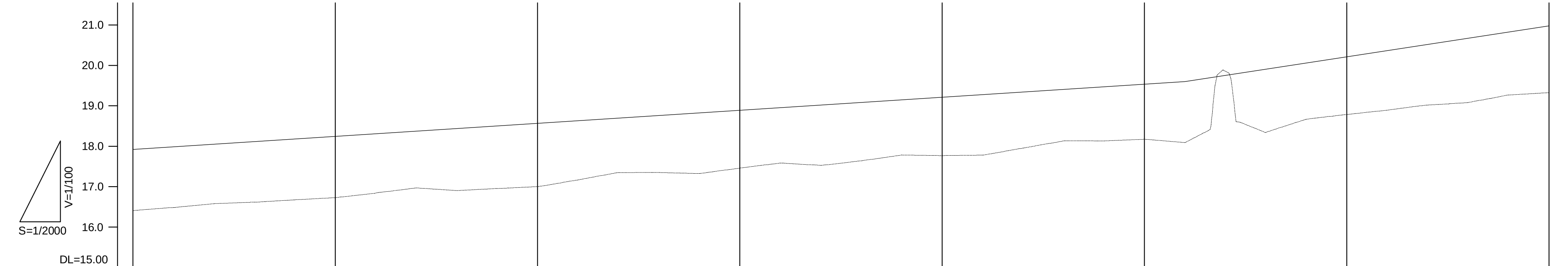
MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : PLAN & PROFILE Sta.3+500~Sta.4+200	Drawing No. PL-6 Scale : A3: 1/2000 Date : MAR. 2013





MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : PLAN & PROFILE Sta.4+200~Sta.4+900	Drawing No. PL-7 Scale : A3: 1/2000 Date : MAR. 2013





Vertical Alignment: 17.921 — +0.323% — 19.600 — +0.764% — 20.975

Station	Finish Grade	Ground Level
4+900	17.921	16.41
4+920	17.985	16.49
4+940	18.050	16.58
4+960	18.115	16.62
4+980	18.179	16.68
5+000	18.244	16.73
5+020	18.308	16.84
5+040	18.373	16.97
5+060	18.438	16.91
5+080	18.502	16.96
5+100	18.567	17.00
5+120	18.631	17.17
5+140	18.696	17.35
5+160	18.760	17.35
5+180	18.825	17.33
5+200	18.890	17.46
5+220	18.954	17.59
5+240	19.019	17.53
5+260	19.083	17.64
5+280	19.148	17.78
5+300	19.213	17.77
5+320	19.277	17.78
5+340	19.342	17.96
5+360	19.406	18.13
5+380	19.471	18.14
5+400	19.535	18.18
5+420	19.600	18.10
5+440	19.753	19.86
5+460	19.906	18.35
5+480	20.058	18.67
5+500	20.211	18.79
5+520	20.364	18.90
5+540	20.517	19.02
5+560	20.669	19.08
5+580	20.822	19.27
5+600	20.975	19.33

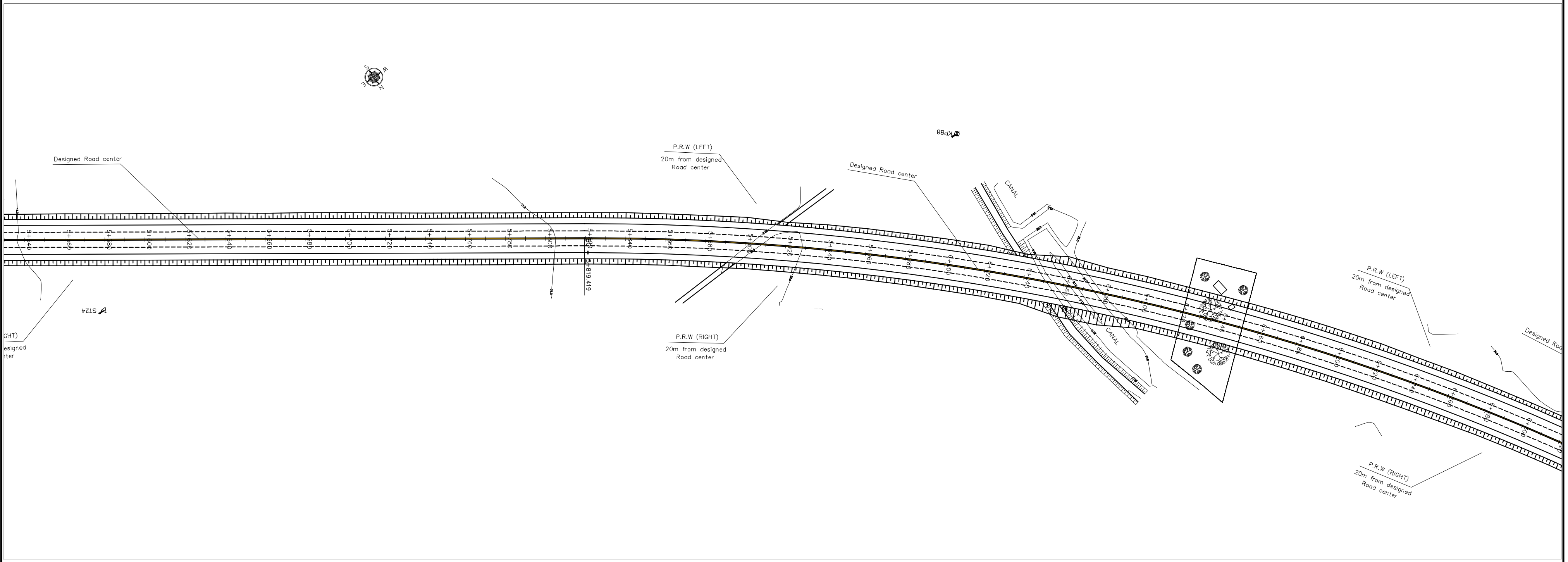
MINISTRY OF PUBLIC WORKS & TRANSPORT
KINGDOM OF CAMBODIA

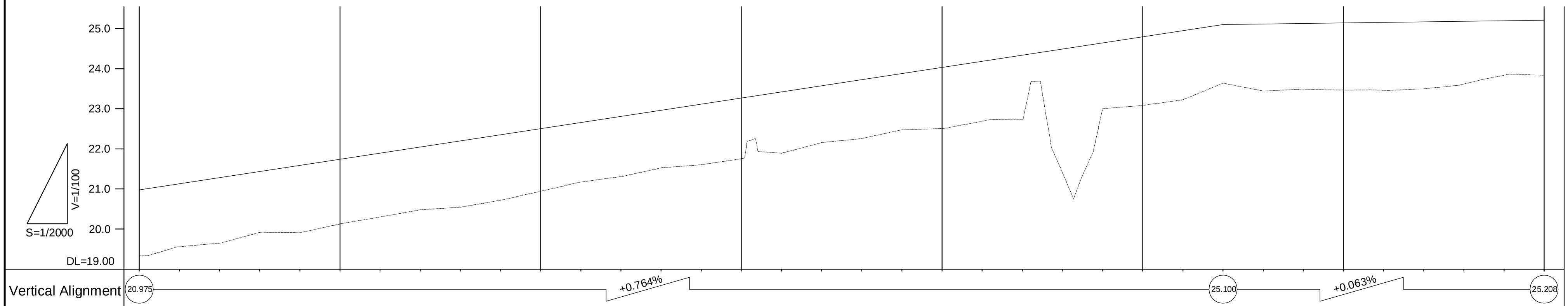
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT

TITLE : PLAN & PROFILE
Sta.4+900~Sta5+600

Drawing No.	PL-8
Scale :	A3: 1/2000
Date :	MAR. 2013





Station	5+600	5+620	5+640	5+660	5+680	5+700	5+720	5+740	5+760	5+780	5+800	5+820	5+840	5+860	5+880	5+900	5+920	5+940
Finish Grade	20.975	21.128	21.281	21.433	21.586	21.739	21.892	22.044	22.197	22.350	22.503	22.656	22.808	22.961	23.114	23.267	23.419	23.572
Ground Level	19.33	19.56	19.65	19.92	19.91	20.13	20.30	20.48	20.55	20.72	20.94	21.17	21.31	21.53	21.60	21.75	21.89	22.16

Station	5+960	5+980	6+000	6+020	6+040	6+060	6+080	6+100	6+120	6+140	6+160	6+180	6+200	6+220	6+240	6+260	6+280	6+300
Finish Grade	23.725	23.878	24.031	24.183	24.336	24.489	24.642	24.794	24.947	25.100	25.114	25.127	25.141	25.154	25.168	25.181	25.195	25.208
Ground Level	22.26	22.47	22.51	22.69	22.74	21.41	23.00	23.08	23.22	23.64	23.44	23.47	23.47	23.46	23.50	23.62	23.84	23.84

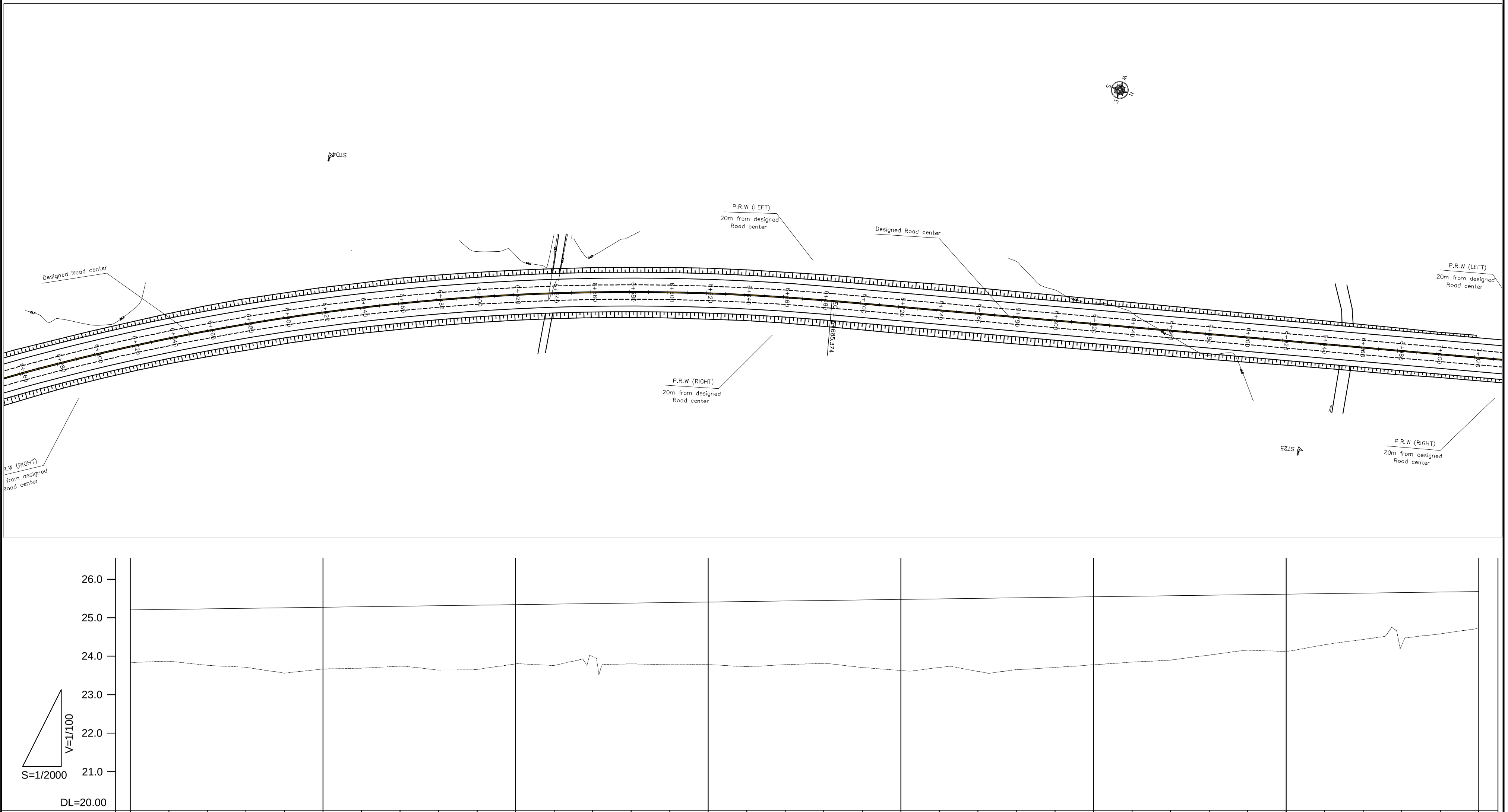
MINISTRY OF PUBLIC WORKS & TRANSPORT
KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT

TITLE : PLAN & PROFILE
Sta.5+600~Sta6+300

Drawing No.	PL-9
Scale :	A3: 1/2000
Date :	MAR. 2013



Vertical Alignment: 25.208 — +0.063% — 25.682

Station	Finish Grade	Ground Level
6+300	25.208	23.84
6+320	25.222	23.86
6+340	25.235	23.76
6+360	25.249	23.71
6+380	25.263	23.56
6+400	25.276	23.66
6+420	25.290	23.68
6+440	25.303	23.73
6+460	25.317	23.64
6+480	25.330	23.65
6+500	25.344	23.80
6+520	25.357	23.76
6+540	25.371	23.99
6+560	25.384	23.80
6+580	25.398	23.77
6+600	25.411	23.78
6+620	25.425	23.72
6+640	25.439	23.78
6+660	25.452	23.81
6+680	25.466	23.70
6+700	25.479	23.63
6+720	25.493	23.70
6+740	25.506	23.60
6+760	25.520	23.65
6+780	25.533	23.70
6+800	25.547	23.77
6+820	25.560	23.84
6+840	25.574	23.90
6+860	25.588	24.03
6+880	25.601	24.16
6+900	25.615	24.11
6+920	25.628	24.29
6+940	25.642	24.43
6+960	25.655	24.28
6+980	25.669	24.58
7+000	25.682	24.72

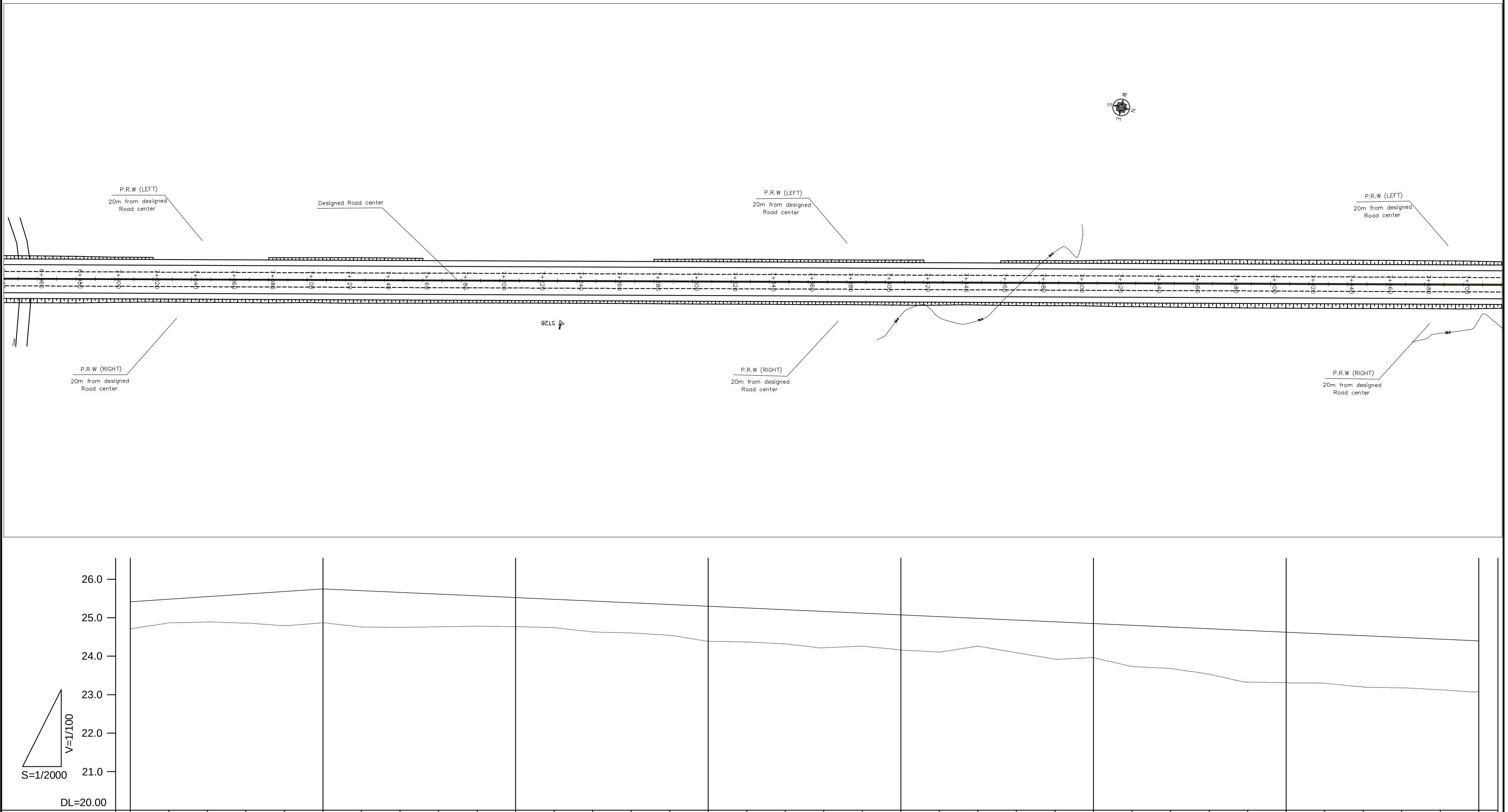
MINISTRY OF PUBLIC WORKS & TRANSPORT
KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT

TITLE : PLAN & PROFILE
Sta.6+300~Sta.7+000

Drawing No. PL-10
Scale : A3: 1/2000
Date : MAR. 2013



Vertical Alignment: 25.682 — +0.063% — 25.750 — -0.225% — 24.400

Station	Finish Grade	Ground Level
7+000	25.682	24.72
7+020	25.696	24.86
7+040	25.709	24.89
7+060	25.723	24.86
7+080	25.736	24.79
7+100	25.750	24.87
7+120	25.705	24.76
7+140	25.660	24.75
7+160	25.615	24.76
7+180	25.570	24.78
7+200	25.525	24.77
7+220	25.480	24.74
7+240	25.435	24.63
7+260	25.390	24.60
7+280	25.345	24.54
7+300	25.300	24.39
7+320	25.255	24.37
7+340	25.210	24.32
7+360	25.165	24.22
7+380	25.120	24.26
7+400	25.075	24.16
7+420	25.030	24.10
7+440	24.985	24.26
7+460	24.940	24.09
7+480	24.895	23.92
7+500	24.850	23.96
7+520	24.805	23.73
7+540	24.760	23.68
7+560	24.715	23.53
7+580	24.670	23.32
7+600	24.625	23.31
7+620	24.580	23.30
7+640	24.535	23.20
7+660	24.490	23.17
7+680	24.445	23.13
7+700	24.400	23.09

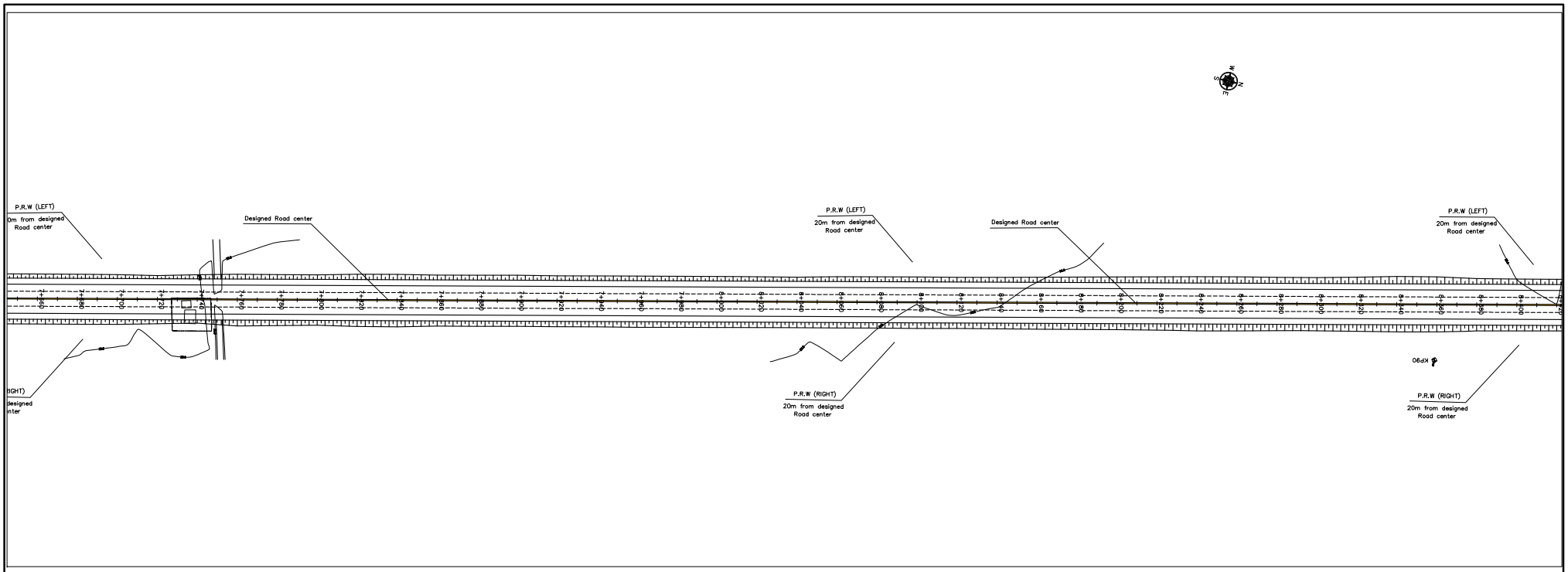
MINISTRY OF PUBLIC WORKS & TRANSPORT
KINGDOM OF CAMBODIA

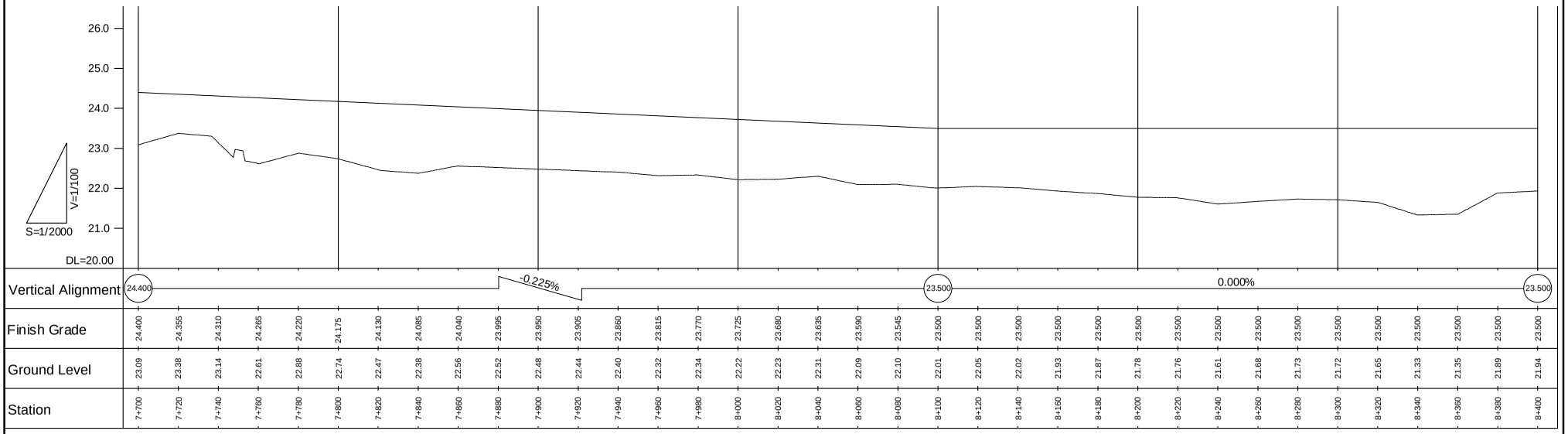
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT

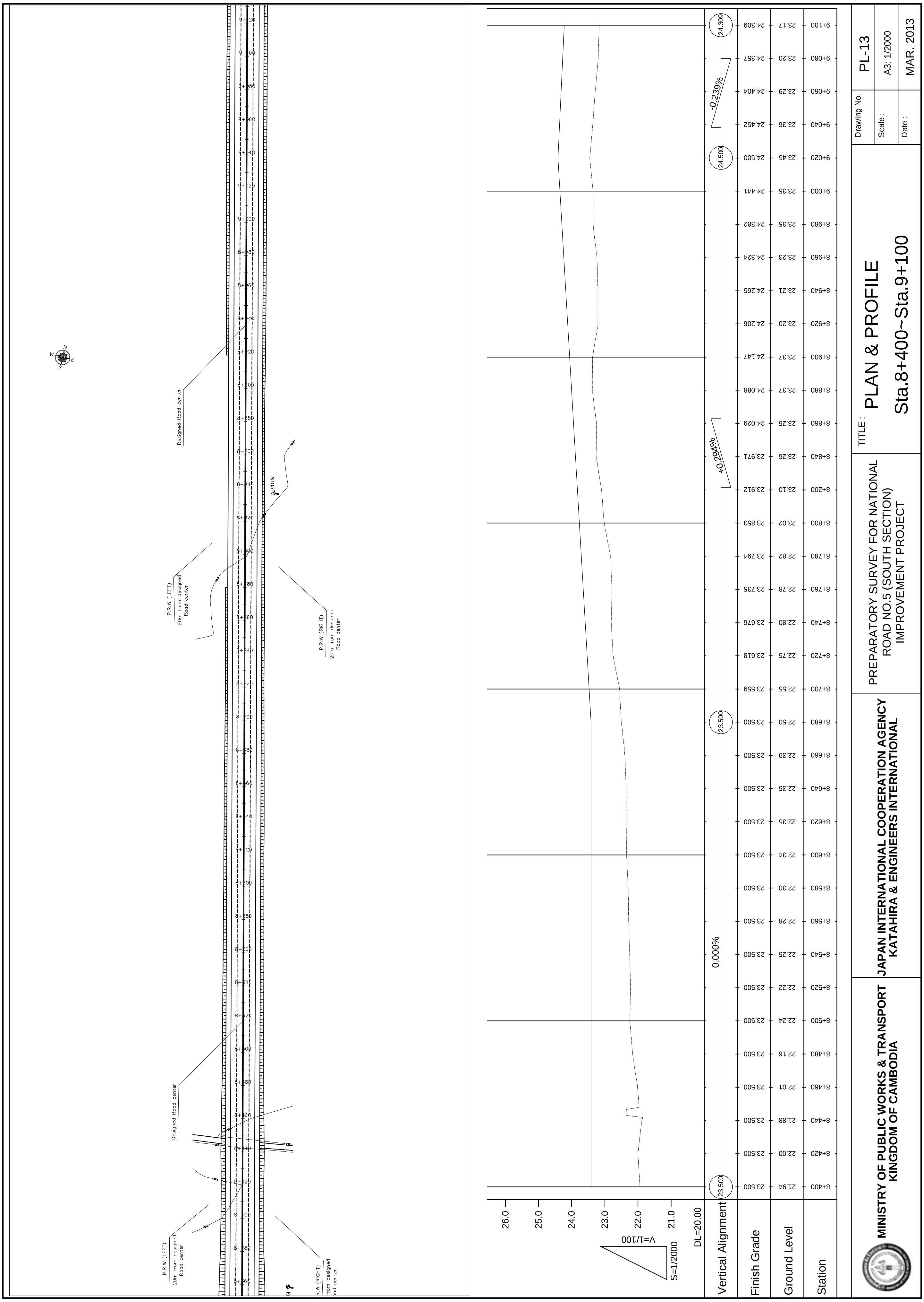
TITLE : PLAN & PROFILE
Sta.7+000~Sta.7+700

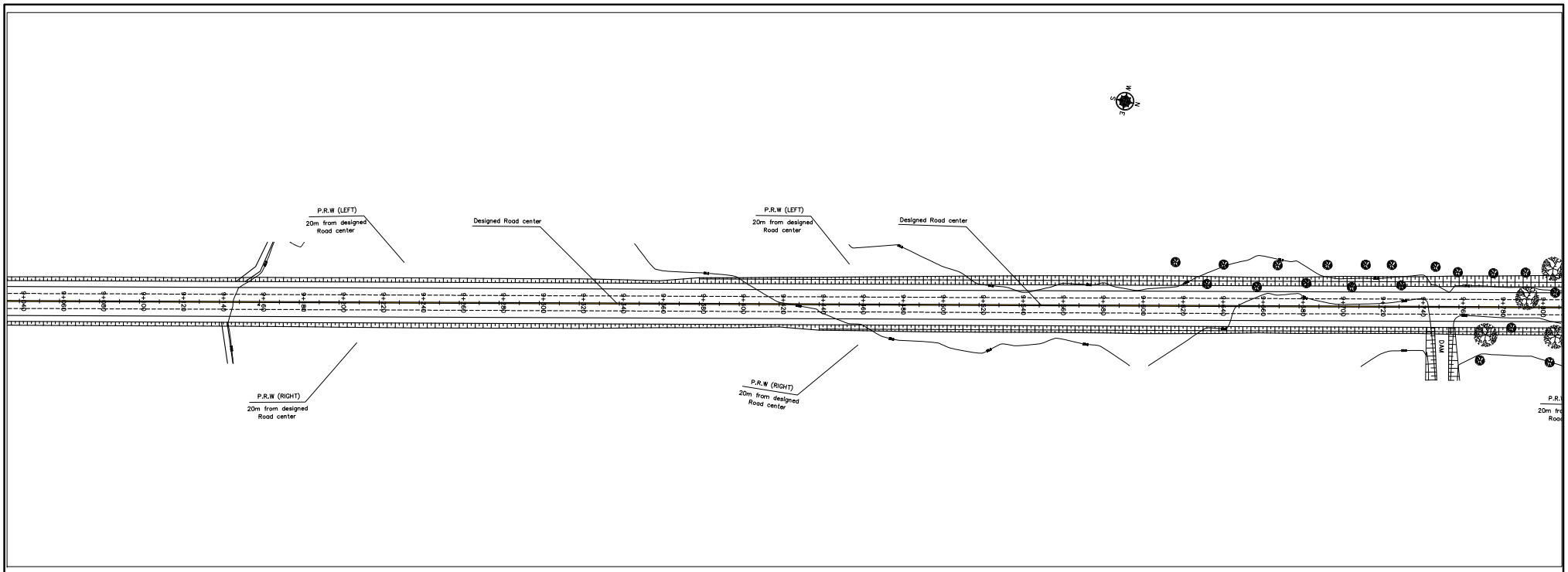
Drawing No.: PL-11
Scale : A3: 1/2000
Date : MAR. 2013

