

Ministry of Public Works and Transport
The Kingdom of Cambodia

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR IMPROVEMENT OF
NATIONAL ROAD NO.1
(PHNOM PENH-NEAK LOEUNG SECTION)
IN
KINGDOM OF CAMBODIA

June 2009

JAPAN INTERNATIONAL COOPERATION AGENCY

KATAHIRA & ENGINEERS INTERNATIONAL

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PREFACE

The Government of Japan decided to conduct "The Preparatory Survey on the Project for Improvement of National Road No.1 (Phnom Penh - Neak Loeung Section) and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team from February 22 to March 5, 2009.

The team held discussions with the officials concerned of the Government of the Kingdom of Cambodia, and conducted field surveys at the study area. After the team returned to Japan, further studies were made. As this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Kingdom of Cambodia for their close cooperation extended to the survey.

June, 2009

EIJI HASHIMOTO
Vice President
Japan International Cooperation Agency

June, 2009

Letter of Transmittal

We are pleased to submit to you the Preparatory survey report on the Project for Improvement of National Road No.1 (Phnom Penh - Neak Loeung Section) in the Kingdom of Cambodia.

This study was conducted by Katahira & Engineers International, under a contract with JICA, during the period from February to June 2009. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Cambodia and formulated the most appropriate basic design for the project under Japan's Grant Aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Kazuyuki Hiraoka
Project manager,
The Preparatory survey team on the
Project for Improvement of National
Road No.1 (Phnom Penh - Neak
Loeung Section) in the Kingdom of
Cambodia
Katahira & Engineers International

SUMMARY

National Road No.1 connects the Cambodian Capital “Phnom Penh” and “Ho Chi Minh City”, the primary commercial city in Vietnam. Furthermore, this national road forms a part of the Asian Highway (AH-1), a well-known international arterial road. The section about 105 km from Neak Loueng up to the border of Vietnam has been improved in 2003 by the Asian Development Bank (ADB). However, the section about 56 km from Phnom Penh to Neak Loueng was excluded from the improvement. Travel speed in this section is restricted to an average of about 30 kph due to severe damages on the road surface. Therefore, the improvement of the section from Phnom Penh to Neak Loueng was an urgent issue to the Government of Cambodia (GOC). To cope with the problem, the GOC requested a grant aid from Japan to improve the section from Phnom Penh to Neak Loueng (hereinafter referred to the project). In response to the request, the Government of Japan (GOJ) decided to conduct a study on the implementation of the requested project.

In accordance with JICA Guidelines for Environmental and Social Considerations April 2004 (hereinafter referred to as JICA Guidelines), every activity and procedure relating to the Environmental and Social Considerations were implemented to comply with JICA Guidelines as closely as possible. The discussions with GOC were held on the measures for Resettlements Issue as often as necessary. A regular meeting on the agenda of “Resettlements Progress” was held twice a month by Inter-ministerial Resettlement Committee (IRC: Counter agency in Cambodian side) and JICA Cambodia Office (attendance of JICA Expert, the Consultant and Embassy of Japan as necessary). Information sharing and follow-up on the important issues such as “to reach appropriate consensus”, “compensation payments” and “resettlement sites arrangement” were achieved among the attendance in the meeting.

Upon the fulfillment of necessary conditions as stated above, the Basic Design Study (B/D) was commenced in March 2004. The Project was formerly composed of 3 stages where Stage-1 and Stage-2 were already completed in 2007 and 2009 respectively. The implementation Review Study for Stage-3 for the section from Sta.0+000 to Sta.13+100 was conducted afterward in 2007. During the Study, the following matters relating to the Project site were found.

- * Modification is required according to the ongoing New Monivong Bridge to match with its alignment and profile.
- * Designation of Right of Way (ROW) from Sta.0+000 to Niroth Pagoda at Sta.1+900 is not confirmed.

In 2008, GOC has finally decided the change of ROW width to 20.0m from the previous 15.0m for the section from Sta.0+000 to Sta.1+900. Furthermore, it became apparent that a pipe laying project named Niroth Production Facility Phase-1 project is being proposed by Phnom Penh Water Supply Authority (PPWSA). In this project, the water supply pipes are laid along the National Road No.1 from the Monivong Bridge to Sta.3+800 that are supposed to interfere with the Project.