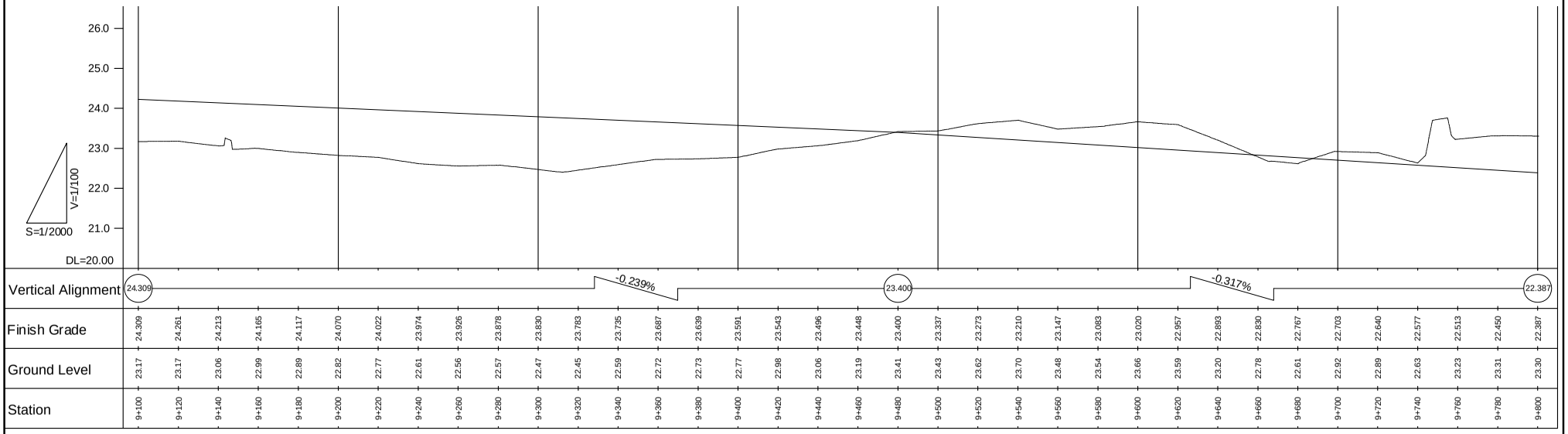




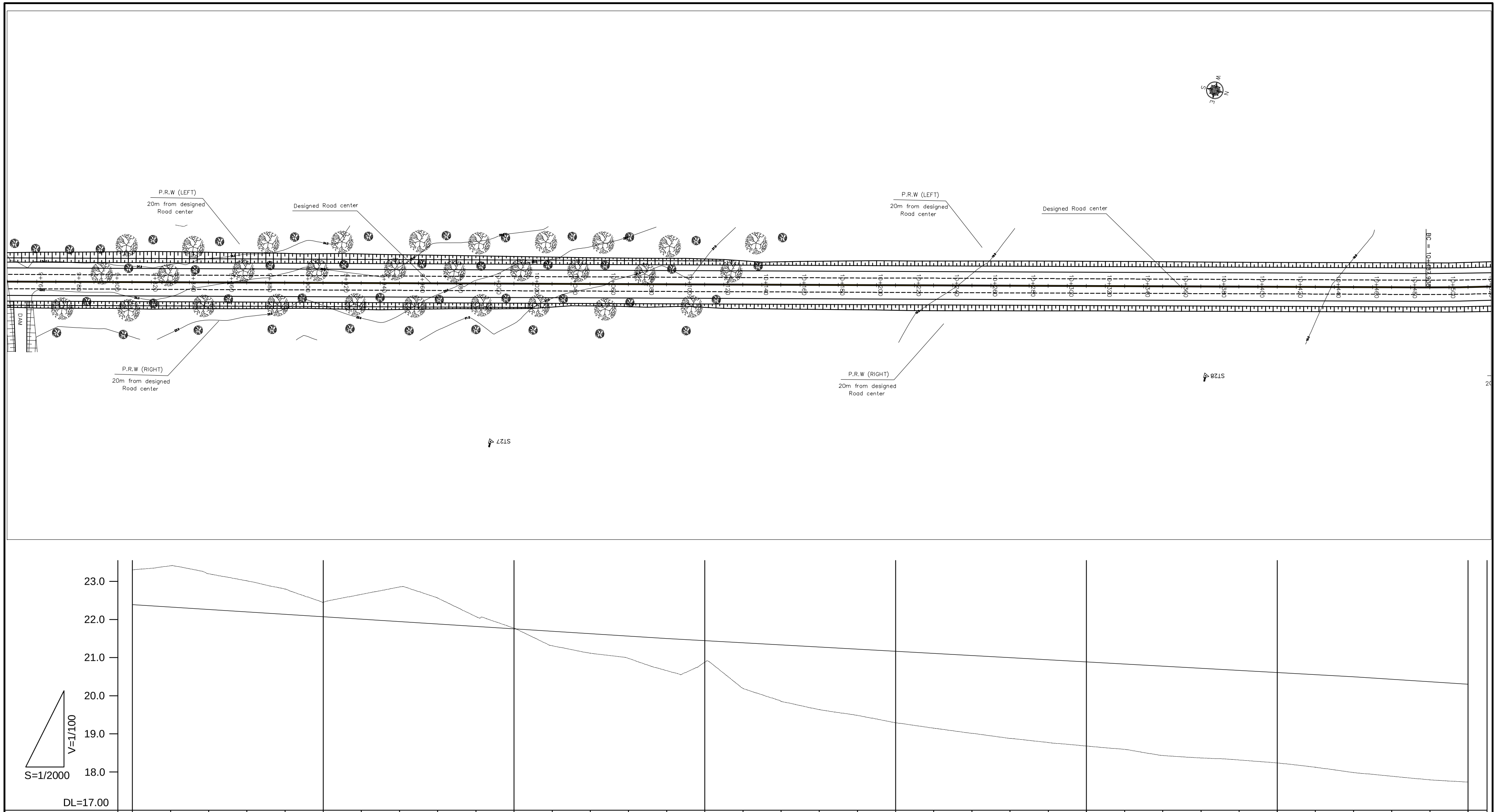
MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : PLAN & PROFILE Sta.7+700~Sta.8+400	Drawing No. PL-12 Scale : A3: 1/2000 Date : MAR. 2013


MINISTRY OF PUBLIC WORKS & TRANSPORT
KINGDOM OF CAMBODIA
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL
PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT
TITLE :
PLAN & PROFILE
Sta.8+400~Sta.9+100
Drawing No. PL-13
Scale : A3: 1/2000
Date : MAR. 2013
Designed Road center
P.R.W (LEFT) 20m from designed Road center
P.R.W (RIGHT) 20m from designed Road center
S=1/2000
V=1/100
DL=20.00
Vertical Alignment
Finish Grade
Ground Level
Station
0.000%
+0.294%
-0.239%
23.500
24.500
24.309
Station: 8+400, 8+420, 8+440, 8+460, 8+480, 8+500, 8+520, 8+540, 8+560, 8+580, 8+600, 8+620, 8+640, 8+660, 8+680, 8+700, 8+720, 8+740, 8+760, 8+780, 8+800, 8+820, 8+840, 8+860, 8+880, 8+900, 8+920, 8+940, 8+960, 8+980, 9+000, 9+020, 9+040, 9+060, 9+080, 9+100
Ground Level: 21.94, 22.00, 21.88, 22.01, 22.16, 22.24, 22.22, 22.25, 22.28, 22.30, 22.34, 22.35, 22.35, 22.39, 22.50, 22.55, 22.75, 22.80, 22.78, 22.82, 23.02, 23.10, 23.26, 23.25, 23.37, 23.37, 23.20, 23.21, 23.23, 23.35, 23.35, 23.45, 23.36, 23.29, 23.20, 23.17
Finish Grade: 23.500, 23.500, 23.500, 23.500, 23.500, 23.500, 23.500, 23.500, 23.500, 23.500, 23.500, 23.500, 23.500, 23.500, 23.500, 23.559, 23.618, 23.676, 23.735, 23.794, 23.853, 23.912, 23.971, 24.029, 24.088, 24.147, 24.206, 24.265, 24.324, 24.382, 24.441, 24.500, 24.452, 24.404, 24.357, 24.309





MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : PLAN & PROFILE Sta.9+100~Sta.9+800	Drawing No. PL-14 Scale : A3: 1/2000 Date : MAR. 2013



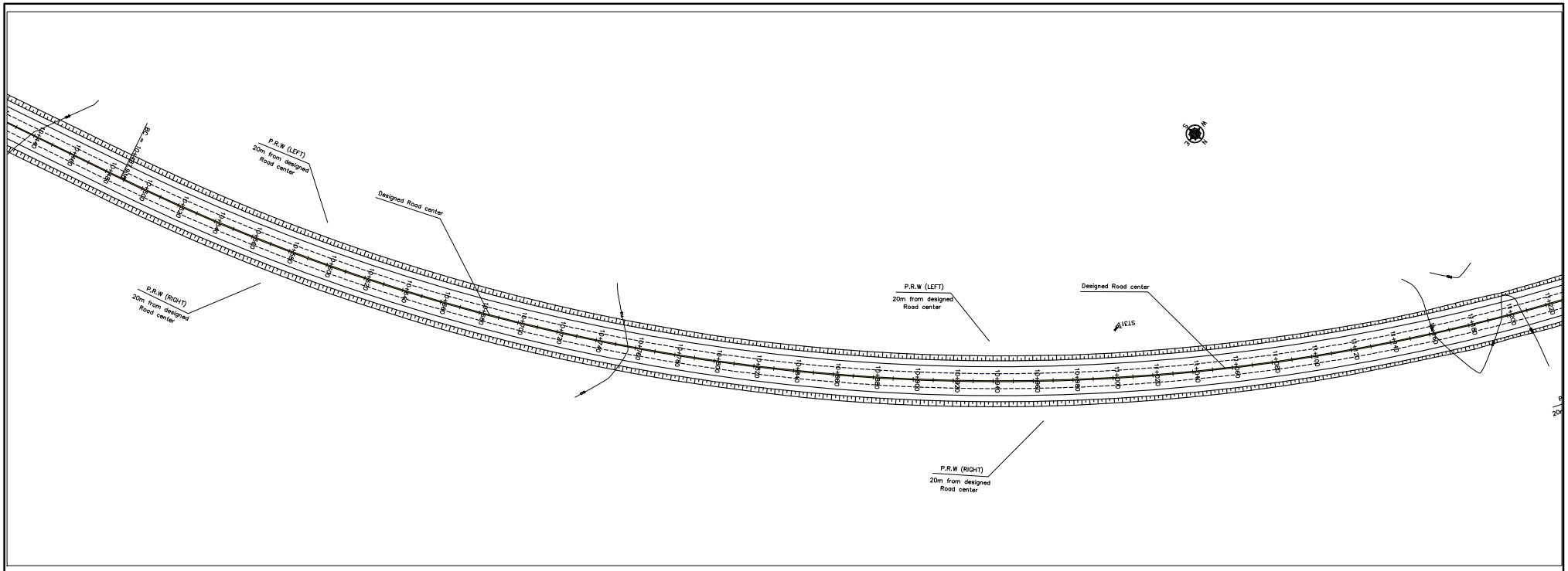
Station	Vertical Alignment	Finish Grade	Ground Level
9+800	22.387	22.387	23.30
9+820		22.323	23.41
9+840		22.260	23.20
9+860		22.197	23.02
9+880		22.133	22.80
9+900		22.070	22.45
9+920		22.007	22.66
9+940	-0.317%	21.943	22.85
9+960		21.880	22.56
9+980		21.817	22.08
10+000		21.753	21.78
10+020		21.690	21.31
10+040		21.627	21.11
10+060		21.563	20.98
10+080	21.500	21.500	20.66
10+100		21.389	20.88
10+120		21.278	20.19
10+140		21.167	19.86
10+160		21.056	19.64
10+180		20.944	19.49
10+200		20.833	19.29
10+200		20.722	19.15
10+220	-0.556%	20.611	19.02
10+240		20.500	18.88
10+260		20.389	18.78
10+380		20.278	18.68
10+300		20.167	18.59
10+320		20.056	18.43
10+340		19.944	18.37
10+360		19.833	18.32
10+480		19.722	18.24
10+400		19.611	18.13
10+420	19.500	19.500	17.99
10+440	-0.334%	19.433	17.89
10+460		19.367	17.80
10+500	19.300	19.300	17.74

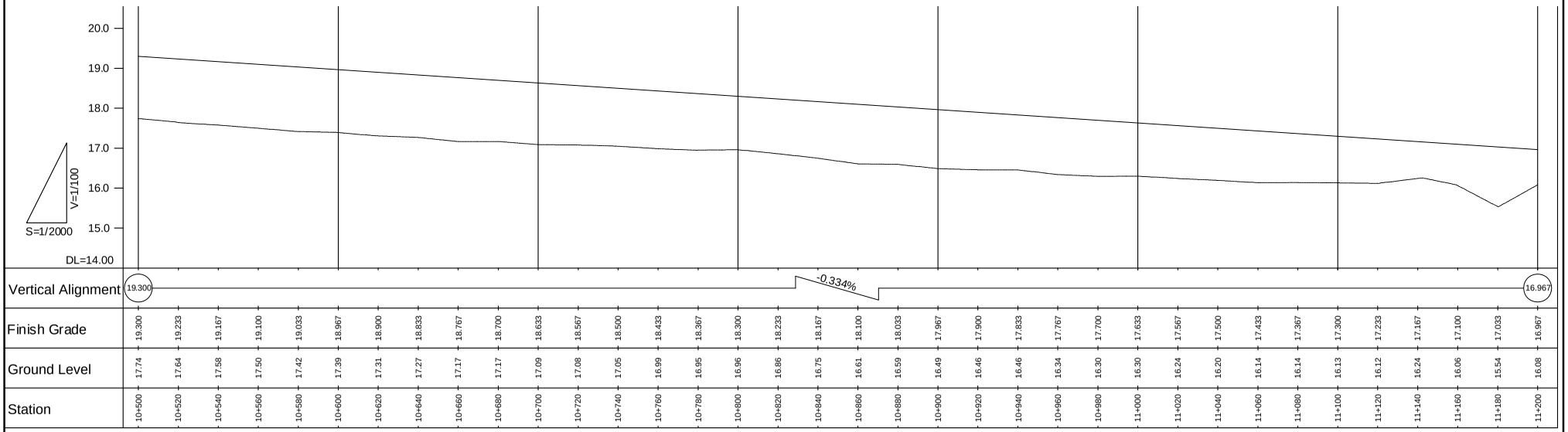
MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : PLAN & PROFILE Sta.9+800~Sta.10+500

Drawing No.: PL-15

Scale : A3: 1/2000

Date : MAR. 2013





Station	Ground Level	Finish Grade
10+500	17.74	19.300
10+520	17.64	19.233
10+540	17.58	19.167
10+560	17.50	19.100
10+580	17.42	19.033
10+600	17.39	18.967
10+620	17.31	18.900
10+640	17.27	18.833
10+660	17.17	18.767
10+680	17.17	18.700
10+700	17.09	18.633
10+720	17.08	18.567
10+740	17.05	18.500
10+760	16.99	18.433
10+780	16.95	18.367
10+800	16.96	18.300
10+820	16.86	18.233
10+840	16.75	18.167
10+860	16.61	18.100
10+880	16.59	18.033
10+900	16.49	17.967
10+920	16.46	17.900
10+940	16.46	17.833
10+960	16.34	17.767
10+980	16.30	17.700
11+000	16.30	17.633
11+020	16.24	17.567
11+040	16.20	17.500
11+060	16.14	17.433
11+080	16.14	17.367
11+100	16.13	17.300
11+120	16.12	17.233
11+140	16.24	17.167
11+160	16.06	17.100
11+180	15.54	17.033
11+200	16.08	16.967

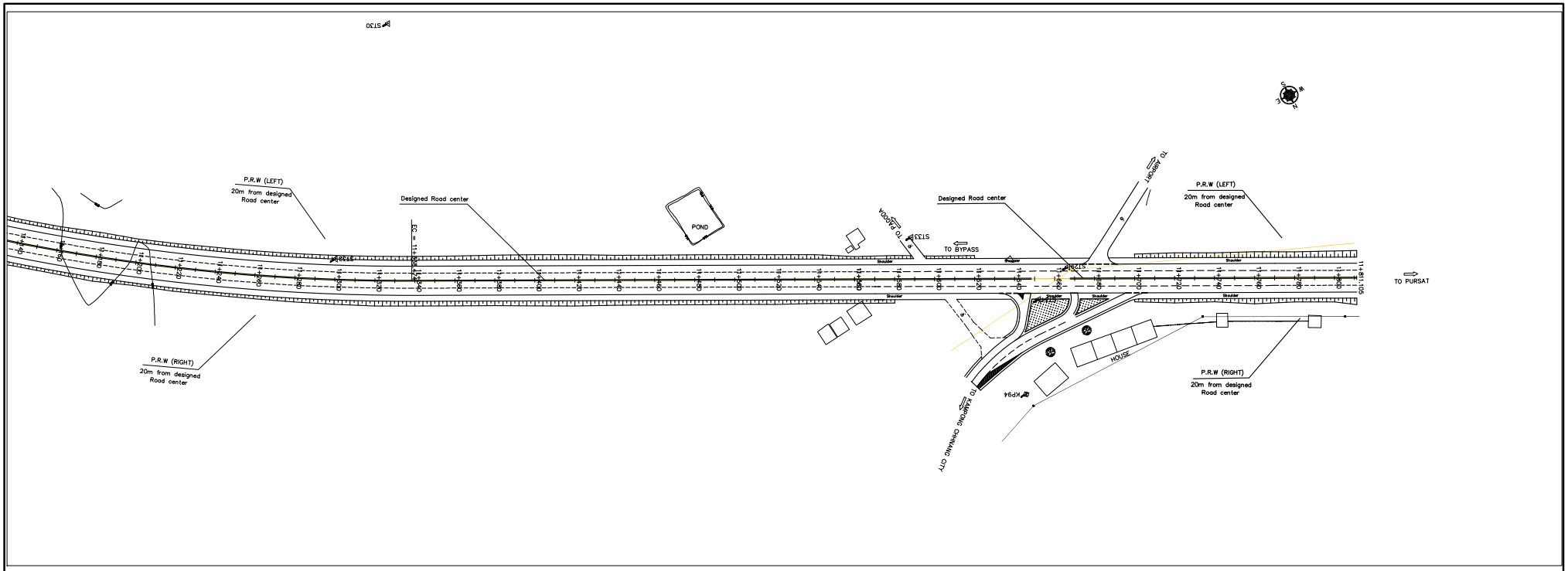
MINISTRY OF PUBLIC WORKS & TRANSPORT
KINGDOM OF CAMBODIA

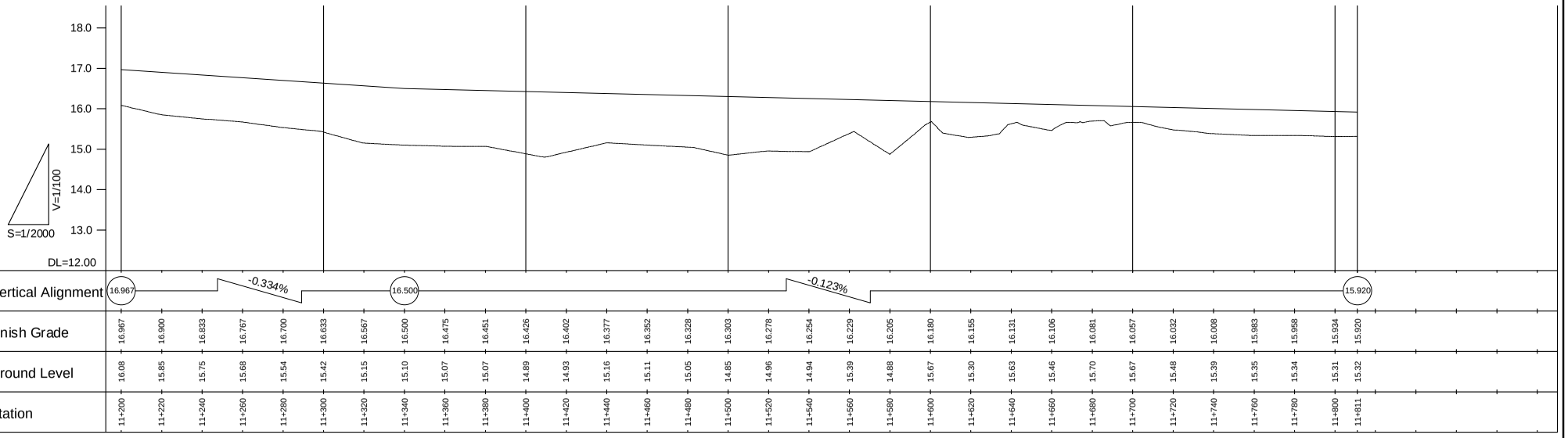
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT

TITLE : PLAN & PROFILE
Sta.10+500~Sta.11+200

Drawing No.	PL-16
Scale :	A3: 1/2000
Date :	MAR. 2013

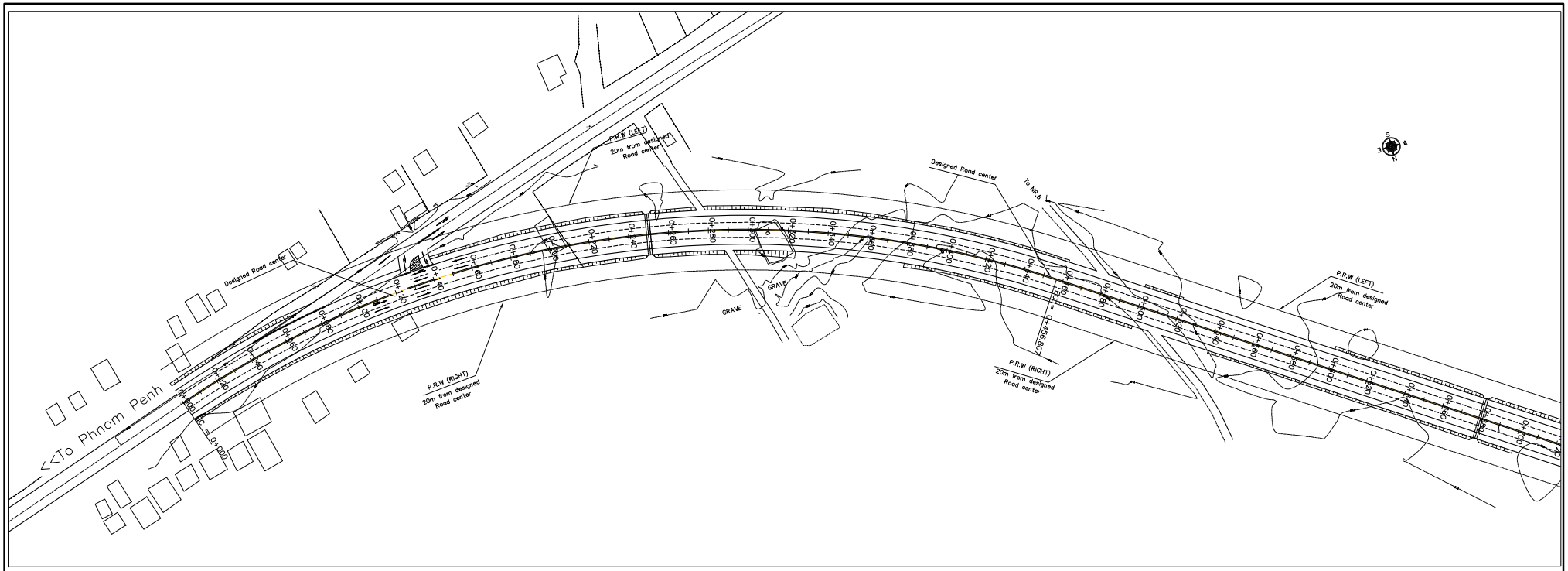


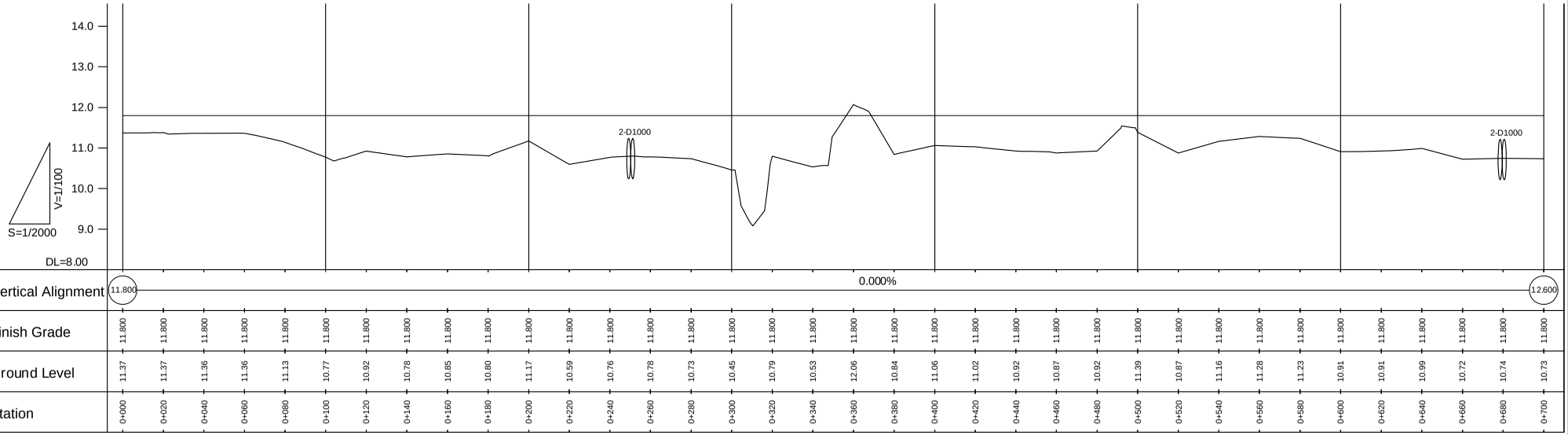


MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : PLAN & PROFILE Sta.11+200~Sta.11+811	Drawing No. PL-17 Scale : A3: 1/2000 Date : MAR. 2013

APPENDIX 9-3

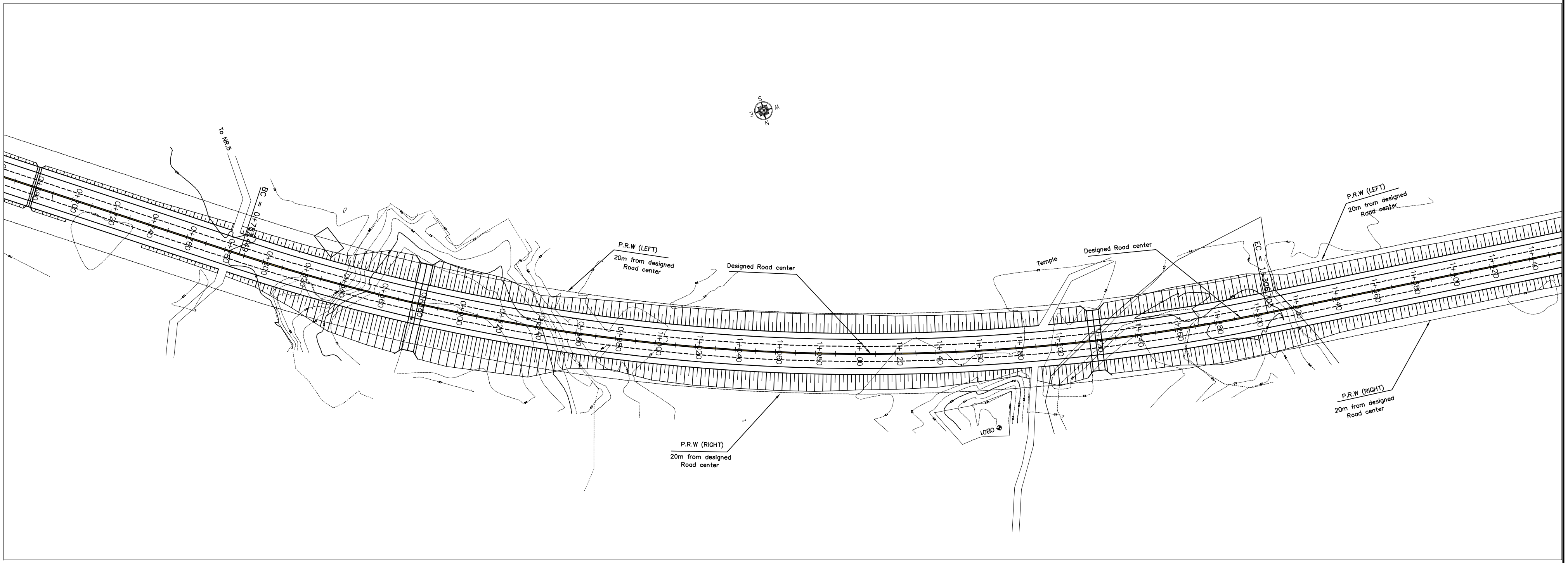
PLAN AND PROFILE
OF
ODONGK BYPASS

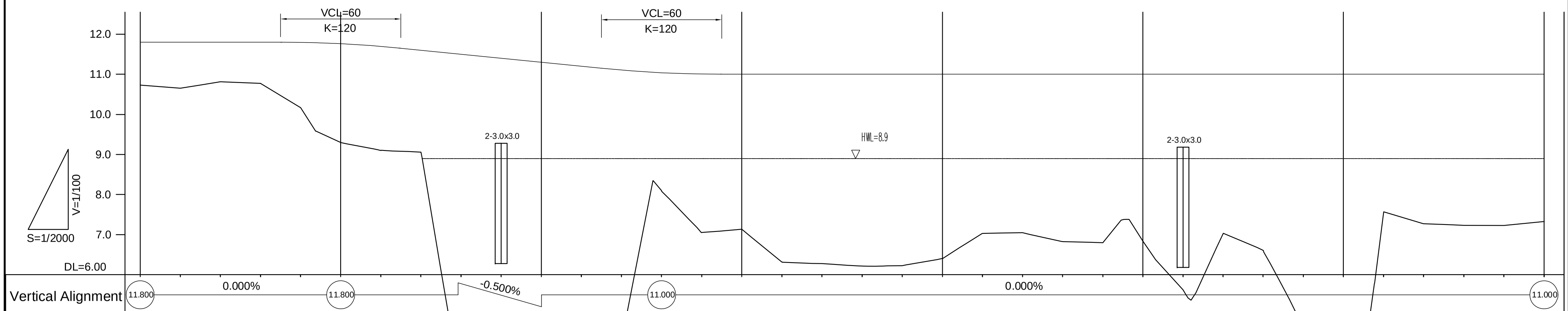




Station	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260	0+280	0+300	0+320	0+340	0+360	0+380	0+400	0+420	0+440	0+460	0+480	0+500	0+520	0+540	0+560	0+580	0+600	0+620	0+640	0+660	0+680	0+700
Ground Level	11.37	11.37	11.36	11.36	11.13	10.77	10.92	10.78	10.85	10.80	11.17	10.59	10.76	10.78	10.73	10.45	10.79	10.53	12.06	10.84	11.06	11.02	10.92	10.87	10.92	11.39	10.87	11.16	11.28	11.23	10.91	10.91	10.99	10.72	10.74	10.73
Finish Grade	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800

MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : PLAN & PROFILE Sta.0-000~Sta.0+700	Drawing No.	PL-1
				Scale :	A3: 1/2000
				Date :	MAR. 2013





Station	Finish Grade	Ground Level
0+700	11.800	10.73
0+720	11.800	10.65
0+740	11.800	10.82
0+760	11.800	10.78
0+780	11.796	10.17
0+800	11.763	9.30
0+820	11.696	9.10
0+840	11.600	9.06
0+860	11.500	3.18
0+880	11.400	2.97
0+900	11.300	2.86
0+920	11.200	3.08
0+940	11.104	4.37
0+960	11.038	8.09
0+980	11.004	7.05
1+000	11.000	7.14
1+020	11.000	6.32
1+040	11.000	6.28
1+060	11.000	6.21
1+080	11.000	6.23
1+100	11.000	6.40
1+120	11.000	7.03
1+140	11.000	7.05
1+160	11.000	6.83
1+180	11.000	6.80
1+200	11.000	6.84
1+220	11.000	5.62
1+240	11.000	7.04
1+260	11.000	6.61
1+280	11.000	4.72
1+300	11.000	4.46
1+320	11.000	7.56
1+340	11.000	7.27
1+360	11.000	7.23
1+380	11.000	7.23
1+400	11.000	7.33