Consequently, the section of the former Stage-3 from Sta.0+000 to Sta.13+100 is now divided into 2 stages, namely new Stage 3 from Sta.4+000 to Sta.13+100 and Stage 4 from Sta.0+000 to Sta.4+000.

Taking account of the background and circumstances as mentioned above, GOJ entrusted the Preparatory Survey Study of Stage-4 of the Project to Japan International Corporation Agency, the official agency implementing Japanese Government's technical assistance and expediting proper execution of the Japan's Grant Aid. Hence, JICA decided to conduct the Preparatory Survey and sent the study team, headed by Mr. TAKEUCHI Hiroshi, Director for Transport and ICT Division 1, Economic Infrastructure Department, JICA.

During the Survey, the team worked out the following matters.

- * As for the New Monivong Bridge, the team had discussions with Phnom Penh Municipality about the details and time schedule of the project.
- * As for Niroth Production Facility-1, the team had discussions with PPWSA about the details and schedules of the project and confirmed that further coordination of the both projects is required as necessary.
- * Additional Topographic Survey was conducted to reflect the latest land profile along the road.
- * Design modification corresponding to the new ROW.
- * Project cost was re-estimated based on the information obtained from the Survey.

Major contents of the Project and Stage-4 section studied during the Preparatory Survey are summarized in the following Table; Major Contents of the Project.

Direct beneficiaries from the implementation of the Project are 1.33 million residents in Phnom Penh and 1.26 million in Kandal Province where the Project is located and indirect beneficiaries are the entire population of 13.39 million in Cambodia. (Figures from the census in 2008)

The advantageous effects to be obtained from the implementation of the Project are summarized as follows;

- Improvement of functions as an arterial road such as separating traffic lanes (vehicle and motorbike lane), providing 4-lane section and bridge construction and replacement will achieve relatively high traffic capacity and reduce traffic accidents on the road.
- Provision of traffic sign boards, guardrails, and hampers are also expected to increase traffic safety for vehicles and residents.
- Improvement of road side service facilities at small-scale market areas, bus stops and school/hospital areas will mitigate traffic congestion and provide safety evacuation for livestock along the road as well as safety environment to the local residents.
- As a result of increased traffic capacity and better traveling performance of the road, traveling time between Phnom Penh and Neak Loueng will be about 45 - 50 minutes by improved driving speed from about 30 kph up to 80kph for the most sections.
- Construction of new bridges with revised load design from load limit of 15 tons to 20 tons will

cope with increasing heavy cargo and contribute to the efficiency of heavy cargo traffic.

- Raised elevation of the road surface provides safety traffic and evacuation space for the people at the time of flooding. It also contribute to improve durability of the road structure.
- New installation of the drainage facilities for road surface water provide smooth traffic flow and enhance traffic safety.
- Socio-economic activities become vital because of the exchange of goods and people by the improved function of National Road No.1. Moreover, living standards of the people will be upgraded by providing them with user friendly roads in the areas.

The implementation of the Project will yield significant advantageous effects and contribute to better living of the people. Therefore, the Project to be undertaken by the Grant Aid of Japan is appropriate from a viewpoint of contributing to the Cambodian nationwide socio-economic vitalization. Furthermore, it is considered that both of the personnel and financial funds are adequate in managerial and maintenance capability for the Project.

Finally, it is a key requirement for the implementation of the Project under the Grant Aid scheme to obtain “appropriate consensus of PAPs” involved in the resettlement issues. Furthermore, the Government of Cambodia is required to utilize the road facilities to the utmost extent through providing the residents with necessary education on traffic rules and traffic safety through self-help effort of the people after completion of the Project.