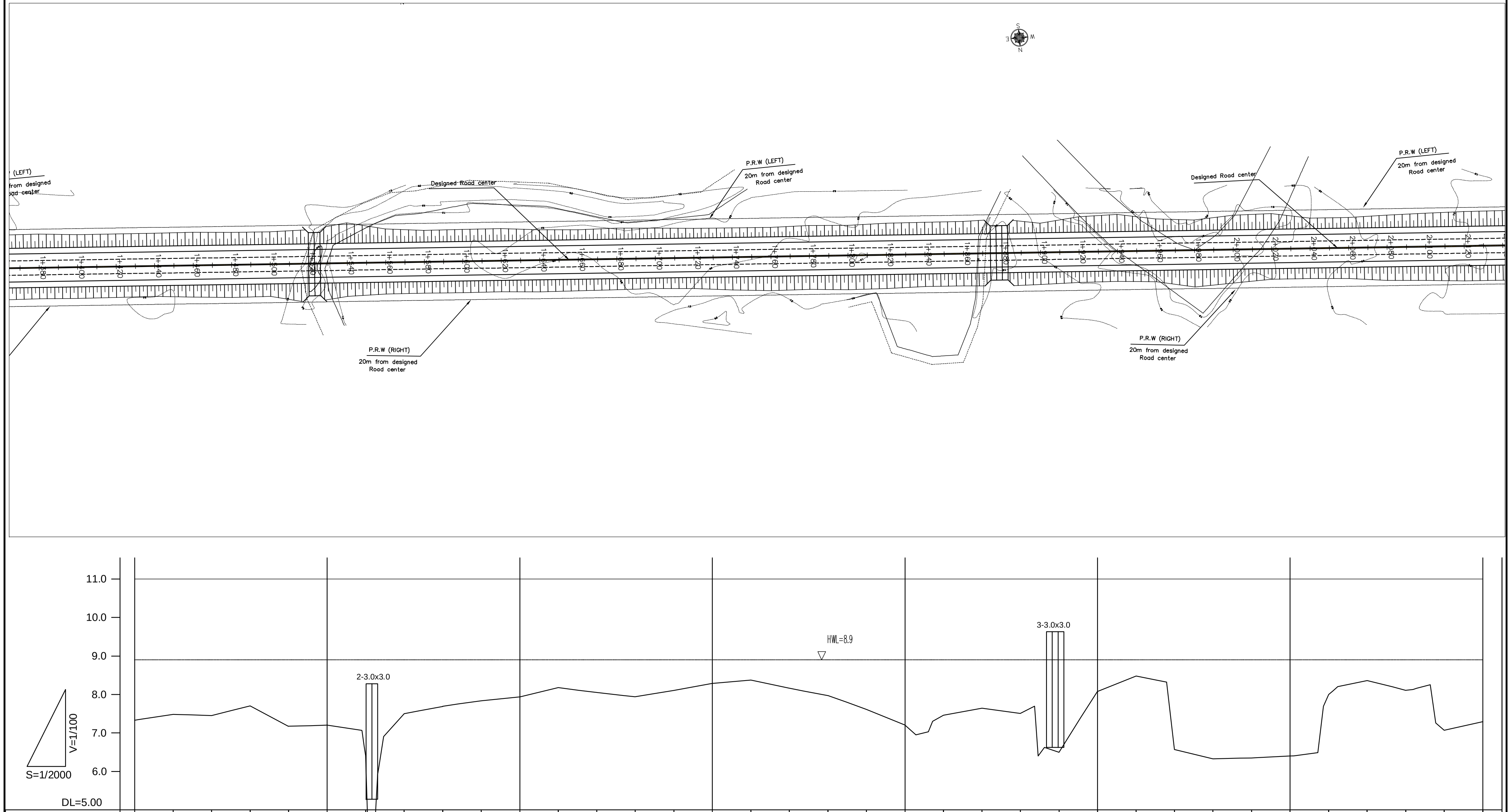
MINISTRY OF PUBLIC WORKS & TRANSPORT
KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT

TITLE : PLAN & PROFILE
Sta.0+700~Sta.1+400

Drawing No.	PL-2
Scale :	A3: 1/2000
Date :	MAR. 2013



Vertical Alignment: 11.000 — 0.000% — 11.000

Station	Finish Grade	Ground Level
1+400	11.000	7.33
1+420	11.000	7.48
1+440	11.000	7.45
1+460	11.000	7.70
1+480	11.000	7.17
1+500	11.000	7.20
1+520	11.000	6.33
1+540	11.000	7.50
1+560	11.000	7.69
1+580	11.000	7.84
1+600	11.000	7.94
1+620	11.000	8.17
1+640	11.000	8.05
1+660	11.000	7.94
1+680	11.000	8.10
1+700	11.000	8.29
1+720	11.000	8.37
1+740	11.000	8.16
1+760	11.000	7.97
1+780	11.000	7.61
1+800	11.000	7.21
1+820	11.000	7.46
1+840	11.000	7.64
1+860	11.000	7.51
1+880	11.000	6.50
1+900	11.000	8.08
1+920	11.000	8.48
1+940	11.000	6.57
1+960	11.000	6.33
1+980	11.000	6.35
2+000	11.000	6.40
2+020	11.000	8.00
2+040	11.000	8.36
2+060	11.000	8.11
2+080	11.000	7.07
2+100	11.000	7.29

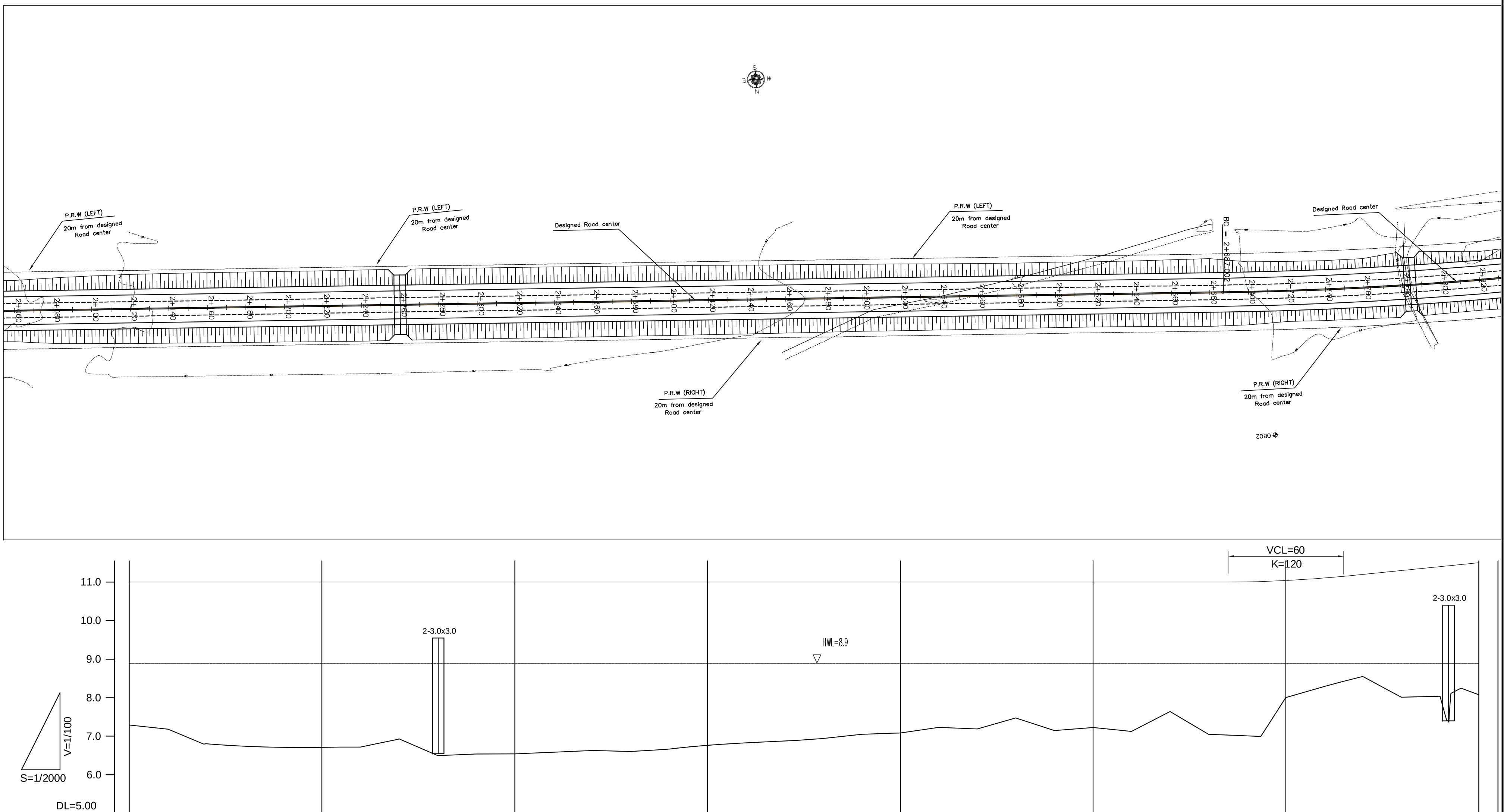
MINISTRY OF PUBLIC WORKS & TRANSPORT
KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT

TITLE :
PLAN & PROFILE
Sta.1+400~Sta.2+100

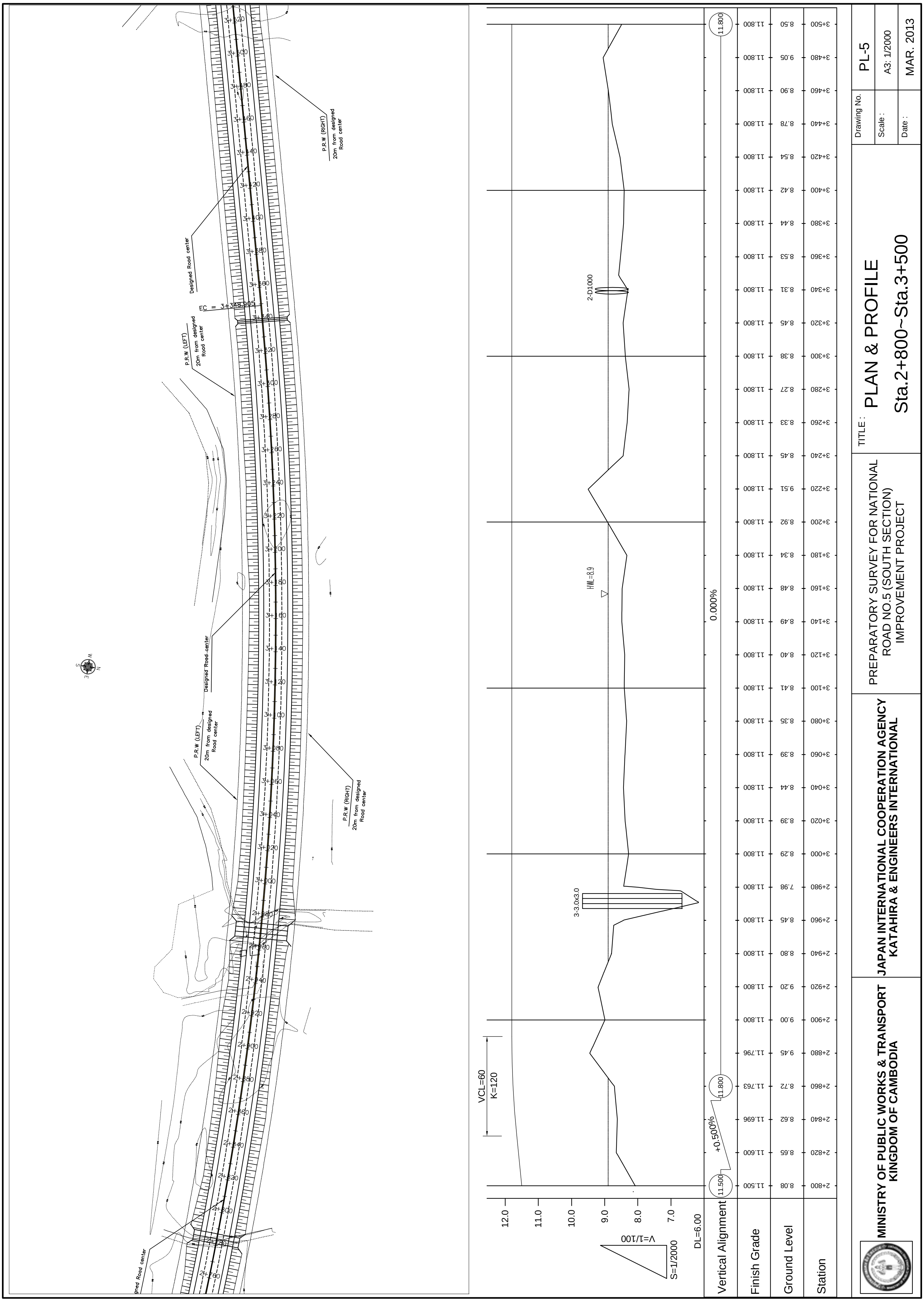
Drawing No.	PL-3
Scale :	A3: 1/2000
Date :	MAR. 2013

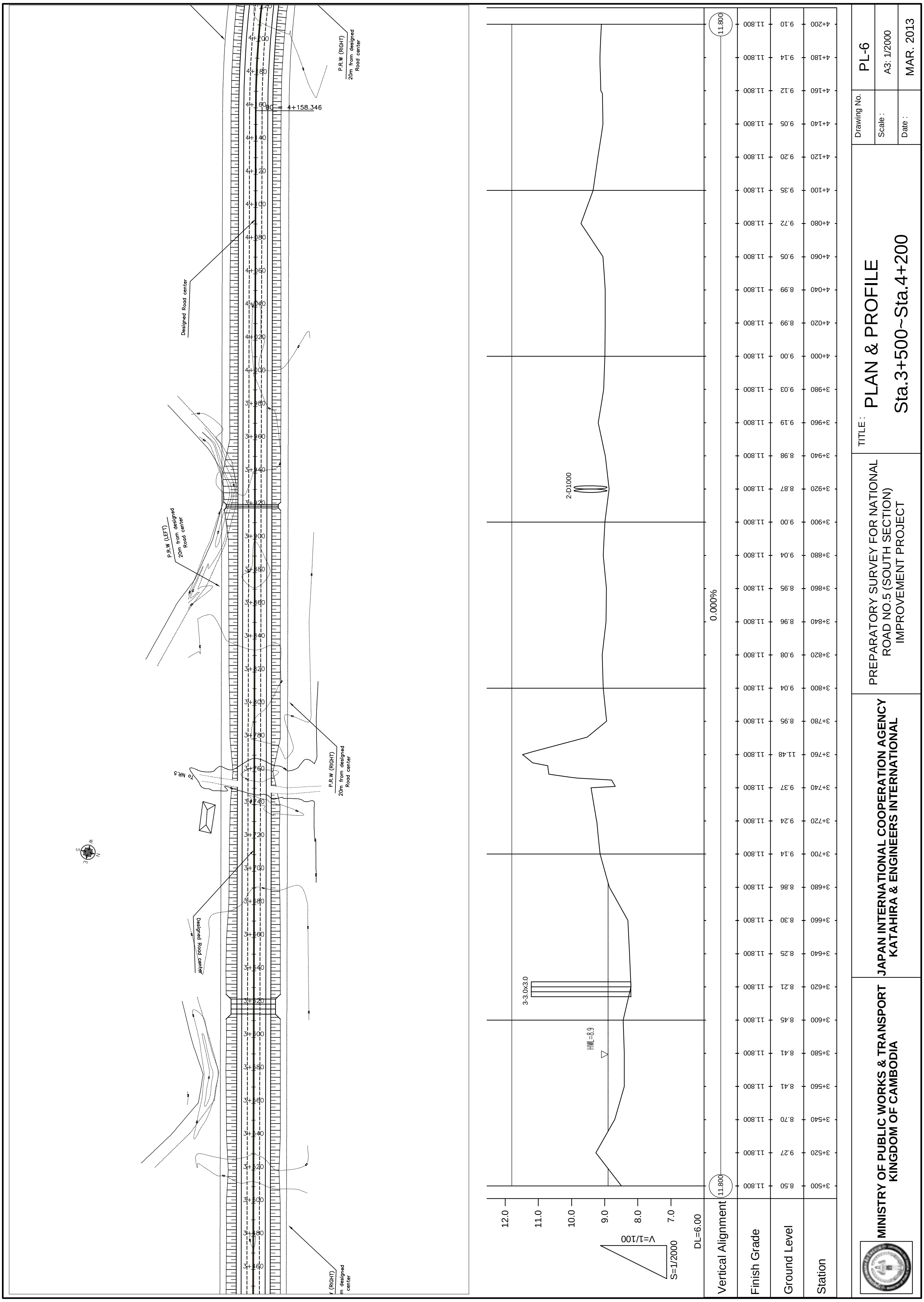


Station	Ground Level	Finish Grade
2+100	7.29	11.000
2+120	7.22	11.000
2+140	6.81	11.000
2+160	6.74	11.000
2+180	6.71	11.000
2+200	6.72	11.000
2+220	6.72	11.000
2+240	6.94	11.000
2+260	6.50	11.000
2+280	6.54	11.000
2+300	6.55	11.000
2+320	6.59	11.000
2+340	6.64	11.000
2+360	6.61	11.000
2+380	6.67	11.000
2+400	6.77	11.000
2+420	6.83	11.000
2+440	6.88	11.000
2+460	6.95	11.000
2+480	7.06	11.000
2+500	7.09	11.000
2+520	7.24	11.000
2+540	7.20	11.000
2+560	7.48	11.000
2+580	7.15	11.000
2+600	7.23	11.000
2+620	7.13	11.000
2+640	7.65	11.000
2+660	7.06	11.000
2+680	7.02	11.004
2+700	8.01	11.038
2+720	8.30	11.104
2+740	8.55	11.200
2+760	8.02	11.300
2+780	8.04	11.400
2+800	8.08	11.500

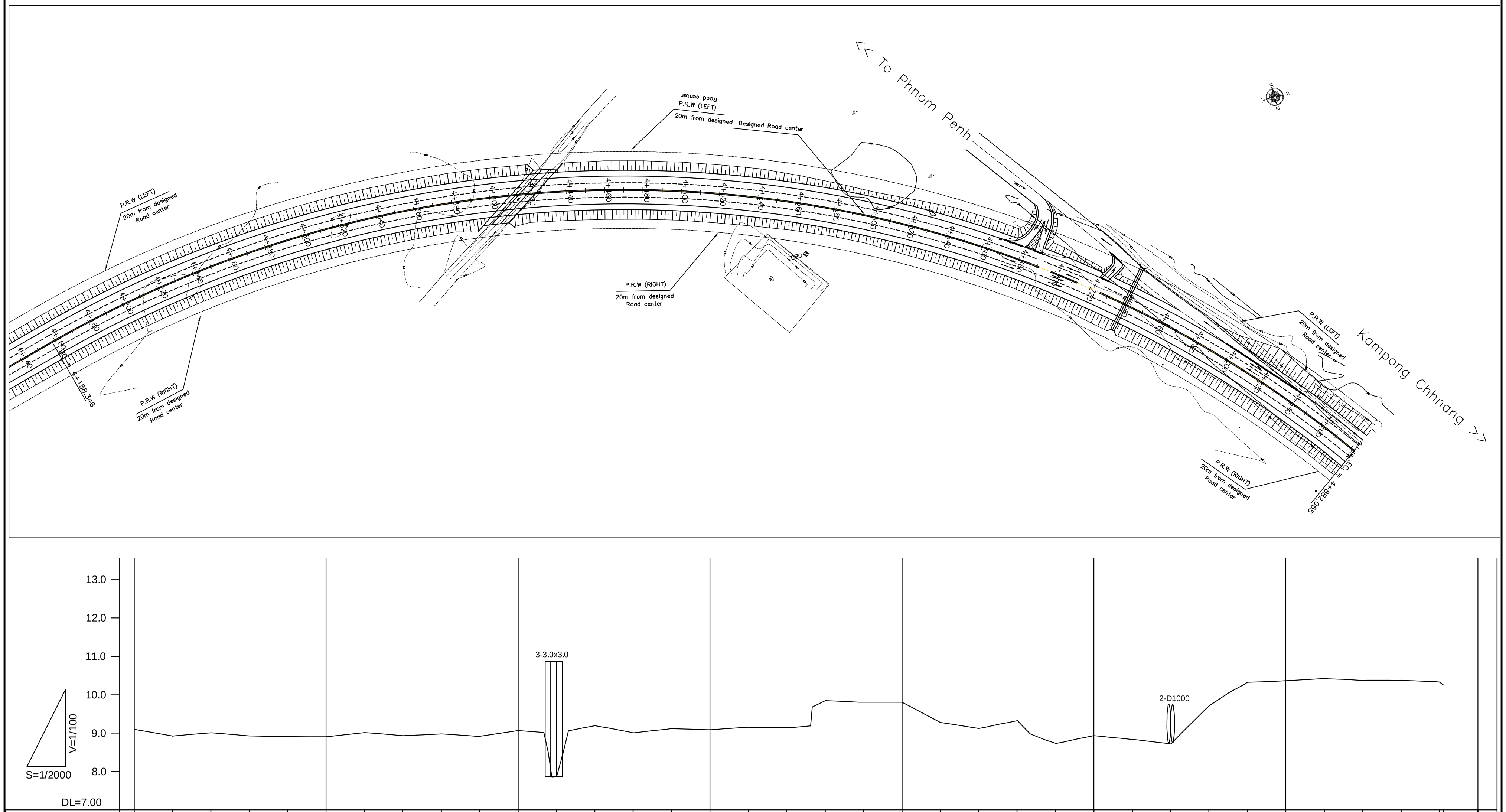
Vertical Alignment: 11.000 (2+100), 0.000%, 11.000 (2+700), +0.500%, 11.500 (2+800)

MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : PLAN & PROFILE Sta.2+100~Sta.2+800	Drawing No. PL-4 Scale : A3: 1/2000 Date : MAR. 2013


MINISTRY OF PUBLIC WORKS & TRANSPORT
KINGDOM OF CAMBODIA
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL
PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT
TITLE : PLAN & PROFILE
Sta.2+800~Sta.3+500
Drawing No. PL-5
Scale : A3: 1/2000
Date : MAR. 2013
S=1/2000
V=1/100
DL=6.00
Vertical Alignment
Finish Grade
Ground Level
Station
VCL=60
K=120
+0.500%
0.000%
11.500
11.800
3-3.0x3.0
2-D1000
HWL=8.9
EC = 3+348.905
Designed Road center
P.R.W (LEFT) 20m from designed Road center
P.R.W (RIGHT) 20m from designed Road center
Station: 2+800, 2+820, 2+840, 2+860, 2+880, 2+900, 2+920, 2+940, 2+960, 2+980, 3+000, 3+020, 3+040, 3+060, 3+080, 3+100, 3+120, 3+140, 3+160, 3+180, 3+200, 3+220, 3+240, 3+260, 3+280, 3+300, 3+320, 3+340, 3+360, 3+380, 3+400, 3+420, 3+440, 3+460, 3+480, 3+500
Ground Level: 8.08, 8.65, 8.62, 8.72, 9.45, 9.00, 9.20, 8.80, 8.45, 7.98, 8.29, 8.39, 8.44, 8.39, 8.35, 8.41, 8.40, 8.49, 8.48, 8.34, 8.92, 9.51, 8.45, 8.33, 8.27, 8.38, 8.45, 8.31, 8.53, 8.44, 8.42, 8.54, 8.78, 8.90, 9.05, 8.50
Finish Grade: 11.500, 11.600, 11.696, 11.763, 11.796, 11.800



MINISTRY OF PUBLIC WORKS & TRANSPORT
KINGDOM OF CAMBODIA
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL
PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT
TITLE : PLAN & PROFILE
Sta.3+500~Sta.4+200
Drawing No. PL-6
Scale : A3: 1/2000
Date : MAR. 2013
Designed Road center
P.R.W (RIGHT) 20m from designed Road center
P.R.W (LEFT) 20m from designed Road center
BC = 4+158.346
To NR.5
2-D1000
3-3.0x3.0
HWL=8.9
0.000%
11.800
S=1/2000
V=1/100
DL=6.00
12.0
11.0
10.0
9.0
8.0
7.0
Vertical Alignment
Finish Grade
Ground Level
Station
3+500 8.50 11.800
3+520 9.27 11.800
3+540 8.70 11.800
3+560 8.41 11.800
3+580 8.41 11.800
3+600 8.45 11.800
3+620 8.21 11.800
3+640 8.25 11.800
3+660 8.30 11.800
3+680 8.86 11.800
3+700 9.14 11.800
3+720 9.24 11.800
3+740 9.37 11.800
3+760 11.48 11.800
3+780 8.95 11.800
3+800 9.04 11.800
3+820 9.08 11.800
3+840 8.96 11.800
3+860 8.95 11.800
3+880 9.04 11.800
3+900 9.00 11.800
3+920 8.87 11.800
3+940 8.98 11.800
3+960 9.19 11.800
3+980 9.03 11.800
4+000 9.00 11.800
4+020 8.99 11.800
4+040 8.99 11.800
4+060 9.05 11.800
4+080 9.72 11.800
4+100 9.35 11.800
4+120 9.20 11.800
4+140 9.05 11.800
4+160 9.12 11.800
4+180 9.14 11.800
4+200 9.10 11.800



Vertical Alignment	11.800																	
Finish Grade	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800
Ground Level	9.10	8.93	9.01	8.93	8.92	8.91	9.02	8.94	8.98	8.92	9.07	7.87	9.20	9.02	9.12	9.09	9.16	9.14
Station	4+200	4+220	4+240	4+260	4+280	4+300	4+320	4+340	4+360	4+380	4+400	4+420	4+440	4+460	4+480	4+500	4+520	4+540

Vertical Alignment	0.000%																	11.800
Finish Grade	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800	11.800
Ground Level	9.85	9.81	9.81	9.28	9.12	9.33	8.74	8.94	8.84	8.72	9.71	10.33	10.37	10.42	10.38	10.38	10.34	10.26
Station	4+560	4+580	4+600	4+620	4+640	4+660	4+680	4+700	4+720	4+740	4+760	4+780	4+800	4+820	4+840	4+860	4+880	4+882

MINISTRY OF PUBLIC WORKS & TRANSPORT **KINGDOM OF CAMBODIA**	**JAPAN INTERNATIONAL COOPERATION AGENCY** **KATAHIRA & ENGINEERS INTERNATIONAL**	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : PLAN & PROFILE Sta.4+200~Sta.4+882.055	Drawing No. PL-7 Scale : A3: 1/2000 Date : MAR. 2013

APPENDIX 9-4

CALCULATION OF DEGREE OF SATURATION OF INTERSECTION OF BYPASS WITH EXISTING NR 5

Table-1 Calculation of Degree of Saturation of Intersection (Kampong Chhnang BP)

Intersection of Kampong Chhnang Bypass (South side)						
Results of Intersection Analysis						
Inflow Direction	A	A	B	B	C	C
Outflow Direction	Left-turn	Through	Left-turn	Right-turn	Through	Through and Right-turn
Number of Lanes	1	2	1	1	1	1
Ideal Saturation Flow Rate (One Lane)	1800	2000	1800	1800	2000	2000
Lane Width (m)	3	3	3	3	3	3
Adjustment Factor for Lane Width	1	1	1	1	1	1
Approach Grade (%)	0	0	0	0	0	0
Adjustment Factor for Approach Grade	1	1	1	1	1	1
Heavy Vehicle Ratio (%)	0	0	0	0	0	0
Adjustment Factor for Heavy Vehicles	1	1	1	1	1	1
Timing (sec)	5	35	20	20	35	35
Cycle Time (sec)		60	60	60	60	60
Right Turns Ratio (%)		0		0	0	47.96
Pedestrian Flows (peds/cycle)				10		10
Reduction for Pedestrian				0.27		0.27
Pedestrian Green Time (sec)				15		15
Right Turn Equivalence	60			0.8		1.26
Adjustment Factor for Right Turn and Through						0.89
Adjustment Factor for Exclusive Right Turn Lane						
Left Turns Ratio (%)	100	0	100		0	0
Traffic Volume of Opposing Lane Direction (veh/h)	0		0			
Probability of Left Turns	1		1			
Pass Flow during Yellow Phase (veh/cycle)	2		2			
Left Turn Equivalence						
Adjustment Factor for Left Turn and Through						
Left Turn Phase	専用あり		専用なし			
Adjustment Factor for Bus Blockage	1	1	1	1	1	1
Saturation Flow (veh/h)	1800	4000	1800	1441	2000	1781
Design Hourly Volume (veh/h)	0	1344	424	0		1768
Normalized Traffic Rate	0	0.336	0.24	0		0.468
Capacity (veh/h)	270	2334	721	478		2206
Necessary Phase Rate						
Phase 1		0.336				0.468
Phase 2	0					
Phase 3			0.24			
Degree of Saturation of Intersection			0.708			
Cycle Time(sec)			60			

Queue Length

Number of Lanes	1	2	1	1	1	1
Ideal Saturation Flow Rate	1800	2000	1800	1800	2000	2000
Lane Width(m)	3	3	3	3	3	3
Peak hour Traffic volume (veh/h)	0	672	424	0	884	884
Average Traffic Volume (veh/sec)	0	6	7	0	15	15
Heavy Vehicle Ratio (%)	0	0	0	0	0	0
Average Headway (m/veh)	6	6	6	6	6	6
Average Queue Length (m)	0	36	42	0	90	90
Queue Length(m)	0		67.2			

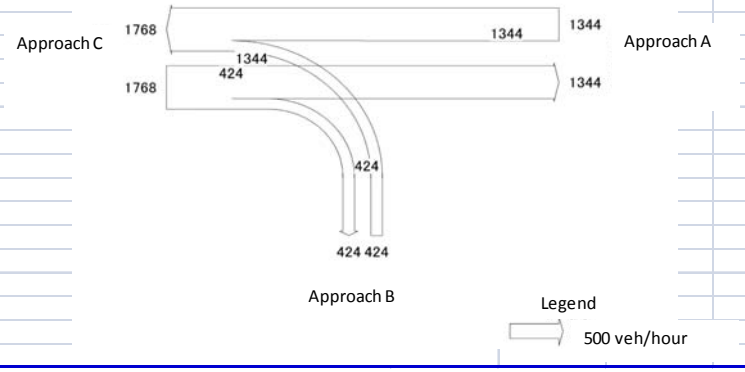


Table-2 Calculation of Degree of Saturation of Intersection (Odongk BP)

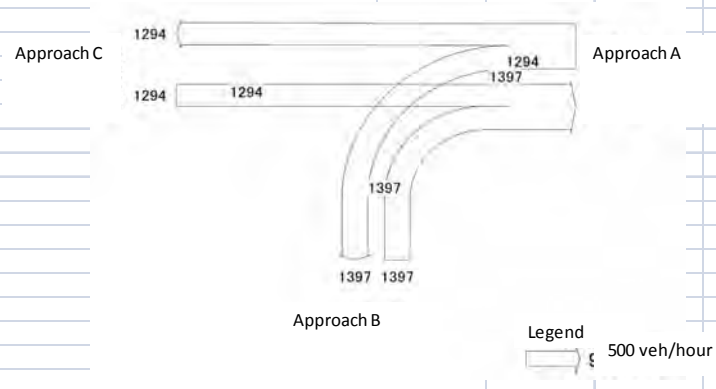
Intersection of Odon Bypass (South side)

Results of Intersection Analysis

Inflow Direction	A	A	B	B	C	C
Outflow Direction	Left-turn	Through	Left-turn	Right-turn	Through	Through and Right-turn
Number of Lanes	2	2	1	2	1	1
Ideal Saturation Flow Rate (One Lane)	1800	2000	1800	1800	2000	2000
Lane Width (m)	3	3	3	3	3	3
Adjustment Factor for Lane Width	1	1	1	1	1	1
Approach Grade (%)	0	0	0	0	0	0
Adjustment Factor for Approach Grade	1	1	1	1	1	1
Heavy Vehicle Ratio (%)	0	0	0	0	0	0
Adjustment Factor for Heavy Vehicles	1	1	1	1	1	1
Timing (sec)	40	40	10	40	40	40
Cycle Time (sec)		90	90	90	90	90
Right Turns Ratio (%)		0		0	0	0
Pedestrian Flows (peds/cycle)				0		
Reduction for Pedestrian				0		
Pedestrian Green Time (sec)				0		
Right Turn Equivalence	90			1		
Adjustment Factor for Right Turn and Through						
Adjustment Factor for Exclusive Right Turn Lane						
Left Turns Ratio (%)	100	0	100		0	0
Traffic Volume of Opposing Lane Direction (veh/h)	0		0			
Probability of Left Turns	1		1			
Pass Flow during Yellow Phase (veh/cycle)	2		2			
Left Turn Equivalence						
Adjustment Factor for Left Turn and Through						
Left Turn Phase	専用あり		専用なし			
Adjustment Factor for Bus Blockage	1	1	1	1	1	1
Saturation Flow (veh/h)	3600	4000	1800	3600	2000	2000
Design Hourly Volume (veh/h)	1396	1294	0	1396		1294
Normalized Traffic Rate	0.343	0.324	0	0.194		0.324
Capacity (veh/h)	1680	1778	280	1600		1778
Necessary Phase Rate						
Phase 1		0.324				0.324
Phase 2	0.343			0.194		
Phase 3			0			
Degree of Saturation of Intersection			0.667			
Cycle Time(sec)			60			

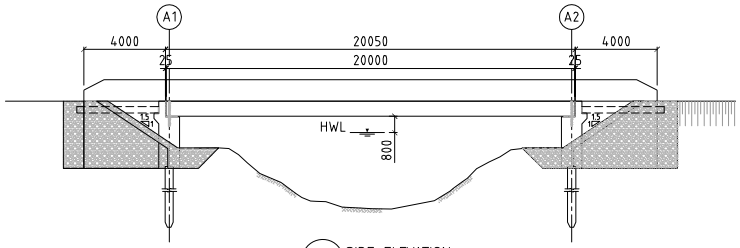
Queue Length

Number of Lanes	2	2	1	2	1	1
Ideal Saturation Flow Rate	1800	2000	1800	1800	2000	2000
Lane Width(m)	3	3	3	3	3	3
Peak hour Traffic volume (veh/h)	698	647	0	698	647	647
Average Traffic Volume (veh/sec)	9	8	0	9	16	16
Heavy Vehicle Ratio (%)	0	0	0	0	0	0
Average Headway (m/veh)	6	6	6	6	6	6
Average Queue Length (m)	54	48	0	54	96	96
Queue Length(m)	81		0			



APPENDIX 10-1

BRIDGES DESIGN



1 SIDE ELEVATION
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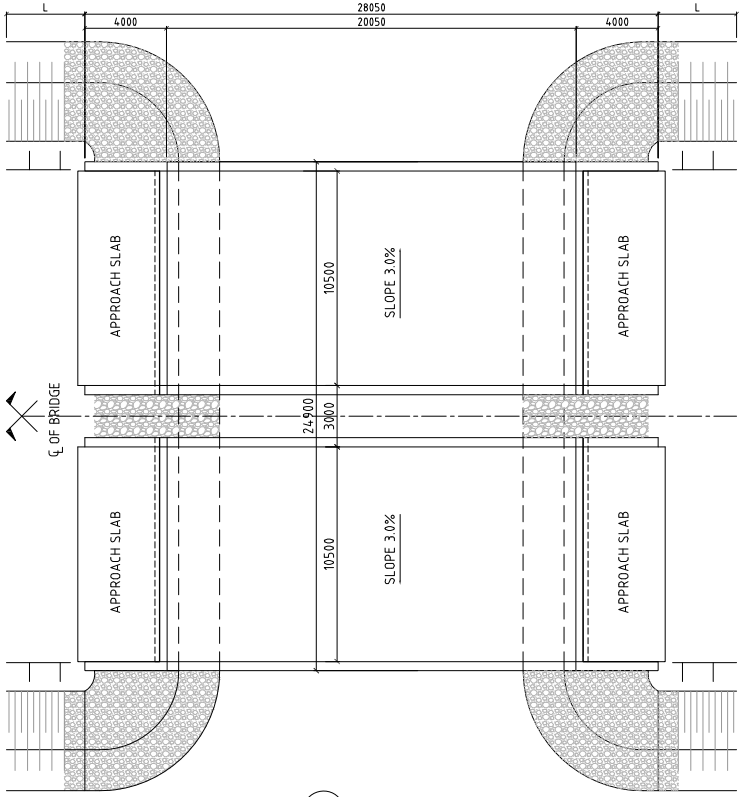

2 PLAN
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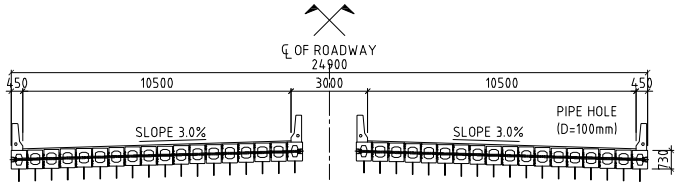
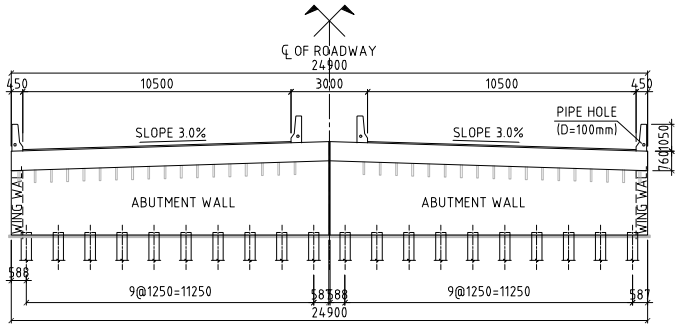
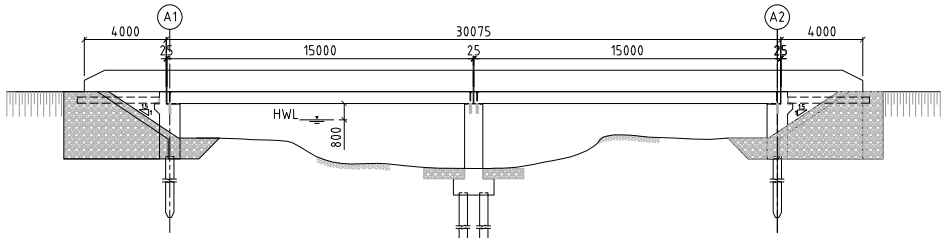


3 CROSS SECTION OF SUPERSTRUCTURE
SCALE 1:200

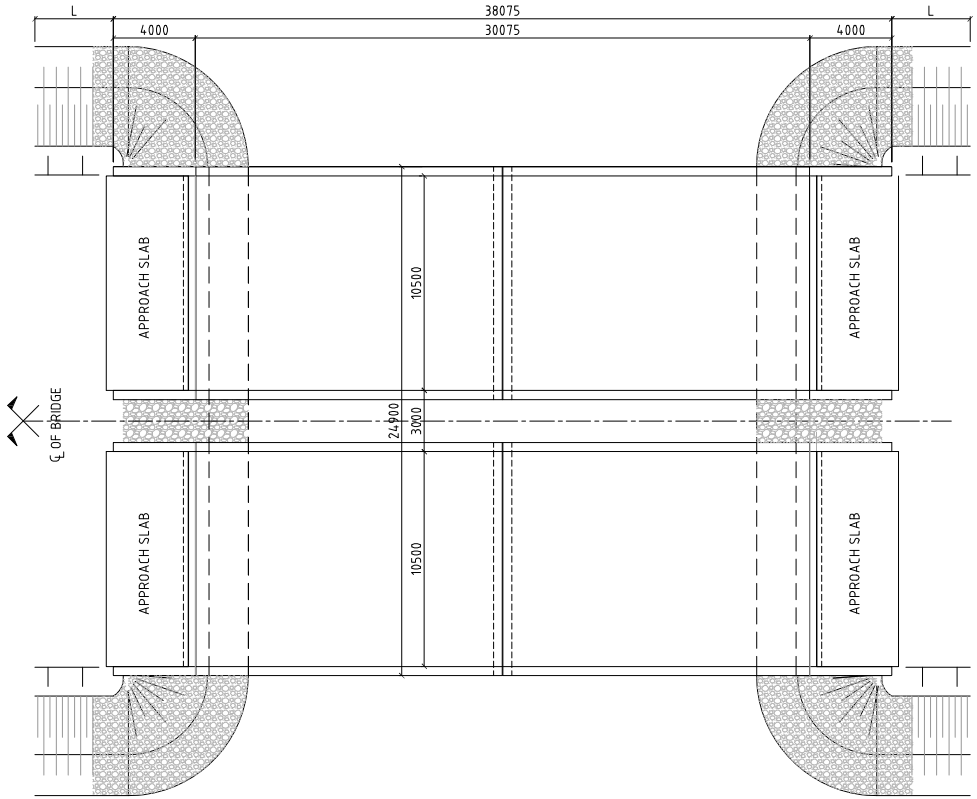


4 CROSS SECTION OF ABUTMENT
SCALE 1:200

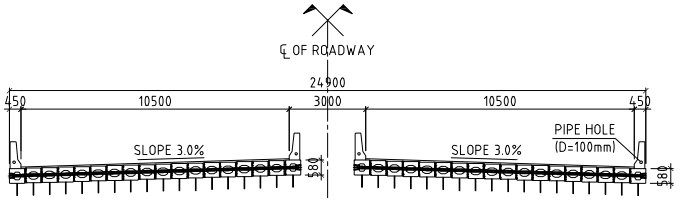
MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	REPLACEMENT OF EXISTING BRIDGE PSC BRIDGE (L=20m) - Br.11, 13 - GENERAL VIEW	Drawing No.	BR-01
				Scale :	
				Date :	MAR. 2013



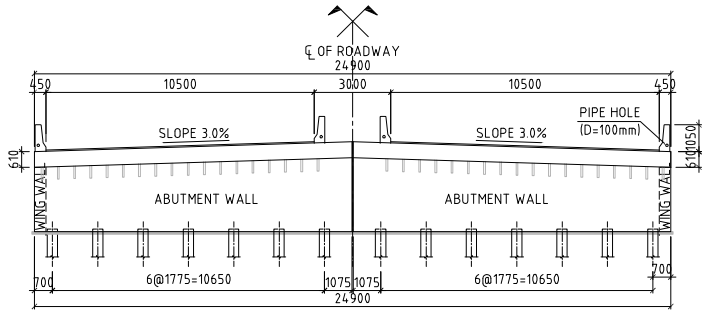
1 ELEVATION
SCALE 1:250



2 PLAN
SCALE 1:250

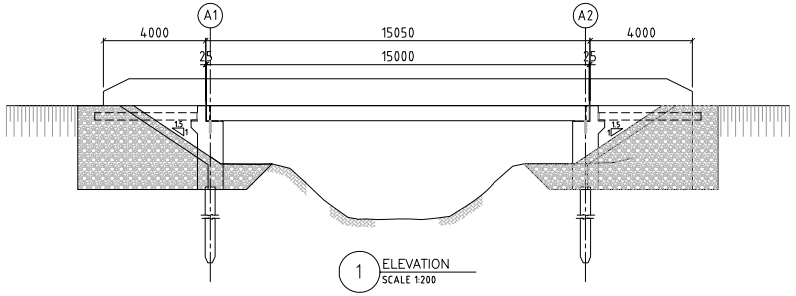


3 CROSS SECTION OF SUPERSTRUCTURE
SCALE 1:200



4 CROSS SECTION OF ABUTMENT
SCALE 1:200

MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	REPLACEMENT OF EXISTING BRIDGE PSC BRIDGE (L=30m) - Br.39 - GENERAL VIEW	Drawing No.	BR-02
				Scale :	
				Date :	MAR. 2013



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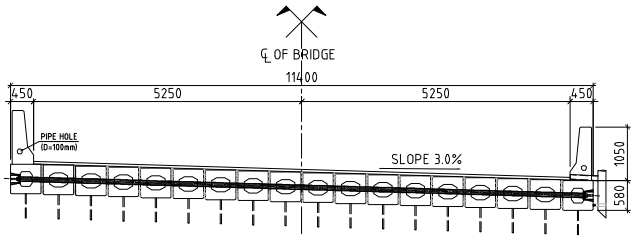

3 CROSS SECTION OF SUPERSTRUCTURE
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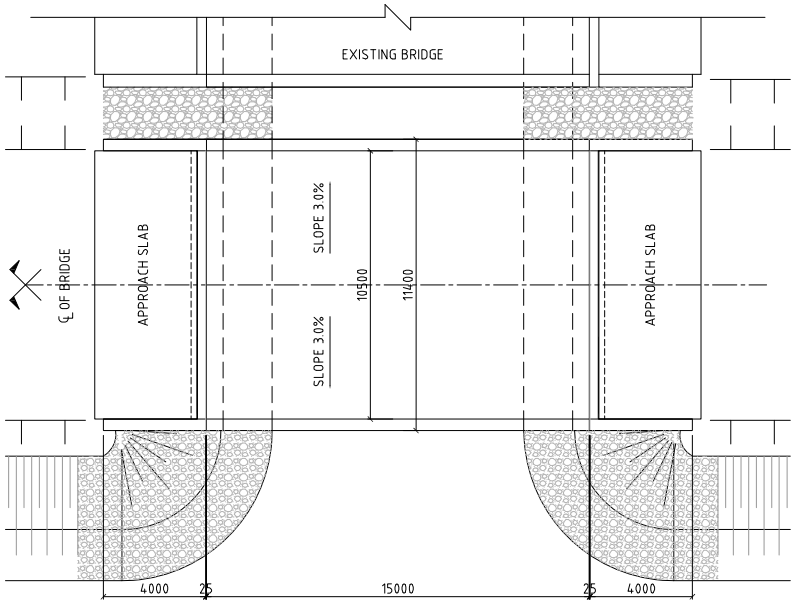

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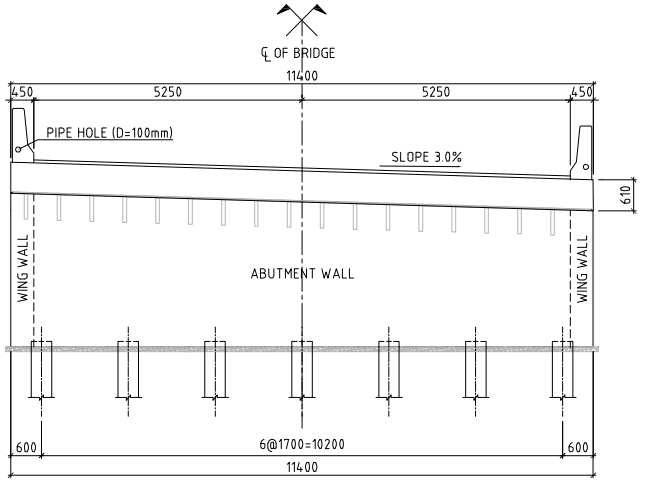

4 CROSS SECTION OF ABUTMENT
SCALE 1:100

MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	CONSTRUCTION OF ADDITIONAL BRIDGE PSC BRIDGE (L=15m) - Br.7, 14, 16' - GENERAL VIEW	Drawing No.	BR-03
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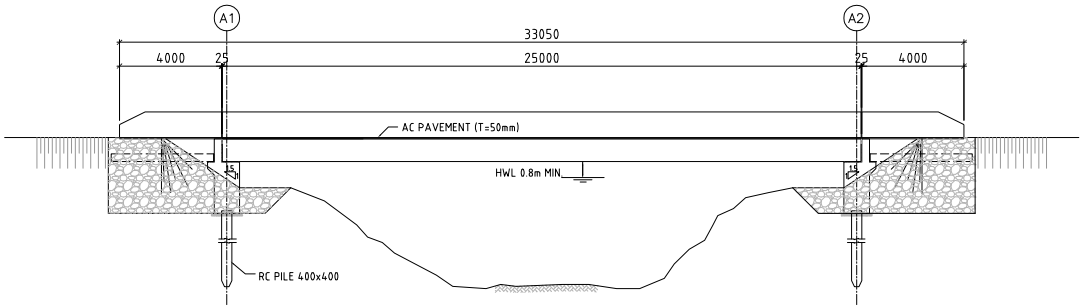
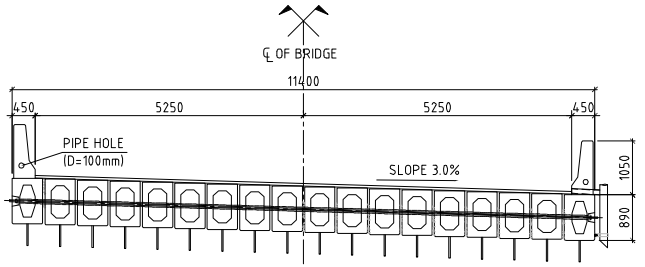
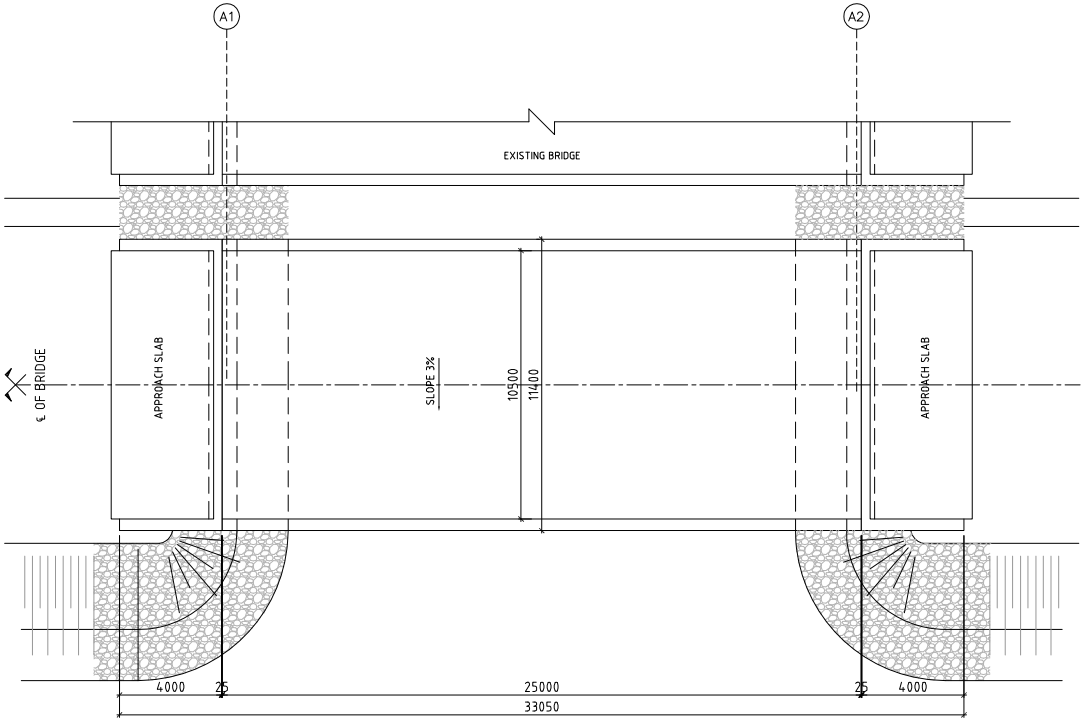
				Date :	MAR. 2013



1 SIDE ELEVATION
SCALE 1:200



3 CROSS SECTION OF SUPERSTRUCTURE
SCALE 1:100



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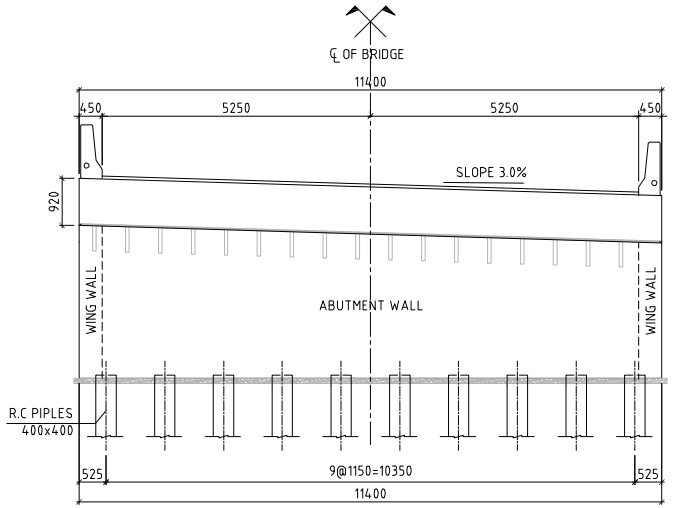
SCALE 1:200



4 CROSS SECTION OF ABUTMENT
SCALE 1:100

MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	CONSTRUCTION OF ADDITIONAL BRIDGE PSC BRIDGE (L=25m) - Br.8, 9, 10, 12, 13', 15, 16 - GENERAL VIEW	Drawing No.	BR-04
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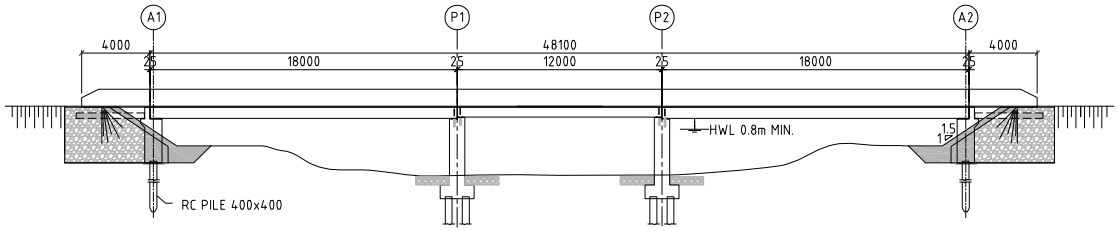
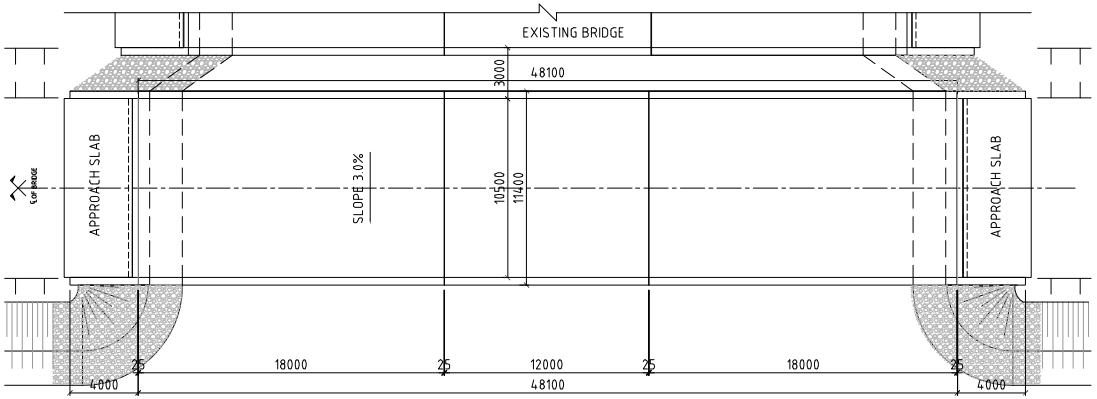
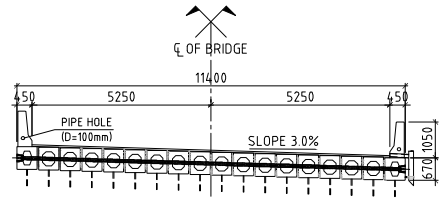
				Date :	MAR. 2013



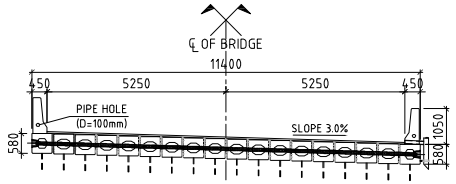
1 SIDE ELEVATION
SCALE 1:300



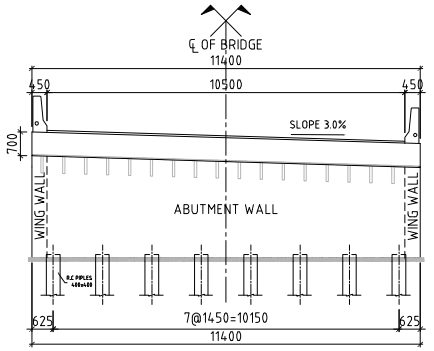
2 PLAN
SCALE 1:300



3 CROSS SECTION OF SUPERSTRUCTURE (A1–P1, P2–A2)
SCALE 1:150



4 CROSS SECTION OF SUPERSTRUCTURE (P1–P2)
SCALE 1:150



5 CROSS SECTION OF ABUTMENT
SCALE 1:150

MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	CONSTRUCTION OF ADDITIONAL BRIDGE PSC BRIDGE (L=48m) - Br.38 - GENERAL VIEW	Drawing No.	BR-05
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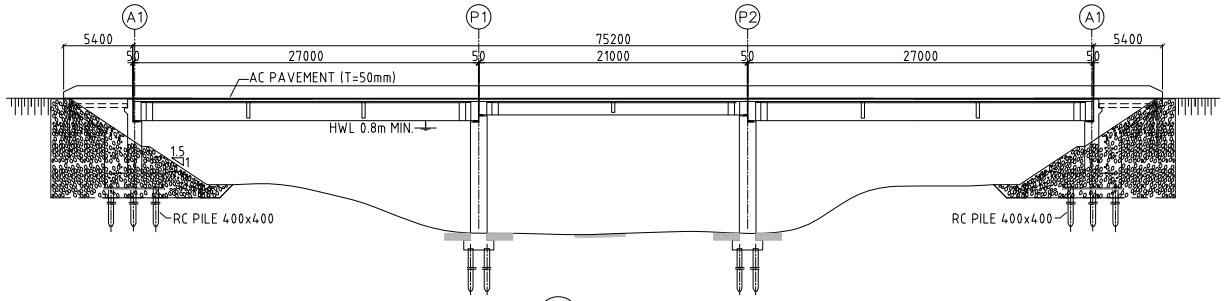
				Date :	MAR. 2013



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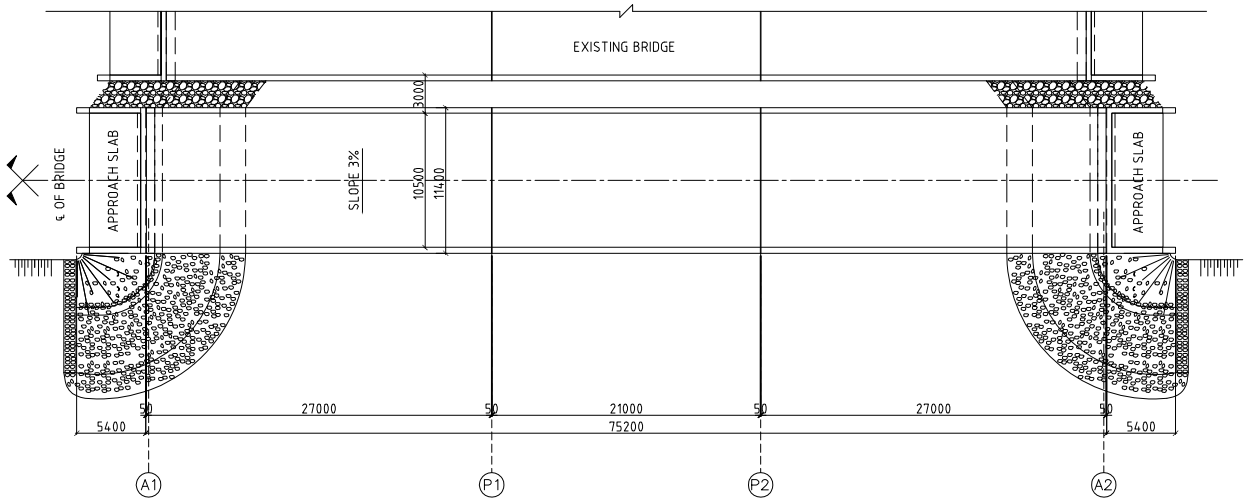
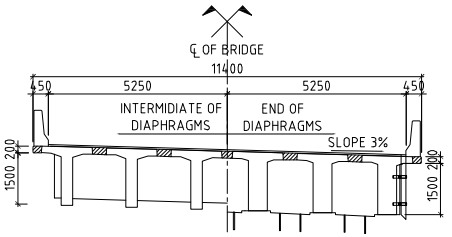
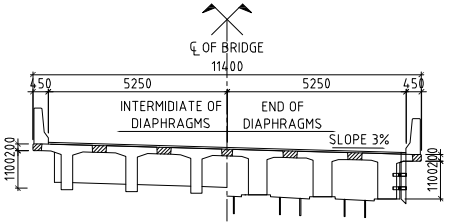
SCALE 1:400



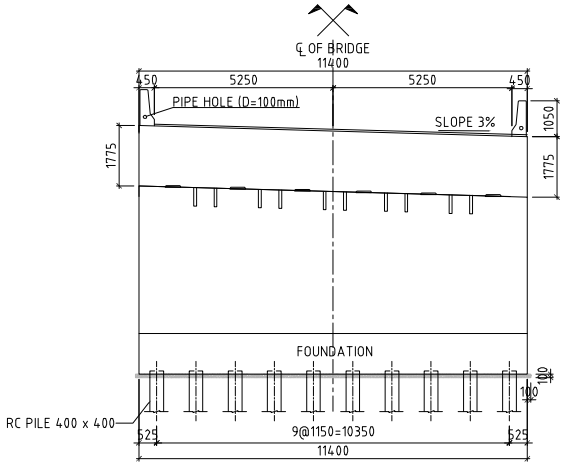
2 PLAN
SCALE 1:400



3 CROSS SECTION OF SUPERSTRUCTURE (P1–P2)
SCALE 1:150

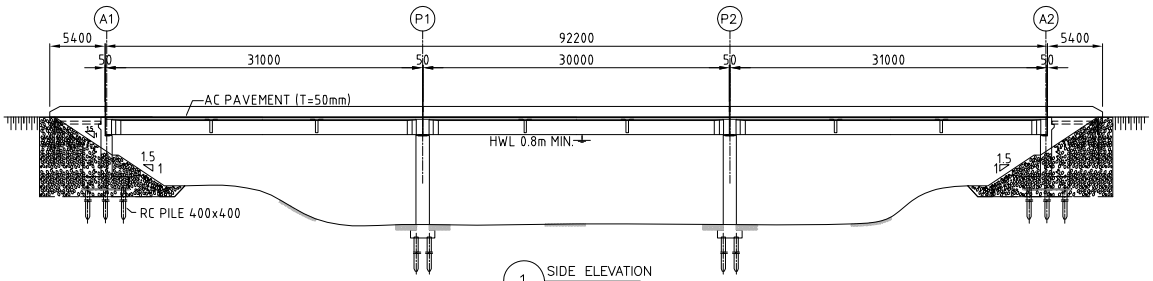


4 CROSS SECTION OF SUPERSTRUCTURE (A1–P1, P2–A2)
SCALE 1:150

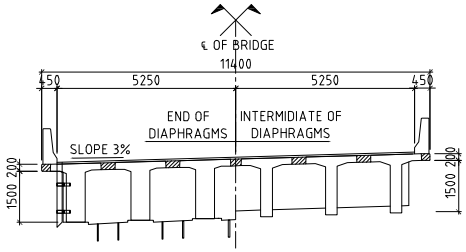


5 CROSS SECTION OF ABUTMENT
SCALE 1:150

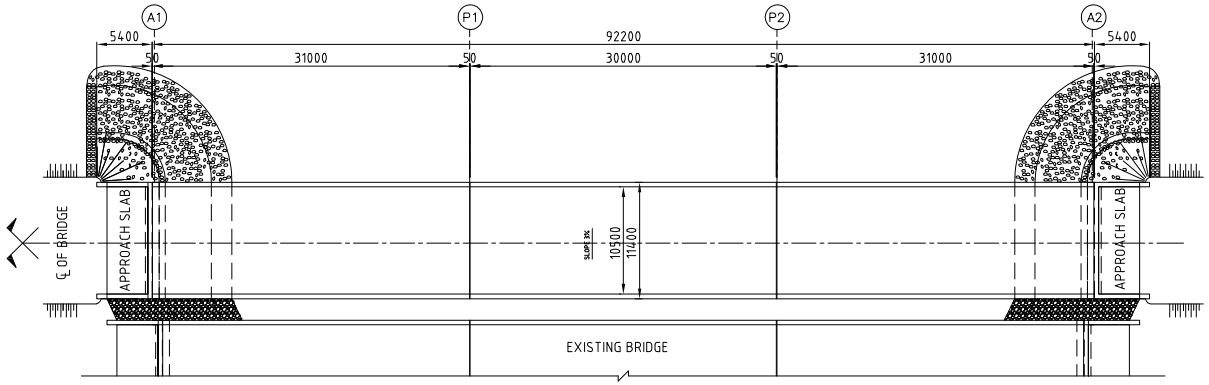
MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : CONSTRUCTION OF ADDITIONAL BRIDGE PCDG BRIDGE (L=75m) - Br.26 - GENERAL VIEW	Drawing No.	BR-06
				Scale :	
				Date :	MAR. 2013