Major Contents of the Project

Item		Current Condition/Outline of Work	Major Works	
			Whole Project (Stage-1to4)	Stage-4
1. Road Improvement	Road Widening	Existing average width of carriageway is 6.5m and mixed traffic of vehicle and motorbike causing traffic accidents	Road Length 55.98km (Sta.0+000-55+980) 4-lane: 1.80km 2-lane: 54.18km	Road Length 4.00km (Sta.0+000-4+000) 4-lane: 1.80km 2-lane: 2.20km
	Road Elevation	Existing elevation is only 30cm above the flood level in 2000	Elevation to be raised for most sections	Elevation to be raised by about 50cm to 70cm
	Pavement	Pavement of 6.5m wide carriageway is seriously damaged by floods	Pavement on carriageway, bike lane and sidewalk for 55.98km.	Pavement on carriageway, bike lane and sidewalk for 11.20km.
2. Widening of Road Shoulder	Market Area	Lack of parking area causing traffic jam	3 nos.	-
	Bus Stop/ Evacuation Space	Bus stop and evacuation space for livestock during flood.	25 nos.	6 nos.
	School/Hospital	Students/pedestrians causing traffic jam	School: 31 nos. Hospital: 9 nos.	School: 2 nos. Hospital: 0 no.
3. Bridge Construction (PC Girder)	Bailey bridges with narrow width and low load capacity causing poor travel performance.	Total length of 3 bridges: 240.6m (68.8+103.0+68.8m) 2 bridges for replacement 1 bridge for construction	-	
4. Pipe/Box Culvert Construction	Existing 4 culverts malfunctioning due to deposit clogging. Lack of opening causing higher floodwater level in Phnom Penh and disturbing farming on the other side.	Total of 8 nos. (Box: 91.8m, Pipe 50.1m) *Pipe Culvert: 2nos. (rehabilitation) *Box Culvert 6 nos. (2 for rehabilitation, 4 for new construction)	-	
5. Road Drainage Facility	Lack of drainage facility causing traffic jam and traffic accidents.	Side Ditch length: 6,641m Drainage Pipe length: 5,122m	Side Ditch length: 4,411m Drainage Pipe length: 3,997m	
6. Revetment/ Riverbed Protection	Revetment	Slope erosion occurring at inlet/outlet opening	3 places at bridges 8 places at culverts	-
	Riverbed Protection	Riverbed scouring occurring at inlet/outlet opening	3 places at bridges 8 places at culverts	-
7. Measures for Slope Erosion	Greenbelt	Slope erosion due to water stream and waves at bridge areas and road curves.	Total length of Greenbelt: 2,800m	-
	Wet Masonry	Slopes around culverts being eroded.	Total length: 1,060m at Mekong side	-
8. Measures for Soft Ground	Replacement by Selected Soil	Existing soft ground to be replaced by selected soil prior to embankment work.	15.08km at Mekong side 44.28km at Calmatage side	-
	Replacement by Sand	Soft soil under water to be replaced by sand.	1.91km at Mekong side 2.16km at Calmatage side	1.11km at Mekong side 1.44km at Calmatage side
9. Intersection Improvement	Traffic jam and traffic accident frequently occurring at busy intersection like Chbar Ampov.	Improvement at 4 locations: Both sides of Chbar Ampov, Niroth Pagoda and Tiger Beer intersections	Improvement at 3 locations: Both sides of Chbar Ampov and Niroth Pagoda intersections	
10. Ancillary Facilities	Traffic Light	Traffic lights needed at Chbar Ampov and Niroth Pagoda area for mitigation of traffic congestion and safety traffic.	4 intersections: 13 nos. traffic light for vehicle 24 nos. for pedestrian	4 intersections: 13 nos. traffic light for vehicle 24 nos. for pedestrian
	Street Lighting	Street lighting needed at median strip on 4-lane sections on a par with existing street lights for safety environment.	49 nos.	49 nos.
	Gabion Mat for Slope	Gabion mat needed at toe of slope to confine road embankment according to modification of ROW	Total length: 6,170m	Length: 6,170m
	Road Marking/ Traffic Sign	Road marking and traffic sign to be installed appropriately to control safety traffic.	Road marking: centerline, laneline and sideline Crossing: 39 places Traffic sign: 153 nos.	Road marking: centerline, laneline and sideline Crossing: 13 places Traffic sign: 96 nos.
	Median Strip	Median strip to be installed for traffic safety.	Total length: 1,681m	Length: 1,681m
	Curb	Road curbs to be installed for traffic safety.	Total length: 16,800m	Length: 3,431m
	Guardrail	Guardrail to be installed at approach of bridges and culverts.	Mekong side: 180m Calmatage side: 180m	-
	Guide Post	Guide post to be installed at curbs, bridges, culverts and higher embankment more than 5.0m	Total of 1,010 nos.	190 nos.