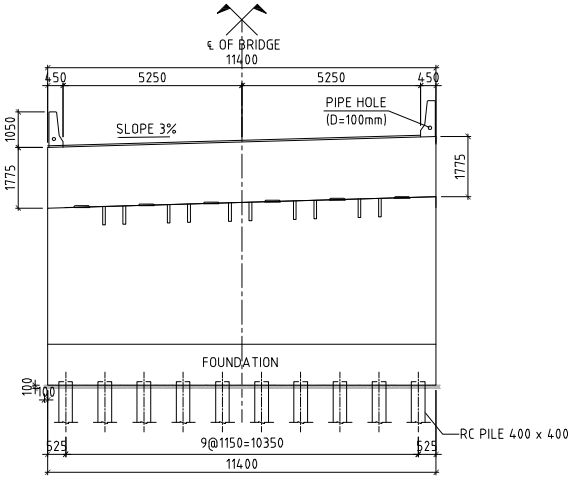
1 SIDE ELEVATION
SCALE 1:500



3 CROSS SECTION OF SUPERSTRUCTURE
SCALE 1:50

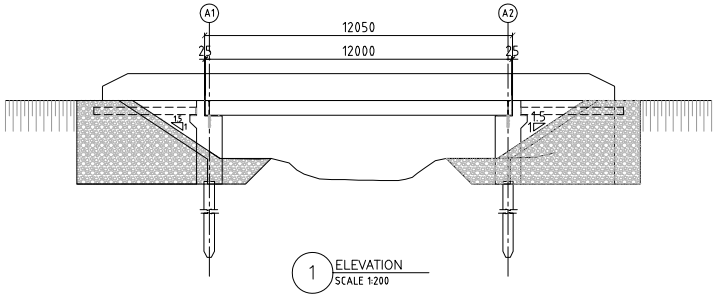


2 PLAN
SCALE 1:500

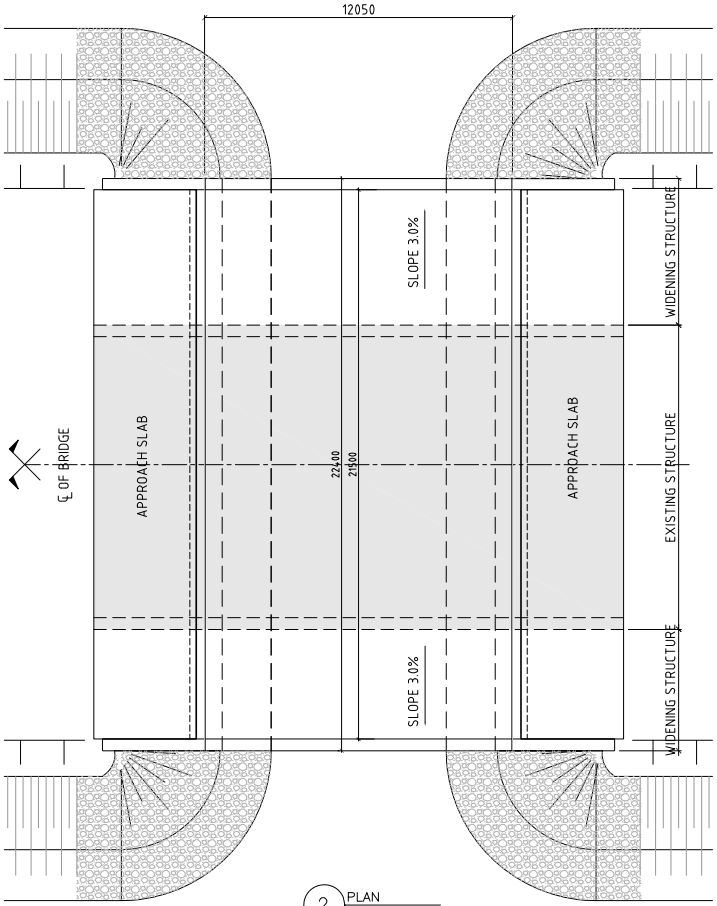


4 CROSS SECTION OF ABUTMENT
SCALE 1:50

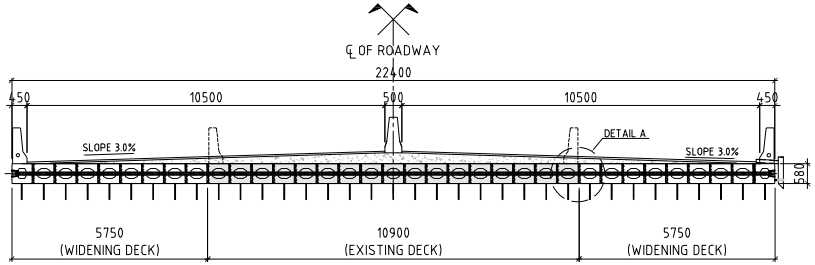
MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : CONSTRUCTION OF ADDITIONAL BRIDGE PCDG BRIDGE (L=92m) - Br.22 - GENERAL VIEW	Drawing No.	BR-07
				Scale :	
				Date :	MAR. 2013



1 ELEVATION
SCALE 1:200



2 PLAN
SCALE 1:200



3 CROSS SECTION OF SUPERSTRUCTURE
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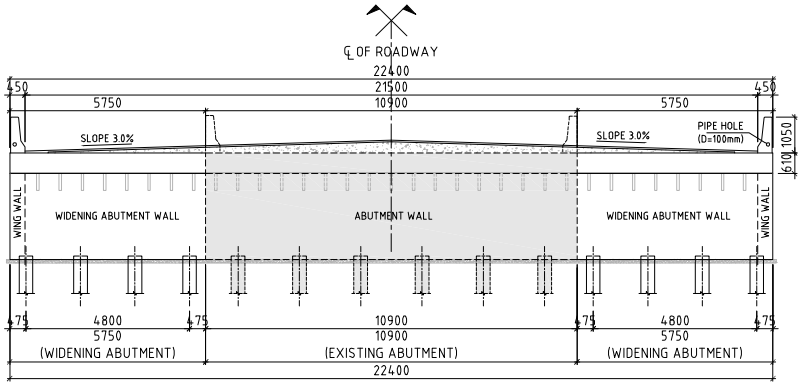
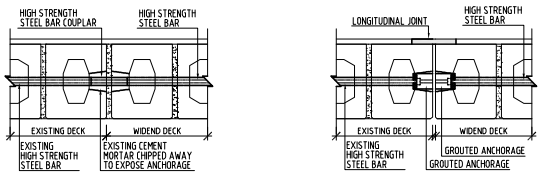
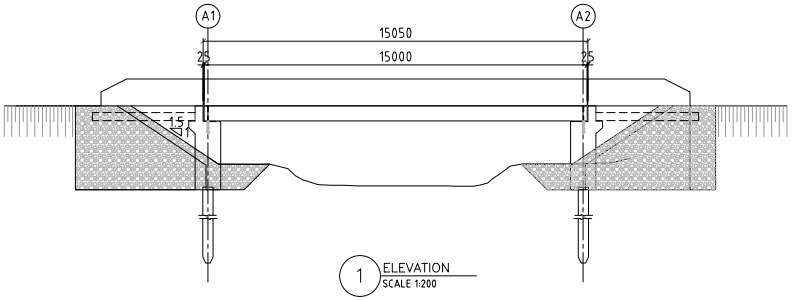


4 CROSS SECTION OF ABUTMENT
SCALE 1:150

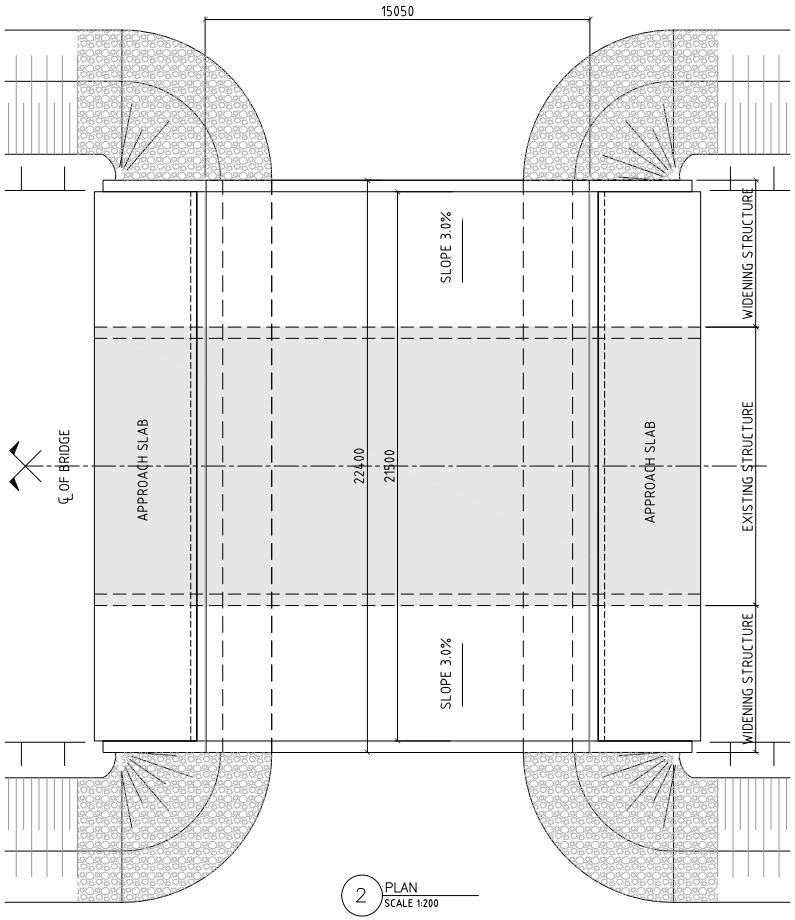


5 DETAIL
SCALE 1:50

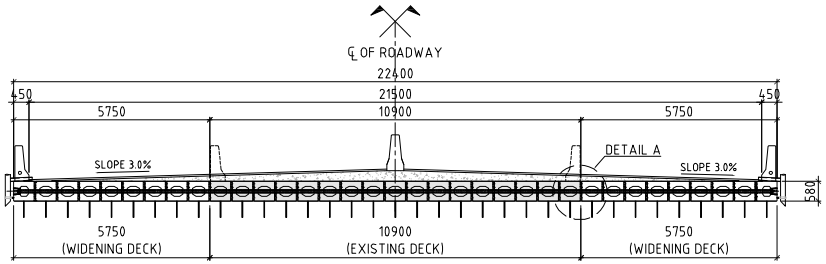
MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : WIDENING OF EXISTING BRIDGE PSC BRIDGE (L=12m) - Br.25, 27, 28, 29, 30, 31, 32, 35 - GENERAL VIEW	Drawing No.	BR-08
				Scale :	
				Date :	MAR. 2013



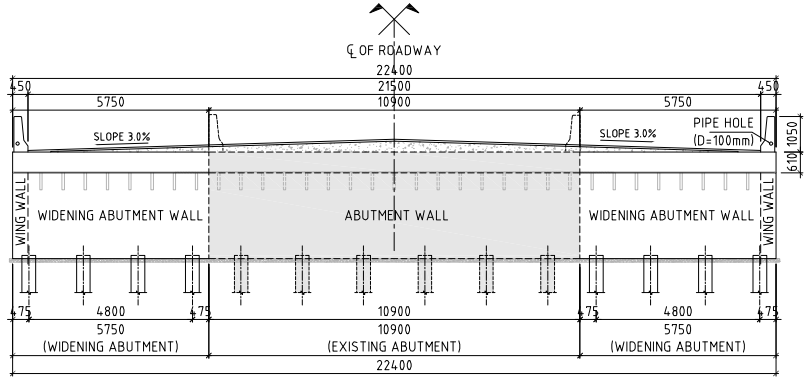
1 ELEVATION
SCALE 1:200



2 PLAN
SCALE 1:200



3 CROSS SECTION OF SUPERSTRUCTURE
SCALE 1:150



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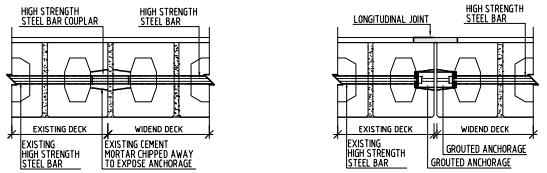
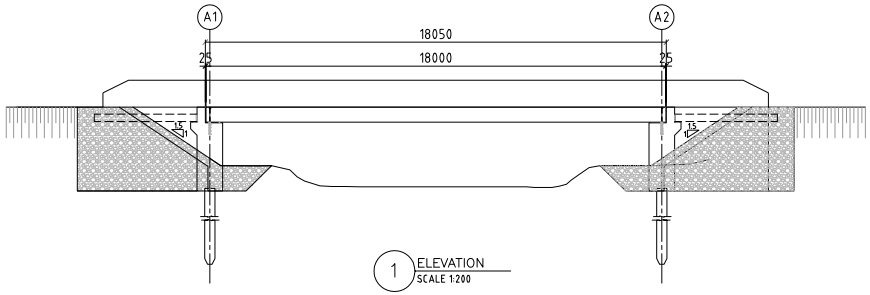
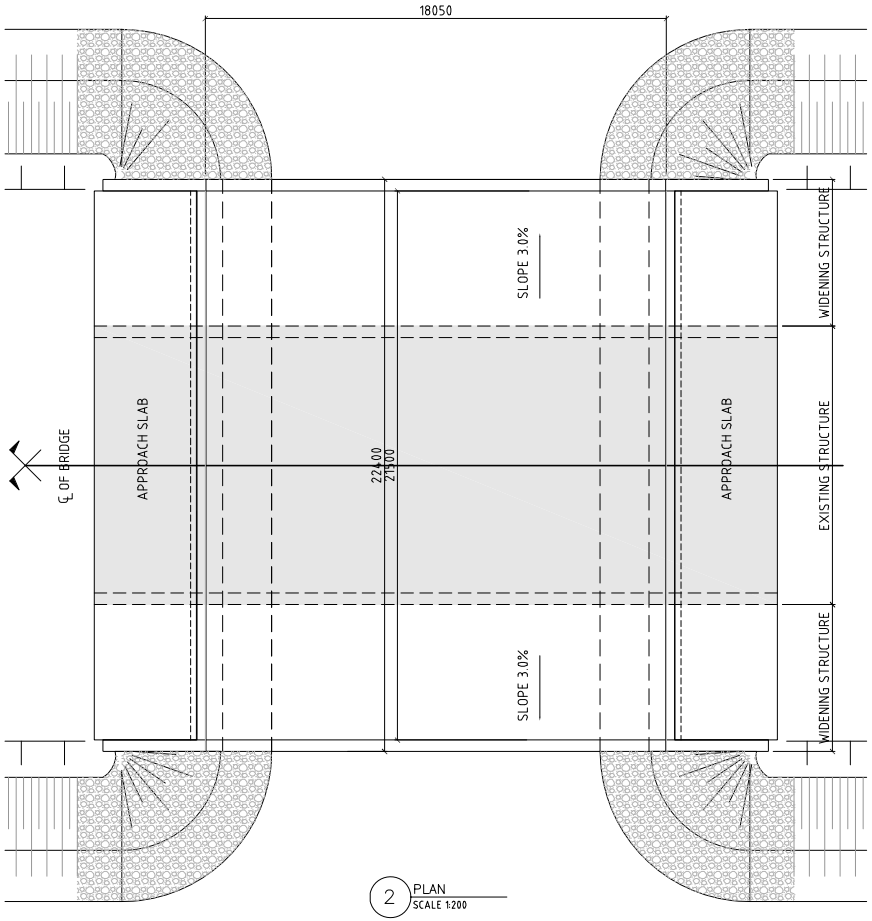


5 DETAIL
SCALE 1:50

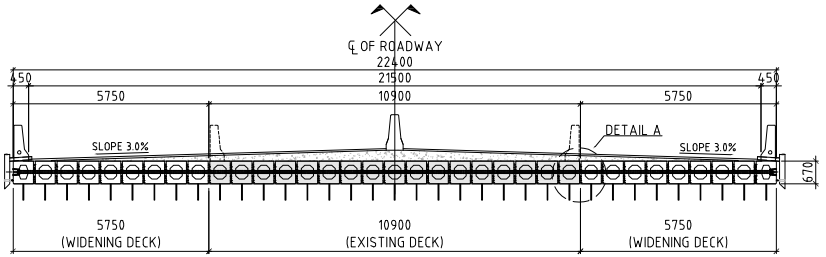
MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	WIDENING OF EXISTING BRIDGE PSC BRIDGE (L=15m) - Br.24, 34 - GENERAL VIEW	Drawing No.	BR-09
				Scale :	
				Date :	MAR. 2013



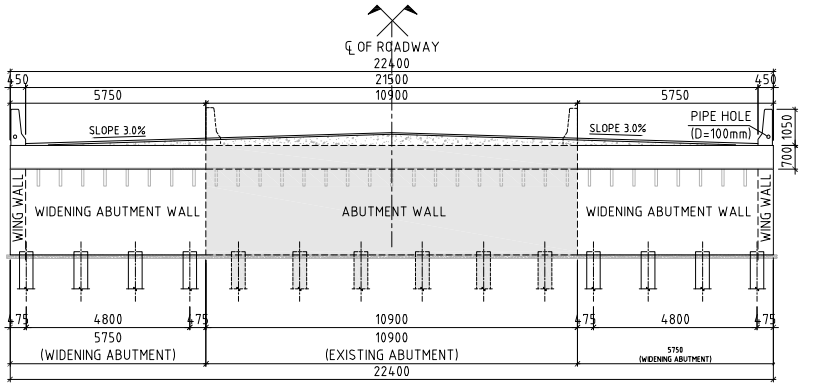
1 ELEVATION
SCALE 1:200



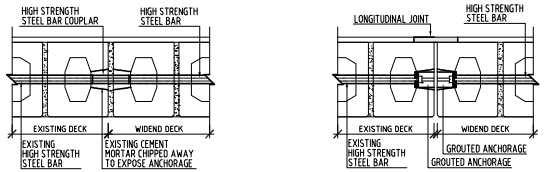
2 PLAN
SCALE 1:200



3 CROSS SECTION OF SUPERSTRUCTURE
SCALE 1:150

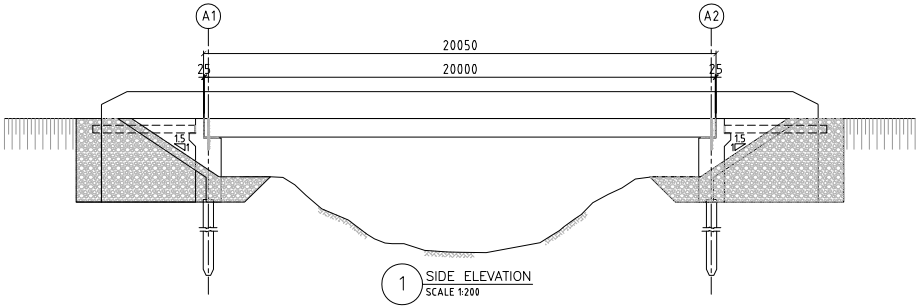


4 CROSS SECTION OF ABUTMENT
SCALE 1:150

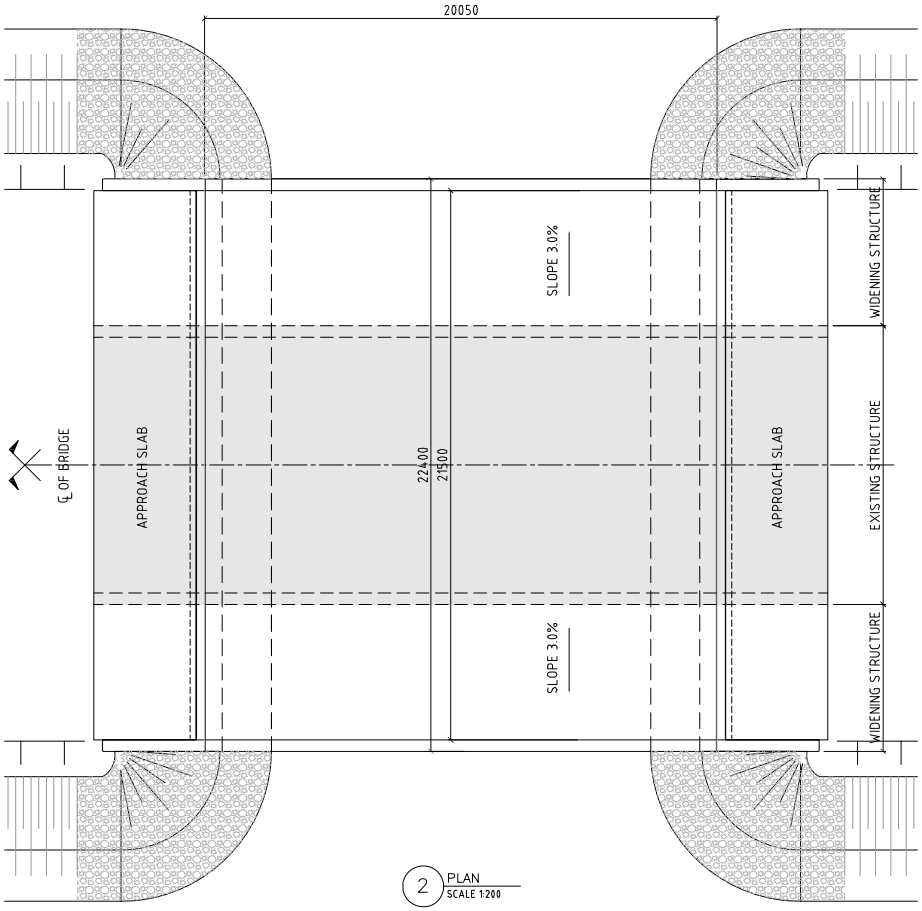


5 DETAIL
SCALE 1:50

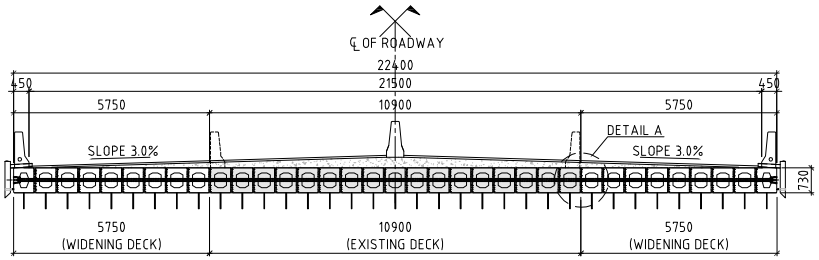
MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	WIDENING OF EXISTING BRIDGE PSC BRIDGE (L=18m) - Br.33 - GENERAL VIEW	Drawing No.	BR-10
				Scale :	
				Date :	MAR. 2013



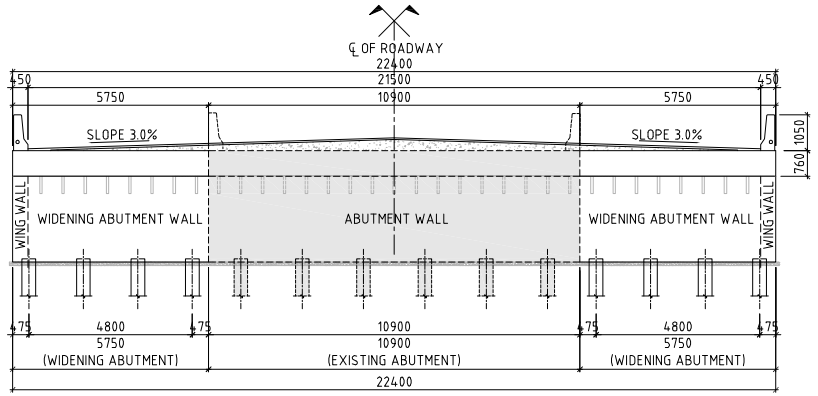
1 SIDE ELEVATION
SCALE 1:200



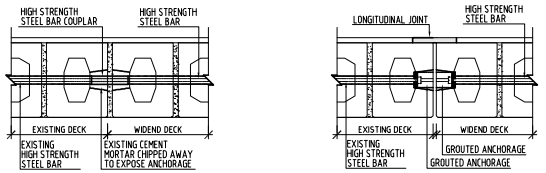
2 PLAN
SCALE 1:200



3 CROSS SECTION OF SUPERSTRUCTURE
SCALE 1:150

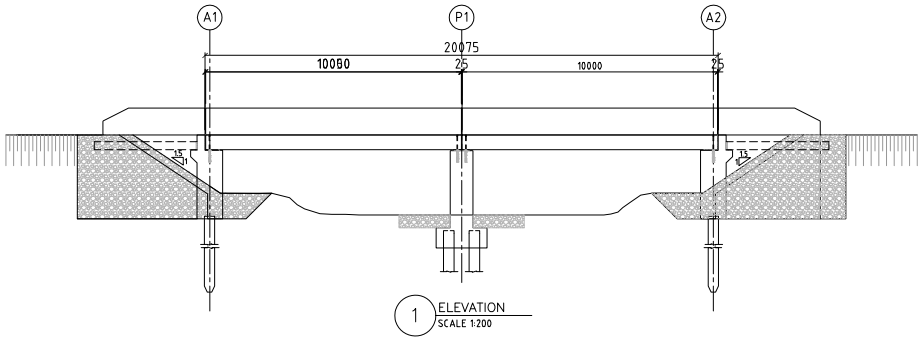


4 CROSS SECTION OF ABUTMENT
SCALE 1:150

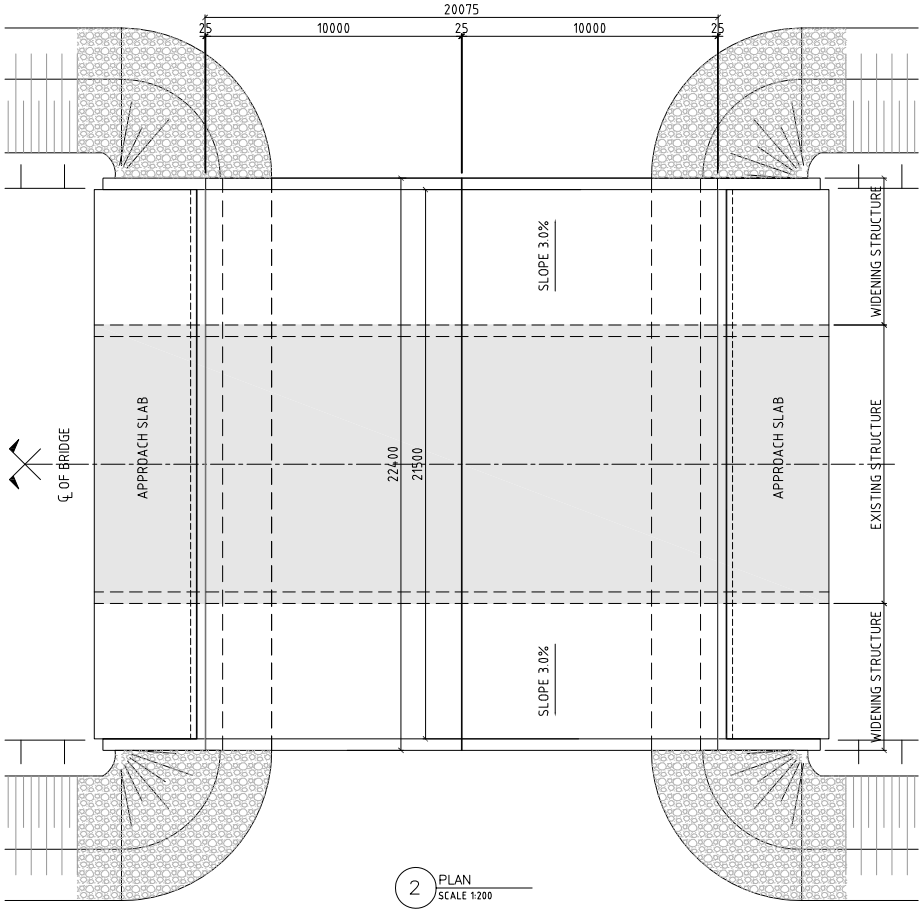


5 DETAIL
SCALE 1:50

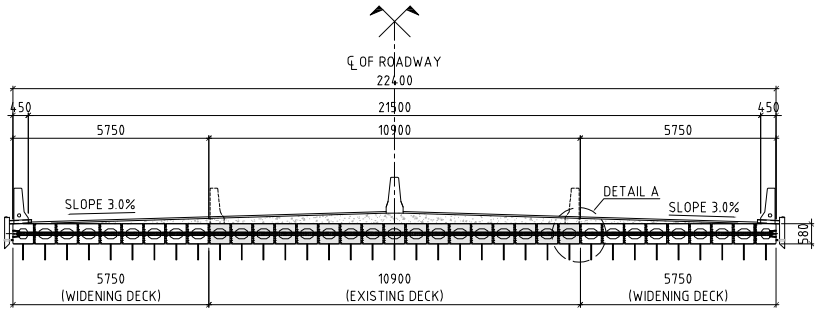
MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	WIDENING OF EXISTING BRIDGE PSC BRIDGE (L=20m) - Br.23, 37 - GENERAL VIEW	Drawing No.	BR-11
				Scale :	
				Date :	MAR. 2013



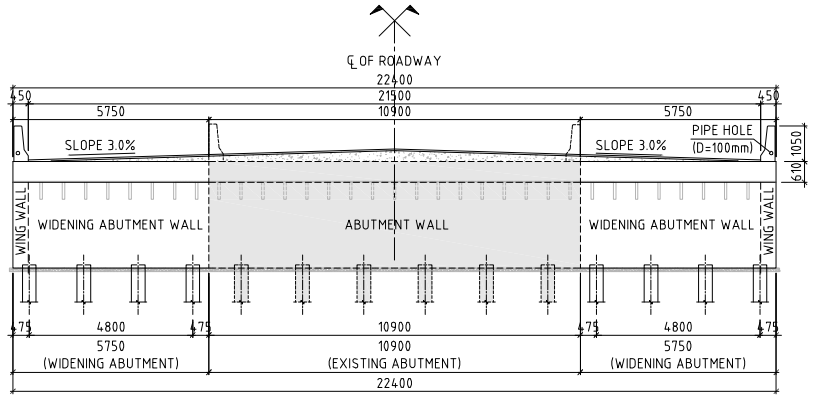
1 ELEVATION
SCALE 1:200



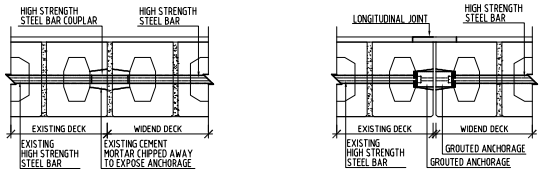
2 PLAN
SCALE 1:200



3 CROSS SECTION OF SUPERSTRUCTURE
SCALE 1:150

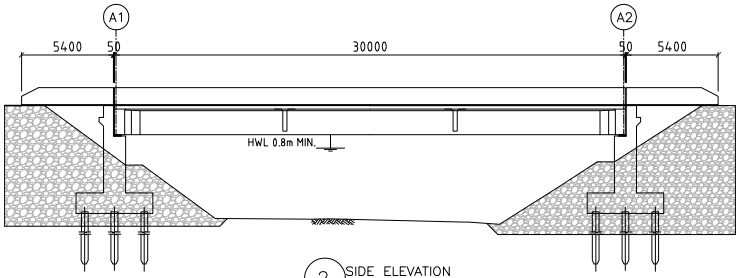


4 CROSS SECTION OF ABUTMENT
SCALE 1:150

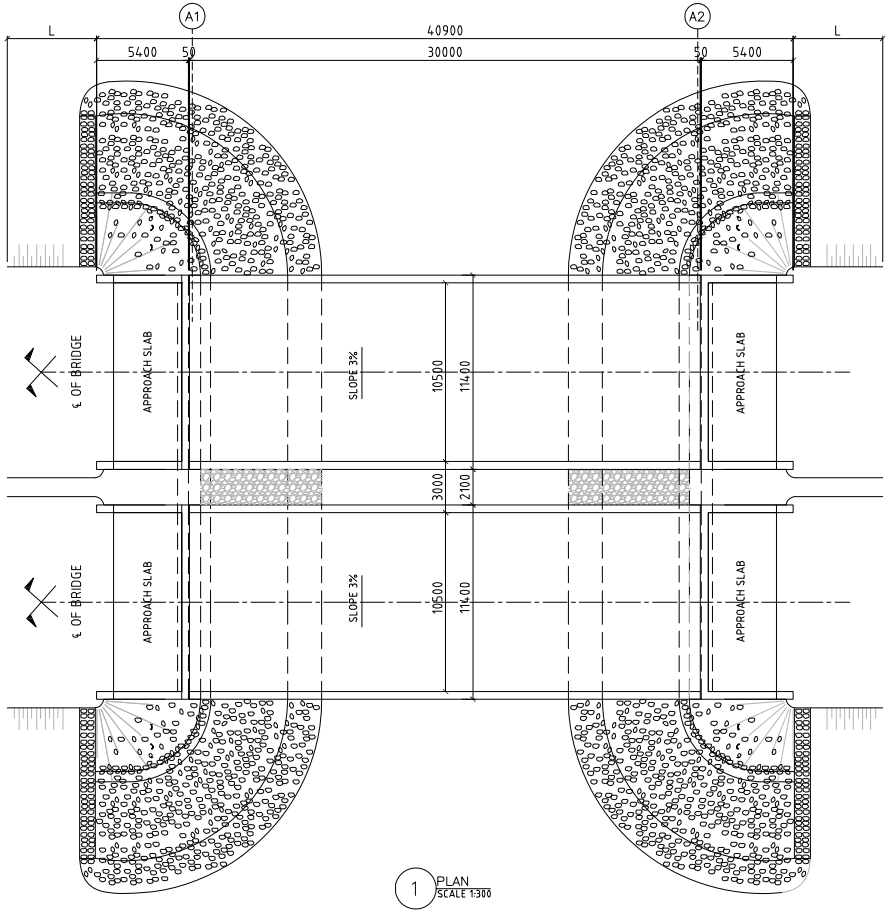


5 DETAIL
SCALE 1:50

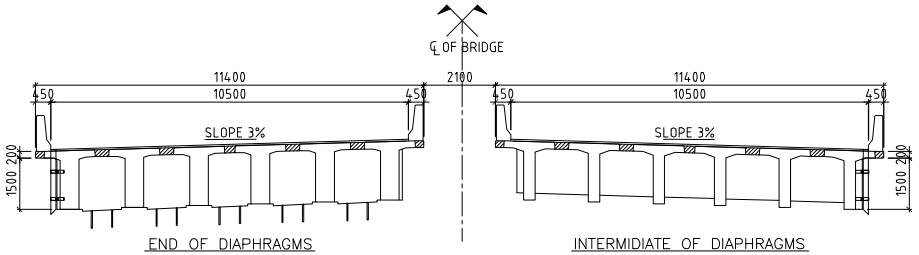
MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : WIDENING OF EXISTING BRIDGE PSC BRIDGE (L=20m) - Br.36 - GENERAL VIEW	Drawing No.	BR-12
				Scale :	
				Date :	MAR. 2013



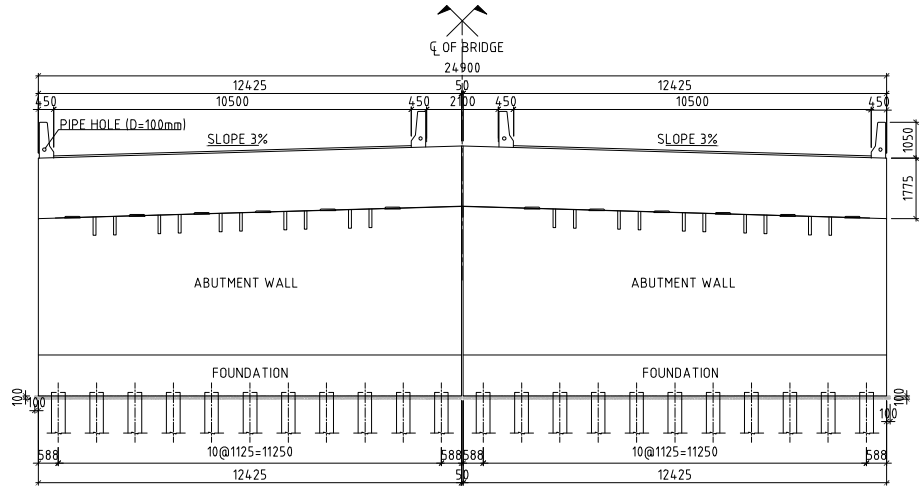
2 SIDE ELEVATION
SCALE 1:300



1 PLAN
SCALE 1:300



3 CROSS SECTION OF SUPERSTRUCTURE
SCALE 1:150



4 CROSS SECTION OF ABUTMENT
SCALE 1:150

MINISTRY OF PUBLIC WORKS & TRANSPORT KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	PREPARATORY SURVEY FOR NATIONAL ROAD NO.5 (SOUTH SECTION) IMPROVEMENT PROJECT	TITLE : CHREY BAK RIVER BRIDGE ON KAMPONG CHHNANG BYPASS GENERAL VIEW	Drawing No.	BR-13
				Scale :	
				Date :	MAR. 2013

APPENDIX 16-1

TECHNICAL SPECIFICATION
ON
STUDY FOR
NATURAL ENVIRONMENTAL IMPACT

SUPPLEMENTARY TECHNICAL SPECIFICATIONS
on
STUDY FOR NATURAL ENVIRONMENTAL IMPACT
under
PREPARATORY SURVEY
FOR
NATIONAL ROAD No. 5 REHABILITATION PROJECT
(PREK KDAM BRIDGE – THLEA MA'AM)

February 2013
KATAHIRA & ENGINEERS INTERNATIONAL

1. Baseline Survey on Natural Environment and Pollution

1.1 Air Quality Survey (Analysis)

Survey Items:

1. PM 10μm or Total Suspended Particulate
2. PM 2.5μm
3. NOX
4. SOX

Survey Time:

1. One day after three consecutive days with no rain in March, 2013, except for holiday and rainy day
2. One day in early July, 2013, except for holiday

Measuring Period:

1. 24 hours in a low

Survey Points:

1. 5 cross-sections
2. Total 10 Points (1 roadside point + 1 point for measuring background on each cross-section)
   Cross Section 1: Around Oudong Referral Hospital in Veang Chas Commune
   Cross Section 2: Around Department of Social Veteran and Youth Rehabilitation in Kampong Chhnang
   Cross Section 3: Northern part of Kampong Chhnang urban area (Around 97 kilometer post)
   Cross Section 4: Eastern edge of Pusat Province (Around 135 kilometer post)
   Cross Section 5: Eastern side of Ou Chankok River River (Around 170 kilometer post)

1.2 Noise and Vibration Survey (Measurement)

Survey Items:

1. Equivalent continuous A-weighted sound pressure Level (LAeq)
2. Vibration Level

Survey Time:

1. One day in March, 2013, except for holiday and rainy day

Measuring Period:

1. 24 hours in a low or from 6 a.m. to 10 p.m. (Depending on security condition during nighttime)

Survey Points:

1. Same points as Air Quality Survey

1.3 Water Quality Survey (Sampling and Analysis)

Survey Items:

1. pH
2. BOD
3. COD
4. SS
5. Coliform

Survey Time:

1. One day after three consecutive days with no rain in March, 2013, except for rainy day
2. One day in early July, 2013

Survey Points:

1. Total 10 Points
   Sampling Point 1: Tonle Sap River
   Sampling Point 2: A reservoir in Kampong Luong Commune, Kandal
   Sampling Point 3: River at provincial boundary between Kampong Spue and Kampong Chhang
   Sampling Point 4: A channel in Svay Commune, Kampong Chhang
   Sampling Point 5: Cheung Kreav River in Chrey Bak Commune, Kampong Chhang
   Sampling Point 6: Phnom Lech Reservoir in Pongro Commune, Kampong Chhang
   Sampling Point 7: Ou Prong River in Prasnoeb Commune, Kampong Chhang
   Sampling Point 8: Bonbou River in Phumi Phasar Town, Kampong Chhang
   Sampling Point 9: Ou Chankok River in Tnot Chum Commune, Pursat
   Sampling Point 10: Pursat River

1.4 Waste Survey

Location:

1. Both sides of the target road including Kampong Chhnang Bypass

Item to be surveyed:

1. Official waste management system of cities and towns along the road
2. Outline of major illegal waste dumping sites (maximum 10 sites) along the road

1.5 Ecosystem Survey

Methodology

1. Literature research
2. Field survey in dry and rainy period
3. Interview to local people

Survey Item (The following items includes, but not limited to)

1. Ecosystem in surrounding area of the proposed NR No. 5

   For example:
   - Paddy field
   - Residential and urban area
   - Vegetable and fruit farm
   - Wetland and flood plain
   - Reservoir and channel
   - Natural river
   - Sparse woodland and shrub land
   - Buffer zone of Tonle Sap biosphere reserve

2. Species and distributions of main roadside trees along both the roadsides (7 m from road center).
3. Possibility of inhabitation of rare or endangered species in surrounding area of the proposed NR No. 5
4. Positive effects of flood on ecosystem, fishery and agricultural land

2. Environmental Impact Evaluation

The environmental impact evaluation shall be conducted on the basis of "PRAKAS (DECLARATION) ON GENERAL GUIDELINE FOR CONDUCTING INITIAL AND FULL ENVIRONMENTAL IMPACT ASSESSMENT REPORTS" and JICA Guidelines for Environmental and Social Considerations (2010).

APPENDIX 16-2

LIST OF FLORA

List of Flora

No.	Local Name	Scientific Name	Family	IUCN Red List Status
1	Breng Khyol	*Eucalyptus camaldulensis Dehnh.*	Myrtaceae	N/A
2	Chrey	*Ficus spp.*	Moraceae	N/A
3	Tnaot	*Borassus flabellifer*	Palmae	N/A
4	Putrea	*Zizyphus mauritiana*	Rhamnaceae	LC
5	Ang Kanh	*Cassia siamensis Lam.*	Leguminosae	N/A
6	Trabaek	*Psidium Guajava*	Myrtaceae	N/A
7	Teuk Dah Ko	*Chrysophyllum cainito*	Sapotaceae	N/A
8	Trabaek Prey	*Lagerstroemia floribunda*	Lythraceae	N/A
9	Snay	*Sterblus asper*	Moraceae	N/A
10	Dongkieb Kdam	*Antidesma cochinensis*	Euphorbiaecae	N/A
11	Pring	*Eugenia spp.*	Myrtaceae	N/A
12	Thbaeng	*Dipterocapus obtusifolius,teysm*	Dipterocarpaceae	N/A
13	Kanthum Thet	*Leucaena leucocephala*	Leguminosae	N/A
14	Sangke	*Combritum quarangulare*	Combritaceae	N/A
15	Chhoeuteal	*Dipterocapus costatus,Gaertn.*	Dipterocarpaceae	N/A
16	Acacia Sleuk Touch	*Acacia auriculiformis Muell.*	Mimosaceae	N/A
17	Por	*Ficus religiosa L.*	Moraceae	N/A
18	Chan Kiri	*Albizia saman*	Leguminosae	N/A
19	Kdol	*Sarcoccphalus cordatus, Mig.*	Rubiaceae	N/A
20	Svay	*Mangifera indica*	Anacardiaceae	N/A
21	Cham Bak	*Irvingia malayana*	Simaroubaceae	LC
22	Poun Sva	*Spondias spp.*	Anacardiaceae	N/A
23	Sdav	*Azadirachta indica Ant. Juss.*	Meliaceae	N/A
24	Raing Toek	*Barringtonia acutangula (L.) Gaertn.*	Lecythidaceae	N/A
25	Trosek	*Peltophorum dasyrrhachis*	Leguminosae	N/A
26	Thlork	*Parinarium annamensis, hance*	Rosaceae	N/A
27	Kor	*Ceiba Pentandra*	Bombacaceae	N/A
28	Pong-Ro	*Schleicheria oleosa*	Sapindaceae	N/A
29	Lvea	*Ficus racemosa*	Moraceae	N/A
30	Thkov	*Anthocephalus chinensis*	Rubiaceae	N/A
31	Svay Chan Ti	*Anacadium occidentale L.*	Anacardiaceae	N/A
32	Chonlos	*Erioglossum edule*	SAPINDACEAE	N/A
33	La Ngeang	*Cratoxylon prunifolium, Dyer.*	Hyperieaceae	N/A
34	Trasek	*Peltophorum ferrugieum*	Ceasalpiniaceae	N/A
35	Tramaeng	*Carallia lucida, Roxb.*	Rhizophoraceae	N/A
36	Phnom Phnaeng	*Hymenocaedia wallichii*	Euphorbiaceae	N/A
37	Ampil Toek	*Pithecellobium dulce*	Leguminosae	N/A
38	Popea Khe	*Terminalia bialata*	Combretaceae	N/A
39	Sla	*Areca catechu*	Palmae	N/A
40	Kantuot	*Phyllanthus acidus*	Euphorbiaceae	N/A
41	Khnol	*Artocarpus heterophyllus*	Moracea	N/A
42	Tiep	*Annona squamosa*	Annonaceae	N/A
43	Am Pil	*Tamarindus indica*	Leguminosae	N/A
44	Doung	*Cocos nucifera*	Palmae	N/A
45	Tra Yoeng	*Diospyros helferi, C.B.Clarke*	Ebcnaceae	N/A
46	Maisak	*Tectona grandis,L.F.*	Verbenaceae	N/A
47	Thnong	*Pterocarpus pedatus, pierre*	Papilionaccac	N/A
48	Chonlus	*Erioglossum edule*	Sapindaceae	N/A
49	Kray Sor	*Albizia thorelii, Poir.*	Mimosaceae	N/A
50	Char	*Butea monosperma*	Leguminosae	N/A
51	Kandoal	*Careya spaerica*	Myrtaceae	N/A
52	Trahs	*Combretum trifoliatum*	Combretaceae	N/A

No.	Local Name	Scientific Name	Family	IUCN Red List Status
53	Phka Kradahs	*Bougainvillea buttiana*	Nyctaginaceae	N/A
54	Russey Khlei	*Bambusa bambos*	Poaceae	N/A
55	Russey Srok	*Dendrocalamus membranaceus*	Gramineae	N/A
56	Russey Ping Pong	*Gigantochloa albociliata*	Poaceae	N/A
57	Ka Bas Prey	*Cochlospermum religiosum*	Cochlospermaceae	N/A
58	Totuem	*Punica granatum*	Punicaceae	LC
59	Andat Koa	*Achyranthes aspera*	Amaranthaceae	N/A
60	Chek	*Musa spp.*	Musaceae	N/A
61	Thmenh Trey	*Ichnocarpus oxypetalus*	Apocynaceae	N/A
62	Kantrieng Khaet	*Chromolaena odorata*	Compositae	N/A
63	Ban La Bay Dam Noeub	*Acacia concinna*	Fabaceae	N/A
64	Rom Chek	*Pandanus humilis*	Pandanaceae	N/A
65	Sbov	*Imperata cylindrical*	Gramineae	N/A
66	Kan Troob	*Murraya koenigii*	Rutaceae	N/A
67	Voi Sao Mav	*Passiflora foetida*	Passifloraceae	N/A
68	Pramaoy Damrei	*Heliotropium indicum*	Boraginaceae	N/A
69	Kamphlaok	*Eichhornia crassipes*	Pontedderiaceae	N/A
70	Lhong Khvorng	*Jatropha curcas*	Euphorbiaceae	N/A
71	Trav	*Colocasia esculenta Var. Esculenta*	Araceae	N/A
72	Cheng Tokae	*Coldenia procumbens*	Boraginaceae	N/A
73	Choeung Kou/Sleng Por	*Bauhinia acuminate*	Ceasalpiniaceae	LC
74	Kak	*Cyperus cyperiodes*	Cyperaceae	N/A
75	Bay Kdaing	*Leea indica*	Leeaceae	N/A
76	Cheung Chab Srok	-	-	-
77	Sangkhor	-	-	-
78	Banla Ouyas	-	-	-
79	Preal	-	-	-
80	Kam Polbay	-	-	-
81	Voer Chuy	-	-	-
82	Changrang Seh	-	-	-
83	Sandaek Khmoach	-	-	-
84	Ban Tiel Krong Samrith	-	-	-
85	Anhanh	-	-	-
86	Lpak	-	-	-
87	Suos	-	-	-
88	Kom Siev	-	-	-
89	Day Tun	-	-	-
90	Kravan (Flower)	-	-	-
91	Kravan (Kdor Ta)	-	-	-
92	Kra Saing	-	-	-
93	Dong Het	-	-	-
94	Mrech Thonsay	-	-	-
95	Chong Krang Sva	-	-	-
96	Pka Sareka Keo	-	-	-
97	Sleuk Kri	-	-	-
98	Puoch	-	-	-
99	Voi Doskuon	-	-	-
100	Voi Kneung	-	-	-
101	Bunla Chheur Em	-	-	-
102	Trakuon Tech	-	-	-
103	Ach Kandol	-	-	-
104	Nheinh	-	-	-
105	Traeng	-	-	-

No.	Local Name	Scientific Name	Family	IUCN Red List Status
106	Por Phenh Nhi	-	-	-
107	Por Phenh Chhmoul	-	-	-
108	Ro Luos Chhmoul	-	-	-
109	Chhat	-	-	-
110	Makak	-	-	-
111	Nhar Srok	-	-	-
112	Ba Buoy	-	-	-
113	Nhchey	-	-	-
114	Phka Kra Ngoak	-	-	-
115	Kra Khob	-	-	-
116	Loeurng Riech	-	-	-
117	Ro Luos Nhi	-	-	-

Note: N/A = Not Available LC = Least Concern

APPENDIX 16-3

RESULT OF NOISE AND VIBRATION SURVEY

1. Result of Noise Survey

Cross Section 1

Roadside Point

Time	Survey Period	Noise Level dB(A)			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	63.2	70	76.2	46.4
	7:00 - 8:00	66.6	70	86.6	47.9
	8:00 - 9:00	69.4	70	91.3	48.5
	9:00 - 10:00	69.4	70	89.7	48.1
	10:00 - 11:00	64.8	70	79	47.3
	11:00 - 12:00	67	70	86.6	47.6
	12:00 - 13:00	65.1	70	84.3	47.5
	13:00 - 14:00	65.4	70	86.2	47.6
	14:00 - 15:00	65.9	70	80.8	49.5
	15:00 - 16:00	64	70	77.2	46.3
	16:00 - 17:00	66.9	70	86.7	48.8
	17:00 - 18:00	65.2	70	76.8	45.9
	18:00 - 19:00	66.2	70	81.4	44.8
Evening	19:00 - 20:00	64.5	65	78.9	44.7
	20:00 - 21:00	61.9	65	76.3	45.1
	21:00 - 22:00	57.5	65	72.4	45.7
	22:00 - 23:00	56	65	70.1	44.3
Night	23:00 - 00:00	56.6	50	74.3	44.5
	00:00 - 1:00	54.8	50	69	44.5
	1:00 - 2:00	53.9	50	69.6	44.3
	2:00 - 3:00	54.7	50	70.4	44.5
	3:00 - 4:00	53.6	50	68.2	44.1
	4:00 - 5:00	56.1	50	70.1	43.7
	5:00 - 6:00	61.7	50	74.9	47.2

Background Point

Time	Survey Period	Noise Level dB(A)			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	47.8	70	62.2	40.5
	7:00 - 8:00	48.4	70	64.5	39.8
	8:00 - 9:00	47.6	70	57.2	40.9
	9:00 - 10:00	47.9	70	59.3	42.1
	10:00 - 11:00	45.6	70	64.7	42.3
	11:00 - 12:00	45.6	70	55.6	41.3
	12:00 - 13:00	45.3	70	58.9	40.7
	13:00 - 14:00	45	70	56.7	41.9
	14:00 - 15:00	44.9	70	60	42
	15:00 - 16:00	45.8	70	55.1	41.5
	16:00 - 17:00	45.6	70	58.5	41.9
	17:00 - 18:00	45.1	70	62.5	41.8
	18:00 - 19:00	45.8	70	56.2	40.7
Evening	19:00 - 20:00	43.1	65	56.4	40.1
	20:00 - 21:00	43.4	65	58.7	40.6
	21:00 - 22:00	44.7	65	57.6	40.1
	22:00 - 23:00	43.1	65	55.3	40.3
Night	23:00 - 00:00	42.8	50	54.4	39.8
	00:00 - 1:00	43.1	50	54.2	41.8
	1:00 - 2:00	44.5	50	60.2	40.6
	2:00 - 3:00	45.9	50	61.6	40.4
	3:00 - 4:00	44.2	50	56.6	40.6
	4:00 - 5:00	45.3	50	58.7	40.5
	5:00 - 6:00	46.3	50	60.1	41.2

Cross Section 2

Roadside Point

Time	Survey Period	Noise Level dB(A)			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	68.6	70	72.5	50.6
	7:00 - 8:00	69.7	70	95.4	53.5
	8:00 - 9:00	66	70	74.2	55
	9:00 - 10:00	63.8	70	80.5	51.1
	10:00 - 11:00	64.6	70	84.6	51.7
	11:00 - 12:00	63.6	70	78.1	55
	12:00 - 13:00	63.3	70	80.1	52
	13:00 - 14:00	62.9	70	74.3	51.3
	14:00 - 15:00	67.9	70	92.9	52.1
	15:00 - 16:00	62.7	70	76.8	51.8
	16:00 - 17:00	62.9	70	78.7	50.8
	17:00 - 18:00	63.5	70	75.2	51.9
	18:00 - 19:00	64.1	70	77.1	52
Evening	19:00 - 20:00	62.6	65	78.6	51.4
	20:00 - 21:00	58.5	65	76.5	49.8
	21:00 - 22:00	56.5	65	72.6	46.1
	22:00 - 23:00	55.4	65	67.4	44.6
Night	23:00 - 00:00	55.6	50	68.8	44.7
	00:00 - 1:00	54	50	72.1	43.1
	1:00 - 2:00	54.8	50	70.7	43.9
	2:00 - 3:00	53.2	50	66.9	43.3
	3:00 - 4:00	54.1	50	67.4	43.4
	4:00 - 5:00	53.6	50	67.6	44.5
	5:00 - 6:00	56.4	50	70.2	47.4

Background Point

Time	Survey Period	Noise Level dB(A)			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	50.4	70	70.4	41.7
	7:00 - 8:00	49.5	70	58.1	44.5
	8:00 - 9:00	53	70	70.5	44.2
	9:00 - 10:00	50	70	65.7	42.1
	10:00 - 11:00	48.3	70	68.1	41.1
	11:00 - 12:00	48.7	70	61.8	41.8
	12:00 - 13:00	49.8	70	69.4	42.3
	13:00 - 14:00	49	70	64.1	42.9
	14:00 - 15:00	50.4	70	68.3	42.1
	15:00 - 16:00	51	70	64.2	43.6
	16:00 - 17:00	48.1	70	57	42.9
	17:00 - 18:00	49.9	70	64.6	42.1
	18:00 - 19:00	49.8	70	64.8	41.8
Evening	19:00 - 20:00	50.2	65	66.7	43.5
	20:00 - 21:00	49.6	65	65.6	41.3
	21:00 - 22:00	49.1	65	60.7	40.8
	22:00 - 23:00	49.2	65	62.3	40.8
Night	23:00 - 00:00	49.3	50	64.6	40.1
	00:00 - 1:00	48.9	50	59.6	40.2
	1:00 - 2:00	48.7	50	56.9	40.4
	2:00 - 3:00	48.5	50	55.6	39.6
	3:00 - 4:00	49.1	50	56.8	39.3
	4:00 - 5:00	49.8	50	66.6	40.4
	5:00 - 6:00	48.6	50	65.1	39.5

Cross Section 3

Roadside Point

Time	Survey Period	Noise Level dB(A)			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	64.6	70	80.8	44.7
	7:00 - 8:00	63.1	70	72.6	46.1
	8:00 - 9:00	64.3	70	77.6	46.3
	9:00 - 10:00	63.2	70	77.6	46
	10:00 - 11:00	61.9	70	75.2	49.5
	11:00 - 12:00	64	70	83.1	49.9
	12:00 - 13:00	64.1	70	76.4	49.7
	13:00 - 14:00	62.9	70	76.2	46.9
	14:00 - 15:00	65	70	80.5	46.7
	15:00 - 16:00	63.5	70	85.9	47.9
	16:00 - 17:00	64.9	70	83.9	47.1
	17:00 - 18:00	65.4	70	81.8	47.7
	18:00 - 19:00	63.3	70	76.8	47.2
Evening	19:00 - 20:00	63.6	65	72.2	46.8
	20:00 - 21:00	63.5	65	72.5	46.3
	21:00 - 22:00	61.4	65	70.6	46.2
	22:00 - 23:00	59.2	65	65.6	44.2
Night	23:00 - 00:00	58.4	50	65.3	44
	00:00 - 1:00	55.1	50	66.6	43.8
	1:00 - 2:00	54.6	50	60.2	43.8
	2:00 - 3:00	56.8	50	63.4	43.6
	3:00 - 4:00	58.9	50	70.1	44.1
	4:00 - 5:00	63.4	50	72.9	44.8
	5:00 - 6:00	63	50	71.3	43.7

Background Point

Time	Survey Period	Noise Level dB(A)			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	45.9	70	63.3	39
	7:00 - 8:00	46.9	70	57.6	37.4
	8:00 - 9:00	48.2	70	66	36.6
	9:00 - 10:00	48.7	70	51.9	38.4
	10:00 - 11:00	49.8	70	60.1	36.3
	11:00 - 12:00	49.5	70	56	37.7
	12:00 - 13:00	48.8	70	63.3	36.2
	13:00 - 14:00	48.5	70	56.6	36.7
	14:00 - 15:00	48.8	70	55.2	36.5
	15:00 - 16:00	48.7	70	60.2	37.2
	16:00 - 17:00	48.6	70	68	37.7
	17:00 - 18:00	48.5	70	63.8	37.4
	18:00 - 19:00	46.4	70	59.6	36.8
Evening	19:00 - 20:00	46.1	65	58.8	36.1
	20:00 - 21:00	45.8	65	60.6	36
	21:00 - 22:00	45.5	65	58.6	36.4
	22:00 - 23:00	44.8	65	56.7	36.1
Night	23:00 - 00:00	44.8	50	61.7	36.6
	00:00 - 1:00	45.1	50	57.7	36.2
	1:00 - 2:00	46.2	50	58.7	36.3
	2:00 - 3:00	44.1	50	55.2	36
	3:00 - 4:00	43.1	50	51.7	36.5
	4:00 - 5:00	43.8	50	54.4	36.9
	5:00 - 6:00	44.8	50	55.5	36.3

Cross Section 4

Roadside Point

Time	Survey Period	Noise Level dB(A)			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	65.3	70	80.4	41.6
	7:00 - 8:00	64.4	70	79.5	38.9
	8:00 - 9:00	64.9	70	78.7	39.2
	9:00 - 10:00	65.1	70	82.2	39.9
	10:00 - 11:00	65.4	70	85.5	38.8
	11:00 - 12:00	67	70	84.5	43.6
	12:00 - 13:00	65.1	70	84.2	40.6
	13:00 - 14:00	63.2	70	79.4	38.5
	14:00 - 15:00	66.3	70	78.4	43.6
	15:00 - 16:00	64.3	70	78.6	40
	16:00 - 17:00	64.7	70	79.2	41.3
	17:00 - 18:00	64.6	70	84.5	41.6
	18:00 - 19:00	66.4	70	81	40.7
Evening	19:00 - 20:00	63.4	65	75.6	39.3
	20:00 - 21:00	62.1	65	74.3	39.1
	21:00 - 22:00	61.5	65	74.2	40.2
	22:00 - 23:00	55.4	65	68.4	38.6
Night	23:00 - 00:00	55.3	50	70.1	39.7
	00:00 - 1:00	54.8	50	67.7	39.3
	1:00 - 2:00	53.6	50	66.8	38.8
	2:00 - 3:00	52.1	50	68.5	38.1
	3:00 - 4:00	54	50	72.7	38
	4:00 - 5:00	52.4	50	71.7	38.6
	5:00 - 6:00	55.7	50	74.3	39.9

Background Point

Time	Survey Period	Noise Level dB(A)			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	46.9	70	61.2	33.6
	7:00 - 8:00	53	70	66.2	36.3
	8:00 - 9:00	46.3	70	61.6	37.4
	9:00 - 10:00	55.3	70	70.2	35
	10:00 - 11:00	45.7	70	58.8	33.3
	11:00 - 12:00	45.5	70	60	33.9
	12:00 - 13:00	46.5	70	64.8	35.2
	13:00 - 14:00	47	70	62.3	36.5
	14:00 - 15:00	47.5	70	58.9	36.8
	15:00 - 16:00	45	70	55.9	34.8
	16:00 - 17:00	47.2	70	67.1	36.4
	17:00 - 18:00	47.4	70	62.1	35
	18:00 - 19:00	47	70	62.7	35.2
Evening	19:00 - 20:00	43.4	65	55.6	33.9
	20:00 - 21:00	44.4	65	56.5	32.9
	21:00 - 22:00	39.3	65	50.3	33.6
	22:00 - 23:00	40.7	65	51.6	34.1
Night	23:00 - 00:00	40.2	50	52.3	33.2
	00:00 - 1:00	39.1	50	51.4	33.6
	1:00 - 2:00	38.6	50	50.4	33.2
	2:00 - 3:00	38.3	50	51.8	33.4
	3:00 - 4:00	38.2	50	50.6	32.9
	4:00 - 5:00	39.1	50	55.3	33.5
	5:00 - 6:00	40.9	50	56.7	33.8

Cross Section 5

Roadside Point

Time	Survey Period	Noise Level dB(A)			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	64	70	70.7	49.1
	7:00 - 8:00	65.6	70	78.1	50.1
	8:00 - 9:00	68.7	70	80.1	50.8
	9:00 - 10:00	67.6	70	78.9	51.6
	10:00 - 11:00	63.4	70	77.4	50.8
	11:00 - 12:00	62.2	70	77.6	49.9
	12:00 - 13:00	65.4	70	75.8	51.8
	13:00 - 14:00	62.6	70	77.2	50.1
	14:00 - 15:00	62.7	70	81.6	48.1
	15:00 - 16:00	61.6	70	74.4	50.1
	16:00 - 17:00	62.6	70	73.5	49.3
	17:00 - 18:00	62.5	70	77.5	49.7
	18:00 - 19:00	61.4	70	74.4	41.1
Evening	19:00 - 20:00	61.3	65	74.1	40.2
	20:00 - 21:00	57.3	65	72.7	43.2
	21:00 - 22:00	57.9	65	72.9	43.9
	22:00 - 23:00	56.8	65	73.1	43.3
Night	23:00 - 00:00	56.9	50	72.9	42.7
	00:00 - 1:00	56.2	50	71.3	41.9
	1:00 - 2:00	56.6	50	68.4	40
	2:00 - 3:00	56.7	50	72.1	41.6
	3:00 - 4:00	61.6	50	78.1	44.6
	4:00 - 5:00	60.7	50	78	44.7
	5:00 - 6:00	61.8	50	85.3	45.1