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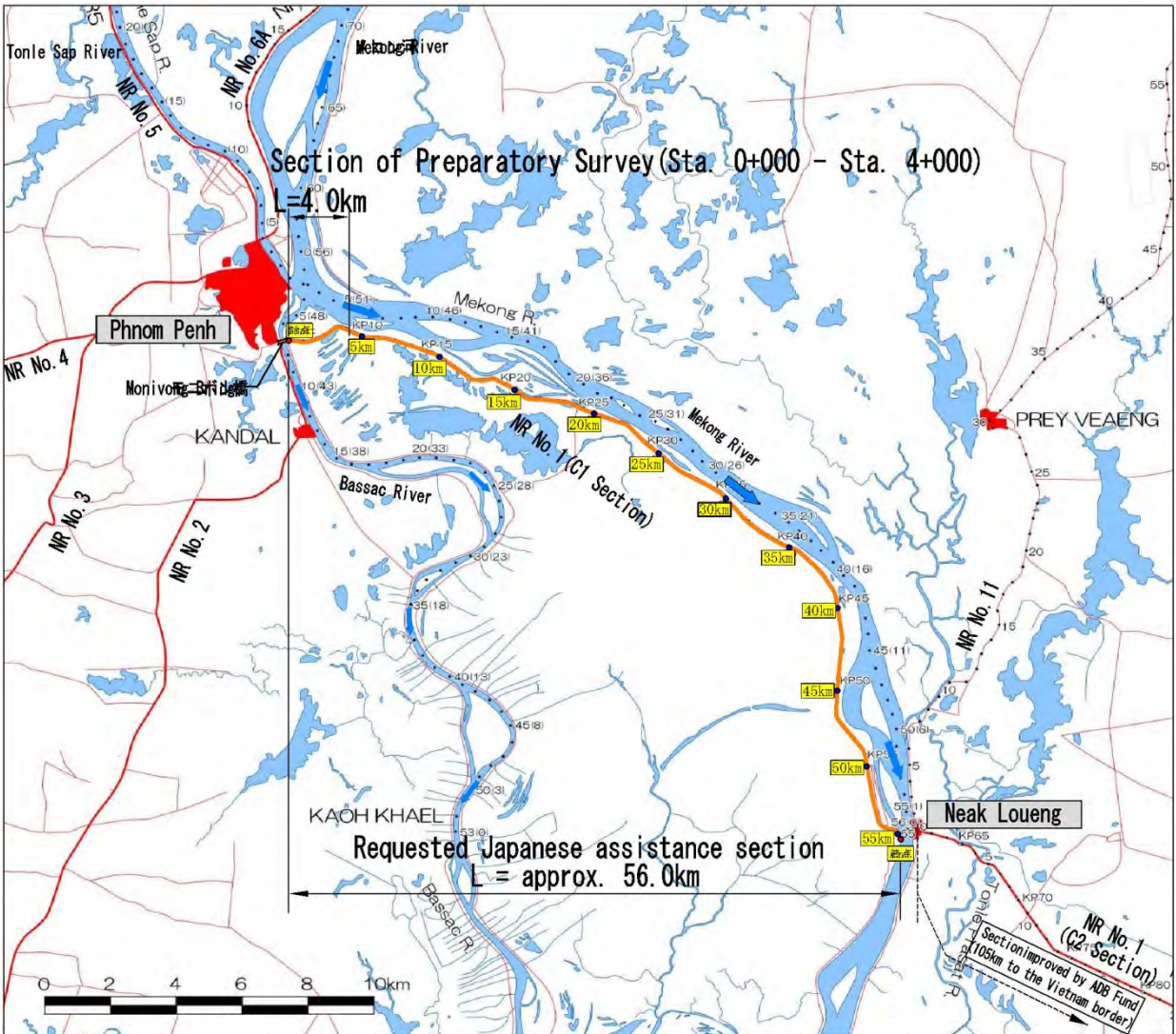
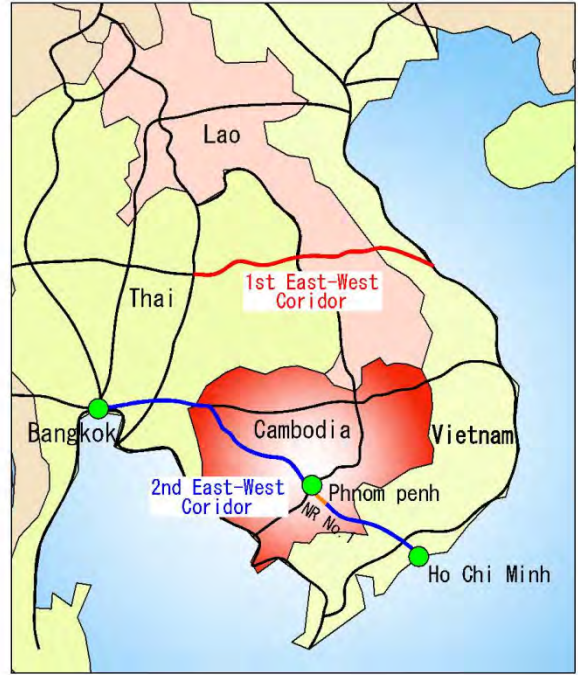
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Location Map