Background Point

Time	Survey Period	Noise Level dB(A)			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	48.3	70	59.9	39.8
	7:00 - 8:00	48.4	70	59.5	39.8
	8:00 - 9:00	48.3	70	56.7	40.2
	9:00 - 10:00	49.1	70	58.2	44.5
	10:00 - 11:00	48.8	70	59.5	42.1
	11:00 - 12:00	48.6	70	60.5	40.9
	12:00 - 13:00	48.5	70	64.1	42.4
	13:00 - 14:00	48.2	70	59.7	43.4
	14:00 - 15:00	48.7	70	64.7	40.8
	15:00 - 16:00	47	70	63.5	39.4
	16:00 - 17:00	46.7	70	59	40.2
	17:00 - 18:00	47.6	70	56.9	41.5
	18:00 - 19:00	46.4	70	60.3	40.2
Evening	19:00 - 20:00	47.3	65	56.5	39.6
	20:00 - 21:00	46.8	65	56.3	39.1
	21:00 - 22:00	45.3	65	55.4	38.8
	22:00 - 23:00	45.6	65	58.2	38.7
Night	23:00 - 00:00	45.1	50	57.5	39
	00:00 - 1:00	45.3	50	55.3	39.3
	1:00 - 2:00	45.1	50	52.3	38.9
	2:00 - 3:00	46.7	50	59.9	39.4
	3:00 - 4:00	46.8	50	58.2	38.7
	4:00 - 5:00	46.3	50	56.6	39.2
	5:00 - 6:00	46.9	50	58.4	39.6

2. Result of Vibration Survey

Cross Section 1

Roadside Point

Time	Survey Period	Vibration Level dB			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	41.9	65	56.4	22.8
	7:00 - 8:00	42.8	65	58.7	23
	8:00 - 9:00	42.7	65	57.8	23.1
	9:00 - 10:00	43.3	65	62.5	22.1
	10:00 - 11:00	43	65	60	23.7
	11:00 - 12:00	42.1	65	57.6	31.5
	12:00 - 13:00	42	65	56.8	29.7
	13:00 - 14:00	44.1	65	59.6	29.2
	14:00 - 15:00	44.5	65	59.3	30.1
	15:00 - 16:00	43.1	65	60.6	29.3
	16:00 - 17:00	41.9	65	60.4	31
	17:00 - 18:00	41.3	65	56.5	30
Night	18:00 - 19:00	39.3	60	56.6	27.8
	19:00 - 20:00	38.3	60	52.4	30.1
	20:00 - 21:00	38.6	60	52.7	28.4
	21:00 - 22:00	37.8	60	56.2	27.1
	22:00 - 23:00	38	60	57.5	27.5
	23:00 - 00:00	35.8	60	55.7	27.3
	00:00 - 1:00	35.9	60	54.2	27.1
	1:00 - 2:00	35.6	60	56.1	27.2
	2:00 - 3:00	34.1	60	53.8	27
	3:00 - 4:00	34.1	60	54.6	27.2
	4:00 - 5:00	38.2	60	56.6	27.9
	5:00 - 6:00	37.5	60	51.6	28

Background Point

Time	Survey Period	Vibration Level dB			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	27.5	65	49.2	14.4
	7:00 - 8:00	20.9	65	45.9	14.3
	8:00 - 9:00	19.5	65	37.8	14.3
	9:00 - 10:00	28.8	65	42.9	14.2
	10:00 - 11:00	29.4	65	49.4	14.6
	11:00 - 12:00	30.8	65	49.8	14.3
	12:00 - 13:00	22.3	65	42.5	15.4
	13:00 - 14:00	26	65	52.2	15.9
	14:00 - 15:00	22.6	65	45.9	15.2
	15:00 - 16:00	22.9	65	49.6	14.6
	16:00 - 17:00	22.6	65	43.3	14.3
	17:00 - 18:00	20	65	40.3	14.2
Night	18:00 - 19:00	21.7	60	46.4	14.6
	19:00 - 20:00	20.3	60	42.5	14.2
	20:00 - 21:00	20.1	60	45.4	14.3
	21:00 - 22:00	19.9	60	46.1	14.1
	22:00 - 23:00	20.2	60	41.6	14.2
	23:00 - 00:00	19.8	60	44.7	14.3
	00:00 - 1:00	20.3	60	44.6	14.7
	1:00 - 2:00	20.2	60	43.8	14.6
	2:00 - 3:00	22.4	60	48.3	15
	3:00 - 4:00	22.1	60	46.4	14.3
	4:00 - 5:00	20.8	60	47.3	14.3
	5:00 - 6:00	22.7	60	52.4	14.4

Cross Section 2

Roadside Point

Time	Survey Period	Vibration Level dB			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	39.1	65	50.6	29.7
	7:00 - 8:00	40.8	65	51.2	30
	8:00 - 9:00	41.7	65	54.7	29.5
	9:00 - 10:00	41.3	65	55.7	28.1
	10:00 - 11:00	42.3	65	60.6	28.6
	11:00 - 12:00	39.8	65	60.6	32.2
	12:00 - 13:00	41.4	65	59.7	32.5
	13:00 - 14:00	43.7	65	52.2	32.4
	14:00 - 15:00	43.4	65	55.3	32.8
	15:00 - 16:00	41.6	65	53.6	31.5
	16:00 - 17:00	43.5	65	51.7	30.8
	17:00 - 18:00	42.3	65	54.7	31.6
Night	18:00 - 19:00	41.4	60	52.7	30.7
	19:00 - 20:00	39.6	60	54.5	30.3
	20:00 - 21:00	32.8	60	49.1	28.1
	21:00 - 22:00	35.9	60	51.7	31.1
	22:00 - 23:00	31.7	60	46.8	29.6
	23:00 - 00:00	31.2	60	45.9	28.8
	00:00 - 1:00	28.5	60	44.3	25.4
	1:00 - 2:00	29.1	60	45.6	25.6
	2:00 - 3:00	28.4	60	48.6	25.1
	3:00 - 4:00	30.1	60	50.1	25.6
	4:00 - 5:00	28.8	60	44.8	25.8
	5:00 - 6:00	39.1	60	50.6	29.7

Background Point

Not Available

Cross Section 3

Roadside Point

Time	Survey Period	Vibration Level dB			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	45.2	65	59.7	25.6
	7:00 - 8:00	44.6	65	61.6	23.9
	8:00 - 9:00	44.6	65	61.8	23.1
	9:00 - 10:00	42.5	65	57.6	20.9
	10:00 - 11:00	42.5	65	58.1	21.2
	11:00 - 12:00	42.6	65	61.2	21.5
	12:00 - 13:00	41.8	65	59.6	20.8
	13:00 - 14:00	45.7	65	62.2	21.5
	14:00 - 15:00	45.5	65	63.2	21.3
	15:00 - 16:00	43.4	65	60.6	22.6
	16:00 - 17:00	46.4	65	63.5	24.1
	17:00 - 18:00	46.4	65	64.5	24.2
Night	18:00 - 19:00	44.9	60	61.1	24.5
	19:00 - 20:00	44.5	60	60.2	24.1
	20:00 - 21:00	40.3	60	55.4	22.6
	21:00 - 22:00	39.1	60	55.1	21.6
	22:00 - 23:00	36.5	60	50.6	21.2
	23:00 - 00:00	34.4	60	48.9	20.1
	00:00 - 1:00	35	60	49.2	20.4
	1:00 - 2:00	34.6	60	49.1	20.5
	2:00 - 3:00	34.6	60	50.2	20.6
	3:00 - 4:00	40.8	60	56.4	22.6
	4:00 - 5:00	39.7	60	51.3	20.8
	5:00 - 6:00	40.3	60	55.2	20.3

Background Point

Time	Survey Period	Vibration Level dB			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	26.7	65	47.4	16.4
	7:00 - 8:00	25.8	65	43.1	16.8
	8:00 - 9:00	31.2	65	48.3	16.8
	9:00 - 10:00	29.6	65	41.2	18
	10:00 - 11:00	29.7	65	44	19.5
	11:00 - 12:00	32.4	65	45.4	19.5
	12:00 - 13:00	36.5	65	49	19.6
	13:00 - 14:00	36.5	65	51.4	17.9
	14:00 - 15:00	35.4	65	47.8	19.2
	15:00 - 16:00	33.6	65	52	22.3
	16:00 - 17:00	31.4	65	50.4	21.1
	17:00 - 18:00	30.7	65	44.9	20.3
Night	18:00 - 19:00	31.8	60	45	20.6
	19:00 - 20:00	28.4	60	43.5	16.7
	20:00 - 21:00	28.1	60	44.6	17
	21:00 - 22:00	23.7	60	41.6	16.9
	22:00 - 23:00	24.6	60	42.3	16.6
	23:00 - 00:00	23.8	60	41.5	16.3
	00:00 - 1:00	22.9	60	39.7	16.1
	1:00 - 2:00	22.9	60	40.6	16.6
	2:00 - 3:00	23.8	60	45.3	16
	3:00 - 4:00	24.5	60	46.7	16.8
	4:00 - 5:00	25.5	60	42.3	16.4
	5:00 - 6:00	25.3	60	45.1	16.3

Cross Section 4

Roadside Point

Time	Survey Period	Vibration Level dB			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	42.8	65	56.1	18.1
	7:00 - 8:00	44.7	65	56.9	17.2
	8:00 - 9:00	41.1	65	57	18.5
	9:00 - 10:00	41.1	65	56.9	18.5
	10:00 - 11:00	40.4	65	55.3	18.9
	11:00 - 12:00	43.1	65	58.9	18.3
	12:00 - 13:00	39.5	65	57.2	17.2
	13:00 - 14:00	40.6	65	57.6	18.2
	14:00 - 15:00	41.9	65	57.1	17.7
	15:00 - 16:00	41.4	65	58.7	16
	16:00 - 17:00	40.9	65	56.6	18
	17:00 - 18:00	42.9	65	56.8	18.4
Night	18:00 - 19:00	42.8	60	56.5	17.1
	19:00 - 20:00	41	60	54.5	17.7
	20:00 - 21:00	39.6	60	49.6	18.6
	21:00 - 22:00	40.6	60	55.4	16.3
	22:00 - 23:00	40.1	60	51.4	16.2
	23:00 - 00:00	39.3	60	50.7	18.8
	00:00 - 1:00	38.3	60	51.9	18.9
	1:00 - 2:00	38.7	60	52.5	18.8
	2:00 - 3:00	40.6	60	54.3	18.7
	3:00 - 4:00	39.8	60	55.5	18.6
	4:00 - 5:00	40.2	60	56.5	18.5
	5:00 - 6:00	41.6	60	56.3	18.4

Background Point

Time	Survey Period	Vibration Level dB			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	36.4	65	59.4	18.4
	7:00 - 8:00	32.2	65	45.8	17.3
	8:00 - 9:00	30.5	65	43.3	16.6
	9:00 - 10:00	34	65	51.8	16.1
	10:00 - 11:00	37.7	65	48.7	15.9
	11:00 - 12:00	34.1	65	50	16.4
	12:00 - 13:00	37	65	55.5	16.7
	13:00 - 14:00	37.1	65	49.5	17.1
	14:00 - 15:00	35.5	65	49.6	16.2
	15:00 - 16:00	34.1	65	47.9	16
	16:00 - 17:00	35.9	65	49	17.4
	17:00 - 18:00	30.2	65	43.9	15.9
Night	18:00 - 19:00	28.6	60	39.7	15.8
	19:00 - 20:00	28.8	60	43	15.2
	20:00 - 21:00	28.1	60	43.8	15.5
	21:00 - 22:00	27.6	60	41.5	15.6
	22:00 - 23:00	28.8	60	41.9	15.7
	23:00 - 00:00	27.5	60	42	15.5
	00:00 - 1:00	29.6	60	43.7	15.6
	1:00 - 2:00	26.3	60	39.2	15
	2:00 - 3:00	27.1	60	40.3	15.3
	3:00 - 4:00	28	60	41.6	15.2
	4:00 - 5:00	28.4	60	41.7	15.4
	5:00 - 6:00	29.8	60	43.2	16

Cross Section 5

Roadside Point

Time	Survey Period	Vibration Level dB			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	40.3	65	58.8	17.1
	7:00 - 8:00	40.4	65	60.9	19.7
	8:00 - 9:00	41.6	65	58.7	19.3
	9:00 - 10:00	42.3	65	58.6	19.6
	10:00 - 11:00	40.2	65	58.9	19.4
	11:00 - 12:00	39.1	65	56.6	19.3
	12:00 - 13:00	44.1	65	58.3	20.2
	13:00 - 14:00	41.4	65	61.2	21.1
	14:00 - 15:00	40.1	65	58.6	20.8
	15:00 - 16:00	40.5	65	57.6	21.5
	16:00 - 17:00	38.8	65	58	20
	17:00 - 18:00	38.8	65	57.8	19
Night	18:00 - 19:00	38.1	60	56.3	16.7
	19:00 - 20:00	37.3	60	55.2	17.2
	20:00 - 21:00	38.4	60	58.9	19.6
	21:00 - 22:00	29.9	60	51.4	17.4
	22:00 - 23:00	33.1	60	53.5	17.5
	23:00 - 00:00	34.5	60	51.7	17.3
	00:00 - 1:00	35.9	60	53.8	17.1
	1:00 - 2:00	36.2	60	54.1	17.5
	2:00 - 3:00	35.4	60	52.1	17.3
	3:00 - 4:00	35.7	60	56.1	17.4
	4:00 - 5:00	35.5	60	52.3	17.6
	5:00 - 6:00	36.1	60	57.7	17.2

Background Point

Time	Survey Period	Vibration Level dB			
		LAeq	Stardard	Lmax	Lmin
Day	6:00 - 7:00	21.8	65	39.1	14.5
	7:00 - 8:00	20.4	65	32.6	14.4
	8:00 - 9:00	20.1	65	41.3	14.5
	9:00 - 10:00	20.4	65	33.2	15
	10:00 - 11:00	23	65	39.3	15.4
	11:00 - 12:00	22.4	65	39.7	15.6
	12:00 - 13:00	21.9	65	40	15.8
	13:00 - 14:00	25.5	65	36.2	16.9
	14:00 - 15:00	22.2	65	43.2	14.9
	15:00 - 16:00	23.2	65	42.9	14.8
	16:00 - 17:00	22.1	65	40	14.8
	17:00 - 18:00	23.1	65	41.5	15.5
Night	18:00 - 19:00	22.4	60	42.9	15.1
	19:00 - 20:00	21.2	60	38.3	15.5
	20:00 - 21:00	20.1	60	36.6	14.8
	21:00 - 22:00	19.9	60	37.2	14.5
	22:00 - 23:00	19.6	60	35.4	14.4
	23:00 - 00:00	20.2	60	36.3	14.8
	00:00 - 1:00	20.1	60	38.2	14.9
	1:00 - 2:00	19.7	60	38.9	15
	2:00 - 3:00	20.2	60	38.8	14.7
	3:00 - 4:00	18.9	60	35.3	14.3
	4:00 - 5:00	19.4	60	33.5	14.5
	5:00 - 6:00	20.5	60	36.5	14.1

APPENDIX 16-4

PREDICTION METHOD AND MODEL

1. Calculation Method of Emission Factor

The approximation formulas are as follows:

$$FE=A/V+B \times V+C \times V^2+D$$

where:

FE : Emission factor

V : Average vehicle travel speed (km/h)

	A	B	C	D
Light Vehicle				
NOx	-0.1874248100	-0.0039820000	0.0000312900	0.1827117200
SPM	0.0204858053	-0.0001713205	0.0000015448	0.0058884575
CO_2	1501.20185	-2.40935	0.02115	174.47635
Heavy Vehicle				
NOx	5.3968052000	-0.0782455300	0.0006706800	3.2657883600
SPM	0.5264308649	-0.0017836421	0.0000140949	0.0846006568
CO_2	908.52069	-23.49899	0.18396	1364.81344

Source : "Grounds for the Calculation of Motor Vehicle Emission Factors using Environment Impact Assessment of Road Project etc. (Revision of FY 2010, National Institute for Land and Infrastructure Management, Japan"

The emission factors for motorcycles are adopted 30 percent of the light Vehicle values.

2. Ambient Air Pollution Dispersion Model (Plume Model)

$$C(x,y,z)=\frac{Q}{2\pi \cdot u \cdot \sigma_y \cdot \sigma_z}\exp\left(-\frac{y^2}{2\sigma_{y^2}}\right)\left[\exp\left\{-\frac{(z+H)^2}{2\sigma_{z^2}}\right\}+\exp\left\{-\frac{(z-H)^2}{2\sigma_{z^2}}\right\}\right]$$

where:

C (x,y,z) : Air pollutant concentration at survey point (x,y,z) (ppm or mg/m^3)

Q : Air pollutant emission rate of point source (ml/s or mg/s)

u : Wind velocity (m/s)

H : Height of emission source (m)

σ_y, σ_z : Horizontal (y) and vertical (z) dispersion coefficient (m)

x : Downwind distance from emission point source to survey point along wind (m)

y : Horizontal distance at right angle to x axis

z : Vertical distance at right angle to x axis

Q is calculated by the following formulations:

$$Q_t = V_w \times \frac{1}{3600} \times \frac{1}{1000} \times \sum_{i=i}^{2} (N_{it} \times E_i)$$

where:

Q_t : Average air pollutant emission rate by time (ml/(m*s) or mg/(m*s))

E_i : Emission factor by vehicle type i (g/ (number*km))

N_{it} : Traffic volume by vehicle type and time (number/hr)

V_w : Conversion factor NOx : 532 ml/g SPM : 1000 mg/g

σ_y and σ_z are calculated by the following formulations:

$\sigma_y = W/2 + 0.46\ L^{0.81}$

$\sigma_z = 1.5 + 0.31\ L^{0.83}$

where:

L : Distance from survey point to roadside (L = x – W/2) (m)

W : Road width (m)

Source : "Environmental Impact Assessment Technique for Road Project No.383-400, June 2007, National Institute for Land and Infrastructure Management, Japan"

Conversion from NOx to NO_2 is calculated by the following formulations:

[NO_2] = 0.54*[NOx]

Source : Total Nitrogen Oxide Emission Control Manual, 2000, Japan

The input data are base on the conceptual road design and traffic forecast result in this

survey, and collected relevant information. These input data to predict air pollution level are setting as follows:

H :	1 m
x :	10.25 m
z :	1.5 m
Ei :	see Table 16.4-3 "With Project"
Nit :	Motorcycle 842 (Number/hr) (Daily Volume x 0.09)
	Light Vehicle 600 (Number/hr) (Daily Volume x 0.09)
	Heavy Vehicle 177 (Number/hr) (Daily Volume x 0.09)
Wind Direction :	North-northwest (Along road direction) or East-northeast (Right angle to road direction)
Wind velocity :	2 m/s Source: Ministry of Water Resources and Metrology, (Annual average wind velocity is approximately 2 m/s according to observation data at Pursat station.)
Alignment of Point Sources	0 ~ 20 m on both sides : 2 m interval 20 ~ 180 m on both sides : 10 m interval

3. Brief Calculation Method of LAeq under Simple Condition (Noise Prediction Model)

$$L_{Aeq,T} = 82.3 + 10 \log_{10}(1+3.47\,q) - 10 \log_{10} l + 20 \log_{10} V + 10 \log_{10} N_T + 10 \log_{10} 3.6/2T$$

where:

$L_{Aeq,T}$: Equivalent continuous A-weighted sound pressure Level of time T (dB)

V : Vehicle speed (km/h)

T : Time (s)

N_T : Traffic volume in time T (number)

l : Distance from carriageway to survey point (l)

q : Heavy vehicle ratio (< 1)

Source : "ASJ RTN-Model 2008 by The Acoustical Society of Japan"

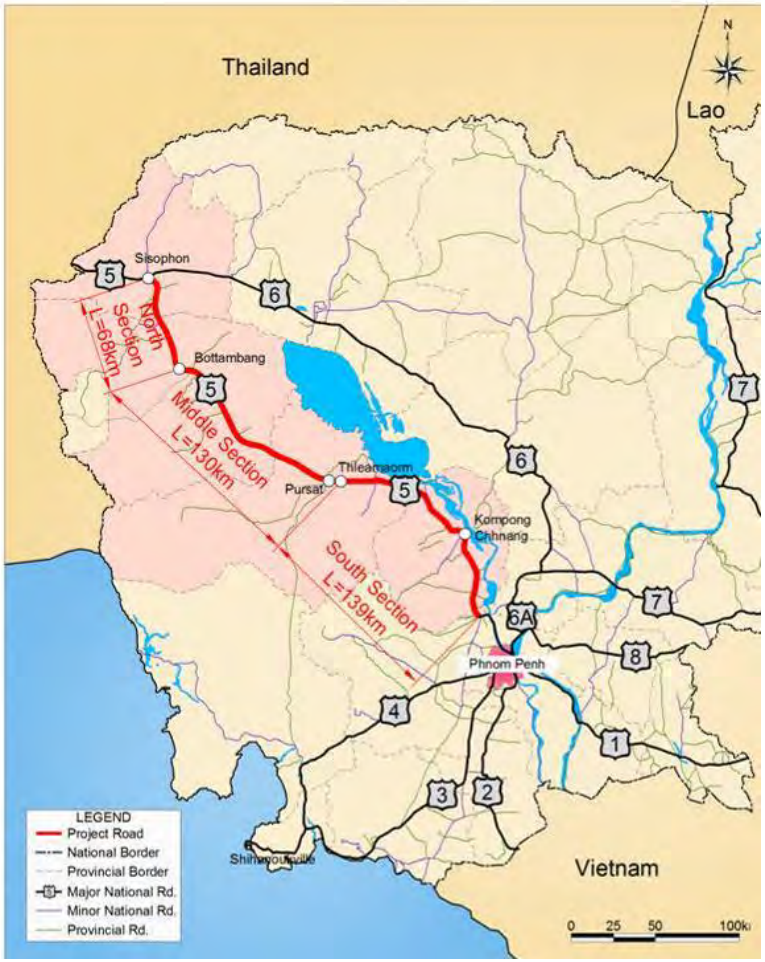
The input data are base on the conceptual road design and traffic forecast result in this survey. These input data to predict noise level are setting as follows:

V :	58 km/hr
T :	From 6:00 to 18:00 43,200 s
	From 18:00 to 22:00 14,400 s
	From 22:00 to 6:00 28,800 s
N_T	From 6:00 to 18:00 1,298 (Number/hr) x 12 hr (Daily Volume x 0.824)
	From 18:00 to 22:00 482 (Number/hr) x 4 hr (Daily Volume x 0.102)
	From 22:00 to 6:00 175 (Number/hr) x 8 hr (Daily Volume x 0.074)
	9 m and 16.5 m (End Point of Road)
l	11.25 m and 18.75 m (15 m line from road center)
	26.25 m and 33.75 m (Borderline between ROW and private land)
q	0.11

APPENDIX 17-1

PROJECT INFORMATION BOOKLET (ENGLISH DRAFT VERSION)

PROJECT INFORMATION BOOKLET
for
THE RESETTLEMENT ACTION PLAN
NATIONAL ROAD No.5 IMPROVEMENT PROJECT



1. **QUESTION:** What is the National Road No.5 Improvement Project?

   ANSWER: National Road No.5 (NR-5) is the trunk road reaching Bangkok through the border between Cambodia and Thailand. It is also designated as Asian Highway (AH-1) or Southern Economic Corridor of GMS. The Survey Road was damaged by the flood in 2000, and the section between Prek Kdam and Thlea ma'Am and the section between Battambang and Sri Sophon have been temporarily repaired. Therefore, Royal Government of Cambodia firstly requested Japanese loan for rehabilitating 2 sections of NR-5, Prek Kdam – Thlea ma'Am and Battambang – Sri Sophon, and construction of 4 bypasses around Banteay Mean Chey, Battambang, kampong Chhnang and Udong. Then, the middle section from Thlea M'am to Battambang also will rehabilitate.

2. **QUESTION:** Who is responsible for the Project?

   ANSWER: The Royal Government of Cambodia represented by IRC (Inter-ministerial Resettlement Committee) will supervise the resettlement action plan implementation. MPWT (Ministry of Public Works and Transport) implements and monitors Resettlement Plan for affected houses, land and other properties on the roads.

3. **QUESTION:** Is the improvement of the road intended to benefit us?

   ANSWER: Yes. The improved road will allow the transportation of goods and people to be quicker, more efficient and cheaper between towns and villages and also from Thailand to all parts of Cambodia. It will help everybody to market their products, get supplies, reduces poverty and to reach public services.

4. **QUESTION:** If there will be road improvements along our road, will we be affected?

   ANSWER: The design and improvement of the highway will affect the use of land, trees and some houses, trading stalls and gardens and entrances in the government owned right of way. During detailed design, these potential effects may be avoided or minimized since actual alignments of the improved road will be determined through consultation with you and the rest of the local communities.

   In case negative impact on land, trees, house and structures cannot be avoided, the owners of affected properties will be properly compensated in cash or in kind for their land use, houses, structures, crops, trees and communal properties in order for them to restore their lost assets, resource or income. Rehabilitation assistance will also be provided to Affected Persons who will be required to relocate in another location.

5. **QUESTION:** What if my private land will be affected by the Project?

   ANSWER: For affected land, compensation can be in the form of replacement land or cash at current market value. If land replacement has been agreed by AHs, the replacement land should be of equal or better productive capacity of the lost land and satisfactory to AHs.

6. **QUESTION:** Does compensation apply to my affected houses or structures?

   ANSWER: Yes. Houses and structures that will be affected by the Project shall be compensated at replacement cost without deduction for depreciation or salvageable materials.

7. **QUESTION:** What about my crops and trees?

   ANSWER: For annual crops, AHs will be given 3 month notice that the land on which their crops are planted will be used by the Project and that they must harvest their crops in time. If standing crops are ripening and cannot be harvested, eligible AHs can be compensated for the loss of the un-harvested crops at the current market value.

   For perennial crops, AHs will be compensated for the loss of fruit and timber trees located within the project area at replacement cost.

8. **QUESTION:** What about our common property resources like school building, pagoda, fence of pagoda and school, irrigation, well and ponds?

   ANSWER: For common property resources, the affected land will be replaced in areas identified in consultation with affected communities and relevant organizations. Affected building and structures will be restored to original and better condition.

9. **QUESTION:** If in case there will be relocation of houses or businesses involved, how can the Project help me rebuild my house during relocation?

   ANSWER: Houses or other properties will be compensated at replacement cost, which includes labor cost to build the houses and the properties. Apart from the compensation for loss of private land and other assets at replacement costs, the Project will ensure that the standard of living of AHs are maintained or better improved after the Project.

<<Entitlement Matrix will be inserted here>>

10. **QUESTION:** When will the detailed measurement survey be conducted?

    ANSWER: The activity will be carried out after the actual alignment has been identified. The DMS survey team will be composed of:

    - Representative of IRC;
    - Team of Working Group MPWT;

- Provincial Sub-Committee, also Involved representative District, Commune and Village authority; and
- External Monitoring Organization.

The activity will only be carried out in the presence of the AHs. The AHs and the local authorities will be informed a few days prior to the activity.

11. **QUESTION:** If there will be disagreements or problems that arise during project implementation such as compensation, technical and general project-related disputes, do I have the right to voice my complaint?

ANSWER: Yes. If the AH is not satisfied with the compensation package offered or, if for any reason, the compensation does not materialize according to the agreed schedule, the AH has the right to lodge a complaint based on the Grievance Redress Mechanism as provided below.

- First Stage, Commune Level: An aggrieved AH may bring his/her complaint to the commune leader. The commune leader will call for a meeting of the group to decide the course of action to resolve the complaint within 15 days, following the lodging of complaint by the aggrieved AH. The meeting of the group consists of the commune leader, representative/s from PRSC-WG of the district offices, and the aggrieved AH. The commune leader is responsible for documenting and keeping file of all complaints that are coursed through him/her. If after 15 days the aggrieved AH does not hear from Village or Commune, or if the AH is not satisfied with the decision taken by in the first stage, the complaint may be brought to the District Office either in writing or verbally.
- Second Stage, District Office: The District office has 15 days within which to resolve the complaint to the satisfaction of all concerned. If the complaints cannot be solved in this stage, the district office will bring the case to the Provincial Grievance Redress Committee.
- Third Stage, Provincial Grievance Redress Committee: The Provincial Grievance Redress Committee, which consists of Provincial Governor or Deputy Governor as a committee chairman and Directors of relevant Provincial Departments as members will be established in each province prior to DMS, meets with the aggrieved party and tries to resolve the complaint. The Committee may ask to PRSC-WG for a review of the DMS by the EMA. Within 30 days of the submission of the grievance the Committee must make a written decision and submit a copy of the same to MPWT, the EMA, IRC and the AH.
- Final Stage, the Court Procedures: If the aggrieved AH is not satisfied with the solution made by the Provincial Grievance Redress Committee based on the agreed policy in the RAP, the committee shall file administrative procedures against the AHs with the participation of provincial prosecutors. The case will be brought to the Provincial Court and the same will be litigated under the rules of the court. At the same time, the AH can bring the case to the Provincial court. During the litigation of the case, RGC will request to the court that the project proceed without disruption while the case is being heard. If any party is unsatisfied with the ruling of the provincial court, that party can bring the case to a higher court. The RGC shall implement the decision of the court.

The complaint issues will be solved under the agreed policy in the approved RAP.

The concerned Grievance committees will properly document all complaints and resolutions. AHs will be exempted from all taxes, administrative and legal fees.

12. **QUESTION:** How will you know if these undertakings are kept and the objectives of this Project are met?

ANSWER: All project activities will be monitored by IRC, Provincial Sub-Committee, Ministry of Public Works and Transport, and an external monitoring agency. Quarterly reports will be prepared and submitted to IRC and then IRC will forward it to JICA. A post- resettlement impact evaluation will also be undertaken to assess whether impacts of the Project have been mitigated adequately and the pre-project standard of living of AHs have been restored as a result of the resettlement and project. The JICA will also monitor these activities in its regular supervision missions during the period of project implementation.

If you have further queries and suggestions, please contact us at:

Pursat, Kampong Chhnang and Kandal Province, also Provincial Department of Public Works: Pursat, Kampong Chhnang and Kandal

APPENDIX 17-2

TERMS OF REFERENCE FOR EXTERNAL MONITORING AGENCY

Terms of Reference
for External Monitoring Agency (EMA)
Resettlement Action Plan (RAP) Implementation
for the National Road No.5 Improvement Project

I. Background

1. In the Kingdom of Cambodia ("Cambodia"), road transport accounts for around 65% of passenger transport, and 70% of freight transport, and plays the most important role in domestic transport. During the civil war in the 70's and 80's, most of the roads were deteriorated due to poor (practically non-existent) maintenance. Since 1993, the rehabilitation has progressed with the assistance from bilateral and multilateral development partners.

2. National Road No.5 (NR-5) is the trunk national road connecting the capital city of Phnom Penh to major cities such as Kampong Chhnang and Battambang. It is also designated as Asian Highway No. 1 (AH-1) or the Southern Economic Corridor of Greater Mekong Sub-region (GMS). However, the road surface type is mostly DBST and the surface condition is being deteriorated due to rapidly increasing heavy vehicles, as well as inundation/flood. In particular, Northern Section and Southern Section require urgent rehabilitation in view of insufficient road width and poor pavement condition.

3. Following the RGC's request to ensure sustainable transportation of the NR5, JICA study team was mobilized in 2012 to conduct a feasibility study of the South Section from Praek Kdam to Thlea Ma'am including the two bypasses around Kampong Chhnang and Udong cities, while the feasibility study of the Middle Section Thlea Ma'am to Battamabng including the bypass around Pursat will be conducted later based on the agreement between the two governments.

4. The RAP contains the measures to be carried out by the Inter-ministerial Resettlement Committee (IRC) of which the Ministry of Public Works & Transport (MPWT) is a member to avoid and/or minimize impacts on the affected households (AHs), particularly on their sources of livelihood, and for the purpose of improving or at least restoring their standards of living to pre-project level consistent with the JICA Guidelines for Environmental and Social Considerations (April 2010).

5. The purpose of the RAP is to identify the impact on the local population of upgrading and improvement of the road; and to provide measures for compensation where the population is negatively affected by the work, primarily through the acquisition of farmland and encroachment on to residential and commercial sites.

6. AHs are grouped into three broad categories, viz. Individual, Household and Communities, and other sub-groups are defined within each group. In particular within the household category, there are vulnerable groups defined as those that are socially or economically disadvantaged and who will suffer more economically and socially from relocation and improvement than the general population.