Perspective
(View from the east bank of the second Monivong Bridge)

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ABBREVIATIONS

AASHTO	:	American Association of State Highway and Transportation Officials
ADB	:	Asian Development Bank
AH	:	Asian Highway
BCU	:	Bridge Construction Unit
B/D	:	Basic Design
DMS	:	Detailed Measurement Survey
EDC	:	Electricite du Camboge
E/N	:	Exchange of Note
ESCAP	:	Economic and Social Commission for Asia and the Pacific
GDP	:	Gross Domestic Product
GOC	:	Government of Cambodia
GOJ	:	Government of Japan
IRC	:	Inter-Ministerial Resettlement Committee
M/D	:	Minutes of Discussions
MPP	:	Municipality of Phnom Penh
MPWT	:	Ministry of Public Works and Transport
PAPs	:	Project Affected Persons
PPWSA	:	Phnom Penh Water Supply Authority
PRW	:	Provisional Road Width
RAP	:	Resettlement Action Plan
RCC	:	Road Construction Center
ROW	:	Right of Way
TC	:	Telecom Cambodia
T/N	:	Tender Notice
UN	:	United Nations
V/C	:	Verification of Contract

Chapter 1 Background and Objectives of the Project

National Road No.1 connects the Cambodian Capital “Phnom Penh” and “Ho Chi Minh City”, the primary commercial city in Vietnam. Furthermore, this national road forms a part of the Asian Highway (AH-1), a well-known international arterial road. The section about 105 km from Neak Loueng up to the border of Vietnam has been improved in 2003 by the Asian Development Bank (ADB). However, the section about 56 km from Phnom Penh to Neak Loueng was excluded from the improvement. Travel speed in this section is restricted to an average of about 30 kph due to severe damages on the road surface. Therefore, the improvement of the section from Phnom Penh to Neak Loueng was an urgent issue to the Government of Cambodia (GOC). To cope with the problem, the GOC requested a grant aid from Japan to improve the section from Phnom Penh to Neak Loueng (hereinafter referred to the project). In response to the request, the Government of Japan (GOJ) decided to conduct a study on the implementation of the requested project.

In accordance with JICA Guidelines for Environmental and Social Considerations April 2004 (hereinafter referred to as JICA Guidelines), every activity and procedure relating to the Environmental and Social Considerations were implemented to comply with JICA Guidelines as closely as possible. The discussions with GOC were held on the measures for Resettlements Issue as often as necessary. A regular meeting on the agenda of “Resettlements Progress” was held twice a month by Inter-ministerial Resettlement Committee (IRC: Counter agency in Cambodian side) and JICA Cambodia Office (attendance of JICA Expert, the Consultant and Embassy of Japan as necessary). Information sharing and follow-up on the important issues such as “to reach appropriate consensus”, “compensation payments” and “resettlement sites arrangement” were achieved among the attendance in the meeting.

Upon the fulfillment of necessary conditions as stated above, the Basic Design Study (B/D) was commenced in March 2004. The Project was formerly composed of 3 stages where Stage-1 and Stage-2 were already completed in 2007 and 2009 respectively. The implementation Review Study for Stage-3, from Sta.0+000 to Sta.13+100, was conducted afterward in 2007. During the study, following matters relating to the Project site were found.

- Modification according to the ongoing New Monivong Bridge to match with its profile.
- Pending Right of Way (ROW) designation of the section from Sta.0+000 to Niroth Pagoda at Sta.1+900.

Taking these situations into consideration, the scope of Stage-3 was finalized to cover the section from Sta.1+900 to Sta.13+100 excluding the section from Sta.0+000 to Sta.1+900.

In 2008, GOC has finally decided the change of ROW width to 20.0m from the previous 15.0m for the section from Sta.0+000 to Sta.1+900. Furthermore, it became apparent that a pipe laying project named Niroth Production Facility Phase-1 project is being proposed by Phnom Penh Water Supply Authority, In this project, the water supply pipes are laid along the National Road

No.1 from the Monivong Bridge to Sta.3+800 that are supposed to interfere with the Project. Consequently, the section of Stage-3 from Sta.1+900 to Sta.13+100 is now divided into 2 stages, namely new Stage 3 from Sta.4+000 to Sta.13+100 and Stage 4 from Sta.0+000 to Sta.4+000.

Taking account of the background and circumstances as mentioned above, the Preparatory Survey of Stage-4 was conducted from February to July 2009 in order to;

- Modify the design based on the new designation of ROW width as well as the alignment of the new Monivong Bridge.
- Modify the design to reflect the latest land profile along the road.
- Coordinate the design and construction of Niroth Production Facility Phase 1 Project with concerned parties.
- Re-estimate the project cost based on information obtained during the Survey.

General and specific information on the area of Stage-4 are described as follows,

***Populated Area**

The Project is situated in the populated area where commercial activities along the road are relatively high. Especially in the first half section from Sta.0+000 to Sta.1+900, local the area is densely populated and road traffic from/to the city center of Phnom Penh is heavily congested during the peak hours. Furthermore, topographic profile along the section has significantly changed compared with the previous study due to reclamation of the land as land development spreads into the suburbs and this change requires additional topographic survey for the design purposes.

*** Environmental and Social Considerations**

Among the Environmental and Social Considerations, “Resettlement” in Stage-4 is as particularly important as in Stage-1 and Stage-2 for successful implementation of the Project.

It is confirmed that Inter-Ministerial Resettlement Committee (IRC) continues to initiate necessary procedures for the resettlement in accordance with JICA Guidelines.

According to IRC survey, it is estimated that there are about 320 PAPs for resettlement in the section from Sta.0+000 to Sta.1+900 while about 210 PAPs from Sta.1+900 to Sta.4+000 totaling 530 PAPs for the entire Project. And additional land acquisition is required corresponding to the new designation of ROW, 20.0m width. The resettlement procedures will be implemented prior to the commencement of the Project.

***Other Projects in the vicinity**

Other government projects are being implemented in the vicinity of the Project area that shall be taken into design consideration due to close alignment of their structures to Stage-4 project. The descriptions and related studies about these projects are;

【The Construction of New Monivong Bridge】

- Implementing Agency: Phnom Penh Municipality
- Found Source: Phnom Penh Municipality
- Project Status: On going and expected to complete on 2009

The original designs of the area at the New Monivong Bridge east side including the approach road have to be changed. Accordingly, the area affected by road improvement is subject to design change and re-fixation of PAPs with additional topographic survey is required to identify the affected areas by the new bridge.

【The Construction of Niroth Production Facilities-Phase 1】

- Implementing Agency: Phnom Penh Water Supply Authority
- Found Source: International Joint Fund (Japan and France)
- Project Status: Expected to commence in 2010

Discussions were held between Phnom Penh Municipality, the contractor and the Survey Team to clarify the details of their project such as schedule and design. During the survey, it is confirmed that the Water Supply project shall be completed prior to the road project at least on the National Road No.1 section in order to avoid any conflicts between the projects. And it is also agreed that the further coordination on the implementation of the projects is most important.

***Reclamation and Land Development along the road**

Significant changes compared with the previous design in profile along the entire section of the Project were observed due to reclamation and land development by the residents. These changes are causing design modification for proper road drainage.