7. AHs falling into one or more of the following categories are defined as vulnerable groups;

   (i) households headed by women with dependents,

   (ii) disabled household heads with no other means of support,

   (iii) households falling under the generally accepted indicator for poverty, and

   (iv) children (younger than 18 years old) and the elderly (older than 60 years old) households who are landless and with no other means of support.

8. In January-April 2013, a RAP has been prepared based on census and Inventory of Loss (IOL), baseline socio-economic survey (SES) and Stakeholder Meeting. The RAP has been prepared based on i) census and inventory of all affected households; ii) baseline SES; and iii) replacement cost study for affected land, structure and trees.

9. Centre of the resettlement policy is that the affected people will be compensated for their lost assets at replacement cost and provided with rehabilitation assistance to ensure improvement, or at least maintaining their living standards and income to the level they would have without the Project. The cut-off-date is the date of the

first day of IOL, for NR-5 and KCHN bypass is on **1st January 2013** and for Udong bypass is on **11th April 2013**.

10. Refer to the IOL results, 3,368 households to be affected by the Project. Among them, 706 AHs will lose their private land. A total of 609,483.50 m^2 of private land in the two bypasses will be acquired for the Project. Of these, 95.04% (579,255.87 m^2) is used for growing rice.

11. A total of 1,079 AHs along NR-5 and the two bypasses, whose main structures (house, house-shop and/or shop/restaurant) will be affected by the Project. With regard to fruit and timber trees, a total of 14,326 trees of various species and age in NR-5 and the two bypasses have been counted during the IOL. Except some trees in KCHN bypass, most trees are not commercially grown, meaning, they are sporadically planted inside the ROW.

II. Management and Monitoring

12. The RAP requires that the external agency is contracted to provide external monitoring on the Implementation of the approved RAP. The external monitor will indicate any corrective measures necessary to the approved RAP during its implementation.

13. A particular responsibility of the EMA will be to monitor and evaluate, based on the approved RAP, the effectiveness of measures to replace any loss and livelihoods of AHs and of measures to utilize resettlement planning and implementation to maximize the benefits to the immediately adjacent and wider populations of the road improvement and of its integration with social, economic and infrastructural development in the road corridor and the wider region.

III. Requirement for external monitoring

3.1 Monitoring and Evaluation

14. The monitoring and evaluation agency will address specific issues as the following:

(i) Field check/site visits coordinated with the resettlement activities that are taking place based on the approved RAP:

a) Compensation payments, participatory design of relocation and rehabilitation options, and relocation;

b) Random review of DMS forms, if complaints exist, compared to the inventory of assets and entitlements; and

c) Random review of entitlement and compensation documents to ensure that the assessment of compensation is based on the agreed compensation matrix and that all entitlements have been accurately applied;

(ii) Payment of compensation and allowances as per approved Update RAP (URAP). Identify whether all AHs are covered under the URAP and confirm that they are all eligible for compensation, resettlement and rehabilitation assistance, irrespective of tenure status, social or economic standing, and any such factors that may discriminate against achieving the project objectives.

(iii) Timing of disbursement of payment and documentation Detailed Measurement Survey (DMS) and payments;

(iv) Public consultation and awareness of resettlement entitlements;

(v) Coordination of resettlement activities with the construction schedule;

(vi) Land acquisition and transfer produces;

(vii) Progress of construction/rebuilding of structures on residual land or to new relocation sites;

(viii) Level of satisfaction of AHs with the provisions of each kind of compensation and implementation of the URAP;

(ix) Grievance redress mechanism (documentation, process, and resolution);

(x) Capacity of AHs to restore/re-establish livelihoods and living standard. Special attention will be given to relocating AHs and vulnerable AHs;

(xi) Trends in living standards. Throughout the RAP implementation process, the EMA will observe and conduct surveys to monitor the progress AHs are making to restore living standards. Special attention will be paid to any differences based on gender. Any potential problems in the restoration of living standards will be reported;

(xii) Effectiveness, impact and sustainability of entitlements and rehabilitation measures and the needs for further improvement, as required under the approved RAP;

(xiii) Gender impacts and strategy;

(xiv) Capacity of AHs to restore/reestablish their livelihood and living standards. Special attention provided or to be provided to severely affected and/or vulnerable households;

(xv) Resettlement impacts caused during construction activities; and

(xvi) Receive complaints from AHs if any and explain to the aggrieved AHs the eligibility for compensation and livelihood restoration set out in the approved URAP.

(xvii) Participation of AHs in RAP updating and implementation;

(xviii) Institutional capacity, internal monitoring and reporting.

3.2 Post evaluation

15. Post-evaluation activities will also be carried out one (1) year after the completion of all relocation activities.

IV. Specific Purpose of External Monitoring

16. The Project requires the services of a domestic monitoring and evaluation team to conduct an independent assessment of the extent to which resettlement and rehabilitation objectives are being met.

17. Specifically, the objectives of the monitoring program are:

(i) to ensure that the standard of living of AHs are restored or improved;

(ii) to monitor whether the overall project and resettlement objectives are being met in accordance with the approved RAP, and if not to suggest corrective measures;

(iii) to assess if rehabilitation measures and compensation are sufficient and comply with JICA Guidelines;

(iv) to identify problems or potential problems; and

(v) to identify methods of responding immediately to mitigate and resolve problems.

V. Methodology of Monitoring and Evaluation

18. The methods for external monitoring and evaluation include:

(i) Review of RAP approved by RGC.

(ii) Check on a random basis the DMS process with AHs from identification to agreement on DMS results.

(iii) Review of SES baseline prepared during RAP preparation (Feasibility Study) and SES conducted by IRC at the detailed design stage. If land acquisition (i.e., RAP implementation) does not occur for at least

two (2) years, EMA will carry out another SES.

(iv) A post resettlement survey will be carried out one (1) year following completion of resettlement activities. Sampling will include 20% of relocating AHs as well as at least 10% of all other AHs. The same AHs interviewed during RAP updating will be interviewed.

(v) Participatory rapid appraisals (PRA): Consultation with AHs and various stakeholders such as resettlement committee, the Project Management Unit, community leaders; key informant interviews; community public meetings; focus group discussions; direct field observations; and in-depth case studies of good practices and problems identified by internal or external monitoring and required special efforts to resolve.

(vi) Random checks of payments disbursed to AHs during monitoring. The EMA will submit a post evaluation report per project one (1) year following completion of resettlement activities.

VI. Team Composition, Timing, and Submission of Reports

19. The domestic EMA will be composed of one team leader with extensive experience in monitoring and evaluation of resettlement activities in Cambodia and with strong ability in preparing resettlement compliance/monitoring reports. He/she should demonstrate good communication skill and have at least a bachelor degree in a relevant field. The team leader will be assisted by two (2) social enumerators. All reports will be submitted to IRC and MPWT.

20. The monitoring work will be consisted in period of two (2) years and post evaluation will be conducted one (1) year after completion of all resettlement activities.

21. The monitoring reports will include one inception report, 8 quarterly monitoring reports, one base line survey report (six months before post evaluation) and one post evaluation report.

22. Duration of Field visits and report preparation will be as follows:

No.	Position	Working Day	Number	Total Input
	Monitoring Work			
1	Team Leader	178	1	178
2	Social Enumerator	119	2	238
	Base Line Survey			
1	Team Leader	50	1	50
2	Social Enumerator	30	2	60
	Post Evaluation			
1	Team Leader	50	1	50
2	Social Enumerator	30	2	60
			Total	636

23. Submission of inception and quarterly report will be within two weeks (14 days) after monitoring activities while submission of post-evaluation report will be within one (1) month after post-evaluation activities.

24. The quarterly report will summarize the findings of the EMA, including (a) progress of RAP implementation, including any deviations from the provisions of the RAP; (b) identification of problem issues and recommended solutions to inform implementing agencies and resolve issues in a timely manner; (c) identification of specific gender issues, as relevant; and (d) report on progress of the follow-up of issues and problems identified in the previous reports.

VII. Expression of Interest

25. Please prepare an estimation of the time and finances required to undertake this work. Should you be awarded the contract, a price would be negotiated to undertake and initial consultation and investigation with the community, after which a fixed amount contract would be set and agreed.

Expressions of interest should be addressed to:

26. [Mr. XXX, Resettlement Department, Ministry of Economy and Finance, St 92, Sngkat Wat Phnom, Khan Daunpenh, Phnom Penh]

27. Expressions of interest should be received no late than [time, date]

28. Inquiries may be directed to: [INSERT name, position, phone number]

APPENDIX 17-3

TERMS OF REFERENCE FOR INCOME RESTORATION PROGRAMS

Terms of Reference for Training and Income Restoration

I. Background Information

1. A Training and Income Restoration Program (IRP) is part of the compensation package provided to all severely affected households and vulnerable affected households by works and land acquisition for the National Road No.5 Improvement Project. Severely affected households include but not limited to the affected households who will (i) lose 20% or more of their total productive land (income generating) and/or assets, and (ii) have to relocate due to the Project.

2. A Consulting firm/Non-Government Organization (NGO) will undertake overall management of the Training and IRP, and will be appointed for that purpose by Inter-ministerial Resettlement Committee (IRC) in the Ministry of Economy and Finance (MEF). The Program will be supervised by the Resettlement Department of the Ministry of Economic and Finance (RD/MEF).

3. The Consulting firm/NGO will directly administer the off-farm training and IRP and will, for that purpose, manage a Training Fund and Income Restoration Training including an Apprenticeship Program[1] (i.e. vocational training) and agricultural extension and training for the entitled AHs. It will provide management support for the Agricultural Relocation and Extension Program and will provide a training of trainers program for the Provincial and District agencies taking part.

4. In January-April 2013, a RAP has been prepared based on census and Inventory of Loss (IOL), baseline socio-economic survey (SES) and Stakeholder Meeting. The RAP has been prepared based on i) census and inventory of all affected households; ii) baseline SES; and iii) replacement cost study for affected land, structure and trees. Refer to the IOL results, 3,368 households to be affected by the Project. Among them, 706 AHs will lose their private land. A total of 609,483.50 m^2 of private land in the two bypasses will be acquired for the Project. Of these, 95.04% (579,255.87 m^2) is used for growing rice. A total of 1,079 AHs along NR-5 and the two bypasses will have their main structures (house, house-shop and/or shop/restaurant) will be affected by the Project. With regard to fruit and timber trees, a total of 14,326 trees of various species and age in NR-5 and the two bypasses have been counted during the IOL.

II. Appointment of NGO/Consulting firm

5. For that purpose IRC proposes to enlist the services of suitably qualified Consulting Firm or NGO to develop and implement the IRP which is required for the severely affected households and vulnerable affected households.

6. The Consulting firm/NGO should have the following qualifications:

   (i) Must have good track records in designing and implementing IRP and Gender Development Program within Cambodia;

   (ii) Must have the necessary community development and gender orientation and experience to appropriately deal with the poor and vulnerable affected households;

   (iii) Must be familiar with the use of Participatory Rapid Appraisal tools; and

   (iv) An inclusion of Gender Specialist in the Team.

III. Objectives of Training and Income Restoration Program

7. The Consulting firm/NGO shall undertake overall management of the Training and IRP, and will be appointed for that purpose by the IRC. The Program will be supervised by RD/MEF.

[1] The apprenticeship program is available for one member of the severely and/or vulnerable affected households, although all the working adults who belong to severely and/or vulnerable affected households are eligible to agricultural extension and training.

3.1 General objective

8. The general objective or goal of the program is to minimize the impact of the project on the livelihoods of affected households, to restore their income and to reduce poverty and social exclusion in the project area.

3.2 Specific project purposes

9. The specific project purposes are:

(i) to improve the vocational skills of severely and/or vulnerable affected households by other means to restore and improve their livelihoods and incomes from off-farm (non-agricultural) employment; and

(ii) to provide opportunities for production and marketing of crops for households severely affected by losses of land, by means of the provision of appropriate and sustainable IRPs.

IV. Activities

10. To prepare the training and IRP, the Consulting firm/NGO will carry out the following tasks:

(i) Carry out Situational and Needs Assessment Analysis

- Analyze existing sources of income of severely and/or vulnerable affected households and existing sources of income in the relocated area to establish a baseline to gauge the success of IRP and estimate current actual income of the affected households;
- Conduct consultations, needs, aptitude, and preference surveys among the affected households;
- Determine whether poor/vulnerable affected households have special needs different to other households;
- Identify the major socio-economic situations and problems of the affected households and it must be understood in the context of the basic profile and culture of the affected communities and the concrete descriptions of their way of life and livelihoods.

(ii) Identify existing or planned programs of the Government, NGOs, and other agencies within the project area to design appropriate strategies to link up with or expand such programs.

(iii) Prepare a gender strategy to include enhancement of opportunities for women's participation, and to provide women increased opportunities to learn new skills and participate in the decision-making process, and take advantage of new employment and income-generating opportunities.

11. Based on the results of the activities above, the Consulting firm/NGO will design the appropriate training and sustainable IRPs based on the number of severely and/or vulnerable AHs.

4.1 Off farm training

12. The Consulting firm/NGO will conduct a training needs survey during the first month of the program, making use of data from existing socio-economic surveys of the Project. On this basis the Consulting firm/NGO will provide 6 months vocational or pre-vocational training to a member of each severely affected household either household head, spouse, son or daughter.

13. Training will be mainly in skills for which there is an established employment demand, but may include basic literacy and numeracy. Skills for which training has provisionally been proposed include crafts production, building trades, motor repair, languages, computer, hairdressing and tailoring.

14. Training will be at a minimum of four (4) centres accessible in each of the four (4) sections of the road works

and will be conducted in Khmer (two (2) centres for each province).

4.2 Job creation

15. Job creation will be undertaken by the Consulting firm/NGO as 6 month apprenticeships with established enterprises, if available in the area, primarily in Pursat and Kampong Chhnang (including Kandal) province aimed at providing on-the-job training and employment for a member in the severely and/or vulnerable affected households.

16. The Consulting firm/NGO will also facilitate hiring of affected households on a priority basis on ongoing project construction activities in order for affected households to benefit directly from the Project.

4.3 Small agricultural and agro-industrial credit

17. The Consulting firm/NGO will facilitate access to existing credit program such as small agricultural production or agro-industrial loans. Loans will be for plant materials, livestock, on-farm irrigation, agricultural tools and equipment, and for small agricultural, depending on the outcome of training capability of the trainees.

4.4 Agricultural extension and training

18. The Consulting firm/NGO will provide training of trainers (concerned Provincial Departments in each of the two provinces) and management support for an agricultural extension program. Agricultural extension and farmer training will be specifically for land use and production development such as livestock, cash crop, home garden and etc. The Consulting firm/NGO will also provide training for women in agricultural and food processing and marketing. All the working adults who belong to severely and/or vulnerable affected households are eligible to this program.

4.5 Access to small enterprise credit

19. The Consulting firm/NGO will facilitate access to existing credit programs to enable affected households to obtain small enterprise loans. Loans will be for crafts production equipment, tools for construction or repair work, and for shop and stall equipment and stock.

V. Staffing and Other inputs

20. The Consulting firm/NGO will provide training personnel in accordance with the following requirements. Durations given below are indicative and subject to variation, during the currency of the services, by agreement with MEF, and estimated on the following basis.

(i) It is assumed that the training and income restoration will be completed within 24 months;

(ii) Person -month of personnel has been considered only the period stayed on the site or relevant institution, organizations or factories for training purpose. Time spent in other place such as Home office of Phnom Penh shall not be included in the person-month.

Personnel Inputs of Consulting Services

Position	Number	Person-month[2]
Team Leader	1	12
Vocational Trainer	4	24
Credit Coordinator	2	8
Apprenticeship Trainer 1	2	12
Agricultural Trainer 1	2	14
Agricultural Trainer 2	2	12
Total	13	82

[2] The amount of person-month will be revised during the RAP updating.

VI. Requirement for report and Reporting

6.1 Requirement for report

21. The Training and IRP must include concrete actions for income restoration, including budget, timetables, responsibility for implementation, economic assumptions and risks and contingency arrangements. The Reports will include, but not limited, to the following:

22. Inception report

- A review of current socioeconomic conditions of the affected household including income baseline. If the existing baseline data is not sufficient, the Consulting firm/NGO is required to carry out supplementary socio-economic survey;
- A summary of Affected households' preferences for training and income restoration (indicating description of methods used to elicit Affected households' views);
- A summary of potential training and IRPs (based on identified economic activities and opportunities prevalent in the area) and options available to affected households and of the process of matching affected households to particular programs or activities;
- A gender strategy.

23. Training and IRP plan

- Detailed feasibility studies of the technical, economic, financial and institutional viability of the proposed IRP[3], including realistic estimation of incomes to be received by participating affected households and the number of affected households that can participate in each activity;
- A time-bound plan on specific programs for affected households who have lost their productivity means;
- A time-bound plan for development of human capital (appropriate trainings which have an established employment demand);
- A time-bound plan on job creation and provision of access to capital for small enterprise, small agricultural, and agro-industrial credit;
- Arrangements and indicators for monitoring the effectiveness of training and IRPs and for modifying plans found to be ineffective;
- Budget and Implementation Schedule.

24. Progress reports (Quarterly)

- The content will include progress based on arrangements and monitoring indicators as set out in the income restoration plan report. It will also include satisfaction of affected households, problems encountered and strategies or resolutions agreed on.

25. Completion report

- It will include concise history of the program, evaluation of the implementation, including financial audit statements.

6.2 Reporting

26. The selected Consulting firm/NGO will submit the following to IRC-MEF:

- Inception Report, one month after mobilization

3 Can be existing or planned programs of the Government, NGOs, and other agencies within the project area with appropriate strategies to link up with or expand such programs.

- Training and Income Restoration Plan, within two months after submission of Inception report (contents as indicated in section VI above),
- Quarterly progress reports
- Completion Report

VII. Schedule

7.1 Schedule

27. The selected consulting firm/NGO for the IRP program will be hired for two and a half years. The consulting firm/NGO will be engaged full-time for the first two years while in the third last year, the consulting firm/NGO will provide back-stop support to the participating affected households, as needed. Post-IRP evaluation will be carried at the end of year 3 or completion of the program.

APPENDIX 17-4

INVENTORY OF LOSS AND SOCIO-ECONOMIC SURVEY QUESTIONNAIRE FORM

INVENTORY OF LOSS AND SOCIO-ECONOMIC QUESTIONNAIRE

QID: [. .]

Date of interview:...../...../ 2013 Starting time:.....……..

Interviewer's name:..... Ending time:…….

Supervisor's name:.....…. Village Headman: …….

I. LOCATION

PK: .....…… (Road direction is from Phnom Penh to Banteay Mean Chey).

Left Right ☐ NR#5 Bypass ☐

House No: …… Village: ....……..

Commune: ..... District: …….…..... Province: .....

Distance from centreline of road to people's land .....meters;

Distance from centreline of road to people's house.....meters (first column or wall).

II. PROFILE OF HOUSEHOLD HEAD

Ask for head of household (if not present ask spouse or other adult, but over 18 years old)

2.1 H/H Name: ……. Call Name: ……

2.2 Age: ……. Sex: Male ☐ Female ☐

2.3 Occupation: .....

2.4 Ethnic group: ☐

Code: 1=Khmer 2=Chinese 3=Cham 4= Vietnamese
5=Other (specify).....

2.5 The respondent is the household head? ☐ Yes (If yes go to 2.8) ☐ No

2.6 If no, what is the relationship with the household head? .....

Name of the respondent: ……..

2.7 Age: ……. Sex: Male ☐ Female ☐

2.8 Fill H\H head status in the box below **(multi answers)** ☐

1= Aged (From 60 years old and older) 2=Widow 3=Disabled 4=Landless
5= Income<20$/month/person (National Poverty Line for Urban Area-2007)

2.9 Religion: ☐

1= Buddhist 2= Muslim 3= Christ 4=Other …….

III. SOCIOECONOMIC PROFILE OF AFFECTED HOUSEHOLD

3.1 How many members are in the household? .....

3.2 If there is more than one family, who are living in this house, give all.

No.	Relationship to H/H	Age	Sex **1=M**	Marital status	Literate **1=No**	School attending	# Years of graded	Working Activities **(code)**

	(code)		2=F	(code)	2=Yes	1=No 2=Yes	completed education	1st	2nd	3rd
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										

Code B: 1=Self, 2=Spouse, 3=Son/Daughter, 4=Parent, 5=Brother/Sister, 6=Relative, 7=Other (specify).....

Code E: 1=Single, 2=Married, 3=Divorced/separate 4= Widowed 5 = Other.....

Code J, K and L:

00	None or Unable to work	09	Batery charging	18	Government officer
01	Small business	10	Construction Worker	19	Manufacturer/Craftsman
02	Food processing for sale*	11	Garment factory worker	20	Farmer (on own farm)
03	Hotel/tourism/restaurant	12	Company staff	21	Fishman
04	Hair cut/dresser/Beauty shop	13	Credit provider/ Money exchange	22	Livestock Raising
05	Wedding host	14	Motor transporter	23	NGO staff
06	Merchant/Market trader	15	Taxi driver	24	Migration out for job
07	Machinery/Vehicle mechanic	16	Agricultural laborer/Worker	25	Pupil/Student
08	Electrician	17	Non agricultural laborer/Worker	26	Other (specify) ……..

3.3 Household Assets

3.3.1 Agricultural equipments:

Equipment types	Number	Total Cost (Riel)	Equipment types	Number	Total Cost (Riel)
Oxcart			Tractor		
Plow			Hand tractor		
Harrow			Rice mill machine		
Water pump			Other.....		

3.3.2 Other Assets:

Equipment types	Number	Total Cost (Riel)	Equipment types	Number	Total Cost (Riel)
Bicycle			TV/VCR/VCP		
Motorbike			Sewing machine		
Bamboo rail			Air conditioner		
Car/ Pickup/Minivan			Washing machine		
Truck			Refrigerator		
Boat without engine			Telephone		
Boat with engine			Generator		
Radio/Cassette Player			Other (specify) …….		

3.3.3 Livestock:

Type of livestock	Total Number		Sales of Livestock in 2010	
	Quantity	Value in Riels	Quantity	Value in Riels
Oxen				
Buffalo				
Pigs				
Horses				
Chickens				
Ducks				
Other (spec.).....				

3.3.4 Main Trees:

Code of Trees

1=Bamboo	2=Banana	3=Coconut	4=Tamarind
5=Chan Kiri	6=Sapodilla	7=Deum Chan	8=Kamping Reach
9=Kantuot	10=Khvet	11=Jack Fruit	12=Korki
13=Kor	14=Krasang	15=Mkak	16=Longan
17=Pring	18=Jujube	19=Sdau	20= Orange
21=Soda	22=Grapefruit	23=Custard apple	24=Sour sop
25=Guava	26=Teuk Dos Kou	27=Acacia/Eucalyptus	28=Lemon
29=Mango	30=Papaya	31= Sugar Palm	32=Cashew

33=Other.....

No.	Tree types	Unit	Total Quantity	Income in 2010 (Riel)	Number of affected trees
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Total Income (Riel)					

3.3.5 Land and Agricultural products:

A. What is your affected land in ROW? (The question "A" is not for bypass)

Land Category	Total of using (m^2)	Affected Area		
		Length (m)	Width (m)	Size (m^2)
Rice field (Sre)				
Orchard (Chamkar)				
Flooded Area				
Commercial				
House Plot / Home Garden				
Other (specify).....				

B. What is your affected land outside ROW?

Land Category	Total Owning (m^2)	Affected Area		
		Length (m)	Width (m)	Size (m^2)
Rice field (Sre)				
Orchard (Chamkar)				
Flooded Area				
Commercial				
House Plot / Home Garden				
Other (specify).....				

C. Agricultural production (all land):

Crop	Area grown (m^2)	Harvested Amount (Kg)	Unit price (Riel/Kg)	Production cost (Riel)	Farming Expend (Riel)	Gross Return (Riel)
Dry rice						
Wet rice						
Vegetable						
Other crop …..						
Total (Riel)						

3.3.6 House and other Structures:

Structure Type Code:

1=House 2=House/Shop 3=Kitchen 4=Bathroom
5= Grange/Storage 6=Shop/Restaurant 7=Craft / Workshop
8= Stall / Market stall 9= Animal table/pigsty 10=Other (specify) .....

Floor Code:

1st=One floor 2nd=Two floors 3=Khmer Style 4= Other .....

Construction Material Code:

1- Temporary Material 2- Thatch 3- Tin / Fibro/ Plastic Sheet 4- Wood
5- Bamboo 6- Roofing Tile 7- Floor Tile 8- Mortar
9- Concrete 10- Earth 11-Metal 12- Brick
13-Others (spec.): ……..…

Material	Structure: …	Structure: …	Structure: …	Structure: …
Roof				
Wall				
Floor				
Column				
Story				
Total floor area, m^2				
Affected area, m^2				

- How many years have you been living here? ..... year(s)

- If you rent the affected structure, how much do you pay per month? .....……Riels

- Where will you relocate to resettle? Shifting back, to same village, other village

3.3.7 Other fixed assets:

No.	TYPE OF ASSETS	UNIT	Affected Quantity	Other
1.	Concrete Well	set		
2.	Pump Well	set		
3.	Timber post with wire	Meter long		
4.	Concrete post with wire	Meter long		
5.	Brick Wall, 100mm	Meter long		
6.	Brick Wall, 200mm	Meter long		
7.	Water supply system	m		
8.	Mortar	m^2		
9.	Vehicle washing place			
10.	Toilet			
11.	Other (spec.): ……			

3.4 Incomes

3.4.1 What are the main sources of total income in your household?

1st ☐	2nd ☐	3rd ☐	4th ☐
1. Wages or salary	2. Farming hired labor		3. Business or trade
4. Agricultural production	5. Livestock	6. Fishing	7. Equipment making
8. Equipment renting	9. Transportation		10. House/land renting
11. Remittance	12. Other (spec.)……..…		

3.4.2 How much the total income (cash and kind) from these activities in ***Last Year***:

1st ..... Riels
2nd ..... Riels
3rd ..... Riels
4th (others)..... Riels
Total in ……..……. Riels (convert to USD ……)

3.5 Expenses

Annual expense …… Riel converts to USD: ……..…

3.5.1 Daily expense (recently expense):

Item	Unit	Price per unit/Riel	Total price (Riel)
Rice			
Food (fish, meat, vegetable, and spices)			
Snack			
Wood/charcoal/fuel/gas			
Other (spec.)….....			
		Total:	
		Annual total (365 days)	

3.5.2 Monthly expense:

Item	Unit	Price per unit/Riel	Total price (Riel)
Cosmetics (perfume, powder, and soap)			
Health (drug, treatment fee).			
Water			
Electricity power			
Other service			
Gasoline			
Other (spec.).....			
		Total:	
		Annual total (12 months)	

3.5.3 Yearly expense:

Item	Unit	Price per unit/Riel	Total price (Riel)
Clothes			
Education (material, tutoring, and meals at school)			
Furniture			
House repairing			
Ceremonies/marriages			
Entertainment/travel			
Other (spec.).....			
		Annual total:	

3.6 Health

3.6.1 Where do you and your household members often go for? (Please tick)

Facility	Health Treatment	Serious Illness	Birth Delivery	How far? (Km)
Traditional Midwife				
Traditional Healer				
Drug shop				
Private Pharmacy				
Health Centre				
Provincial Hospital				
Private Clinic				
Private Hospital				
Other:				

3.6.2 What are the three most important problems with the public health services for the people in this village?

1 = Lack of beds/Equipment
2 = Not enough medicine
3 = No physician medical
4 = Poor quality of service
5 = No midwife
6 = High price
7= Long distance
8 = Unsanitary
9 = Unhelpful staff
10 = Other (Describe).....

1. Most important ☐
2. Second important ☐
3. Third important ☐

3.7 Education

3.7.1 How many children in household is primary school age (6-11)? ☐

3.7.2 How many children in household attend primary school? ☐

3.7.3 If children of primary school age, not attending school, main reason for non-attendance? ☐

1 = Cannot afford school costs
2 = Have to help in business
3 = Takes too long to get to school
4 = other (describe).....

3.7.4 How many children in household is lower secondary school age (12-14)? ☐

3.7.5 How many children in household attend lower secondary school? ☐

3.7.6 If children of lower secondary school age, not attending school, main reason for non-attendance? ☐

1 = Cannot afford school costs
2 = Have to help in business
3 = Takes too long to get to school
4 = other (describe).....

3.8 Credit:

3.8.1 Have you taken any loan? ☐ No **(skip to Q. 3.8.4)** ☐ Yes

3.8.2 If yes, please fill the table below:

When did you borrow money? **Month/year**	Credit Amount **(Riel)**	From Whom **(Code)**	Interest rate **%**

Code: 1 = Govt. /Bank 2 = NGOs / Society 3 = Landlord / traders
4 = Credit provider 5 = Relative 6 = other (specify).....

3.8.3 What did you use this money for **(multi answers)**? ☐

1 = Food consumption 2 = Health care 3 = Schooling costs
4 = Building/Repairing house 5 = Ceremony/Wedding 6 = Farming
7 = Business improving 8 = Supporting to family members
9 = To meet cost caused by the Project 10 = other (specify).....

3.9 Living condition

A. Water source:

3.9.1 Drinking/cooking: …… Washing/bathing…….

1 = Stream/river 2 = Lake/pond 3 = Protected well 4 = Unprotected wel
5 = Rain water 6 = Buying 7 = Waterworks 8 = other (specify).....

3.9.2 If buying from vendor, how much it cost per day? ..... Riels

3.9.3 If you collect by yourself, how much time you spend to do so? ..... minutes

3.9.4 Is the drinking water filter? ☐ Yes ☐ No

3.9.5 Is the drinking water boiled? ☐ Yes, always ☐ Yes, sometimes ☐ No

3.9.6 Is the drinking water filtered? ☐ Yes ☐ No

B. Sanitation:

3.9.7 Do you have a pit latrine? ☐ Yes ☐ No

3.9.8 Is there any drainage system near your house? ☐ Yes ☐ No

3.9.9 If yes, please tick in box as follow:

- Proper rain water drainage ☐
- Waste water drainage ☐
- An open drain ☐

C. Energy source:

3.9.10 Lighting: …… Cooking: ……

1 = None 2 = Fire wood 3 = Private generator
4 = State Electricity 5= Battery 6 = Charcoal
7 = Gas / Kerosene 8 = Torch/Rubber 9 = Other (specify)……

3.10 Accessibility to other facility service

Please indicate the distance of following facility service:

Facilities	Average Distance (Km)
Nearest School	
Market	
Religious centre (Pagoda)	
Drug shop	
Health Centre/ Referral(or District) hospital	
Provincial/Municipality hospital	
Police Administrative Post	
Commune Centre	
District Centre	
Other Urban	

IV. PERCEPTION ON THE PROJECT

4.1 What do you think about the project? ☐

0 = No answer 1 = Bad 2 = Good & Bad 3 = Good 4 = Very good

4.2 If good/very good, rank the 3 following statements in the boxes:

- ☐ Improve cargo transportation
- ☐ Decrease of congestion/accident
- ☐ Improve travel of tourist
- ☐ Attract more investment
- ☐ Increase land price
- ☐ Improve access other facilities
- ☐ Others (spec.) …….....
- ☐ Improve environment
- ☐ Create more direct/indirect job
- ☐ Reduced daily expenditures
- ☐ Flood prevent
- ☐ Big push to outskirts area (Bypass)
- ☐ Improve local product marketing

4.3 If you think there are some bad things about the project, rank 3 following statement in the boxes:

- ☐ Increase daily expenditures
- ☐ Loss of good trading site
- ☐ Increase accident
- ☐ Disturbs families and community
- ☐ Loss house / shop
- ☐ Loss of land use in ROW
- ☐ Worsen access to school
- ☐ Worsen environmental impact
- ☐ Decrease household income
- ☐ Affected on public facilities
- ☐ Loss occupation
- ☐ Worsen people health condition
- ☐ Makes people migrate away
- ☐ other (spec.) ……

4.4 Will you agree to move your affected properties from PRW? ☐

0 = No answer 1 = Not agree 2 = Agree with assistant 3=Voluntary to move

SIGNATURE

Household Head **Village Headman** **Interviewer**

Sketch map of the affected house