Chapter 2 Contents of the Project

2.1 Basic Concept of the Project

2.1.1 Overall Goal and Project Purpose

The Government of Cambodia formulates its development policy named “Rectangular Strategy” in the National Strategic Development Plan (year 2006-2010), in which three (3) objectives of the road sector in the national infrastructure development program are proposed.

- Upgrading of the Road Network throughout the country through improvement and rehabilitation of national traffic arteries.
- Improvement of international traffic arteries connecting to borders with neighbor countries for promoting international exchange with people in remote areas.
- Formulating a sustainable managerial maintenance plan for enhancing investment effects in road improvement and rehabilitation

The policy objective of developing the road infrastructure is to be attained by giving first priority to road rehabilitation, especially the national trunk roads in the country. The National Road No.1 connects Phnom Penh, the capital city of Cambodia and Ho Chi Minh, the primary commercial city in Vietnam. The National Road No.1 serves as the Second East-West Corridor that is important artery in a view of development of the Mekong Region and forms a part of the Asian Highway (AH), an international road network in the region while it also takes an important role as a community road for the people. The National Road No.1 is given a high priority in the above plan.

The overall goal and project purpose are as follows:

- Overall Goal: To stimulate socioeconomic activities in Cambodia.
- Project Purpose: To improve the movement of people and goods between Phnom Penh Municipality and Ho Chi Minh City.

2.1.2 Outline of the Project

This project aims to improve National Road No.1 (Phnom Penh - Neak Loueng Section), approximately with the distance of 56 km to achieve the above over all goal. The project is expected to smoothen the traffic, shorter the travel time and increase the traffic volume as a result of the improvement of the road functions.

The Project has been implemented accordingly to the Involuntary Resettlements schedule initiated by the Government of Cambodia and divided into following four (4) stages.

- Stage 1: Construction of Bridge No.2 and Bridge No.3.

- Stage 2: Improvement of the section between Sta.13+100 and Sta.55+980 and construction of Bridge No.1.
- Stage 3: Improvement of the section between Sta.4+000 and Sta.13+100.
- Stage 4: Improvement of the section between Sta.0+000 and Sta.4+000.

Stage 1 commenced in November 2005 and completed in January 2007.

Stage 2 commenced in November 2006 and completed in February 2009.

2.2 Basic Design of the Requested Japanese Assistance

2.2.1 Design Policy

2.2.1.1 Scope of Assistance

The Project is to improve the National Road No.1 for the section from Sta.0+000 to Sta.4+000. Scope of the Project is generally the improvement of road structure, the same as other projects previously implemented under the cooperation from the Government of Japan. In addition, the section of the Project is situated partially in Phnom Penh Municipality, congested urban areas, for which some urban facilities other than typical road facilities should be considered in the design.

Scope of Assistance from the Government of Japan

- Improvement of road pavement
- Installation and improvement of drainage system for road surface water
- Installation of walk way and parking space
- Installation of access to private parking space
- Installation of traffic safety equipments such as road signs, traffic lights and road markings.
- Installation of median strip, street lights and sodding for 4-lane section
- Re-planting and planting of street trees and sodding on embankment slope.

2.2.1.2 Basic Policy on Design

(1) Design Policy in the Basic Design Study

The designs that were proposed in the Basic Design Study (B/D) and approved by concerned authorities are adopted in principal. Basically, such standards and references as design standards, design condition, geometrical structure standards and pavement composition are not subject to change in this Preparatory Survey.

(2) Updated Site Conditions to be incorporated into the Design Study

The latest information on site changes to be incorporated into the Preparatory Survey and corresponding design considerations are described in the following.

- A most suitable connection between an approach road of the New Monivong Bridge and the Project.
- Provision of access ways to newly constructed facilities along the road such as factories, warehouses, shops, houses and schools for their convenience.
- Incorporation into the design of the latest changes in topographical profiles due to land filling by commercial activities along the road.

(3) Appropriate Consideration on the Road at Congested Areas

A 4-lane section stretching from Sta.0+000 to Sta.1+800 is busy area with numbers of shops and people on shopping. Therefore, the design considerations are to be made not only on function of the road but also better living standards and environment for the people along the road. Specific points of the consideration are as follows.

- Median strips with grass cover and street lightings are provided.
- Existing road side trees at Chba Ampov market from Sta.0+000 to 0+300 are to be relocated to the proposed parking spaces or other suitable locations and encircled by concrete blocks for protection. For sections with parking spaces outside side walk, street trees, which are removed from other places or newly delivered, are planted at every 10.0m.
- Side walk is elevated by 12.0 cm and separated conspicuously from vehicle lane and motorbike lane. Side walk is paved with concrete blocks and painted with thermal insulation paint.
- Side walk is designed to provide number of vehicles crossing over with easy access to facilities along the road.
- Surface water on the road is to be drained through drainage pipes under the side walk, not through side ditches.
- Maintenance catch basins of underground drainage systems are equipped with hinged type ductile iron covers in view of durability, not concrete covers.

(4) Provision of necessary Road Traffic Facilities and Ancillary Facilities

- Traffic Safety Facilities: Street lighting, Traffic light, Lane marking, Cat-eye (Reflected Centerline Stud), Crosswalk, Hump, Road sign (for warning and regulatory)
- Ancillary Facilities: Access way to private facilities and land along the road (Improvement of existing access way), Improvement of existing intersections (up to the corner ends), Raising of elevation of existing manhole cover to match the road elevation.

(5) Considerations on Traffic at Chba Ampov Market (Sta.0+100 to Sta.0+300)

In the previous B/D, regulating traffic flows at Chba Ampov market area was referred to the local authorities for its consideration on the traffic flows, due to absence of information about new Monivong Bridge. However, control the traffic on the National road No.1 with

local traffic at the market area is still essential in terms of enhancement of positive effects of the project. In view of this, traffic lights are to be installed beside the bridge at Sta.0+100 and at the end area of the market at Sta.0+310, and in addition, other traffic lights at major intersections at Sta.1+090 and in front of a high school at Sta.1+550.

(6) Underground Utilities

Considerations are made on existing underground utilities that they will not interfere with the installation of drainage pipes during the project and maintenance activities of the existing utilities after completion of the project, will not cause any unnecessary excavation of the road. Thus, coordination with related utility operators is particularly required for relocating utilities in place under the side walk, parking spaces or road shoulder to deal with possible problems in the future.

(7) Pipe Laying Project by Phnom Penh Water Supply Authority (PPWSA)

In order to eliminate any problems and conflicts during execution of the projects, coordination about project schedules and work procedures will be made. Specific items for the coordination are described as follows.

- Pipe laying work by PPWSA is completed prior to the commencement of the Project.
- Depth of PPWSA pipe location is deliberated in relation to the drainage system of the Project, in which the drainage pipes and its catch basins are installed, in some places, deeper than PPWSA pipes that are installed mostly at minimum of 1.5m under the ground. Design modification is requested to PPWSA that pipes need to be shifted vertically or horizontally to avoid direct contact of the pipes. (Explanation drawings with specific locations are to be presented to PPWSA for further discussion upon completion of the Preparatory Survey.)
- Such ancillary facility of PPWSA project as manholes for air valves is not installed near/on the vehicle lane and road facilities.

2.2.1.3 Basic Policy on Environmental Social Considerations

(1) Involuntary Resettlements

Present situation and state on the Involuntary Resettlement are described in Chapter 1. IRC will take initiative to complete proposed Involuntary Resettlements prior to the commencement of the Project. Possible countermeasures to be taken for promoting smooth Involuntary Resettlements are presented in the following Table 2.2-1.

Table 2.2-1 Resettlement in sequence and Countermeasures

Resettlement in sequence	Countermeasures
<ul style="list-style-type: none"> - Establishing of final ROW(established in 2008) - Detailed Measurement Survey(completed in 2006) - Presentation of compensation amount - Signing of resettlement contract - Payment of compensation - Preparation of resettlement site 	<ul style="list-style-type: none"> - Locating ROW on site - Confirmation of facilities for resettlement - Confirmation of resettlement contract and amount - Holding of public information meetings for information disclosure and grievance settlement - Consideration of possible assistance to PAPs in resettlements

The Consultant through MPWT, the Client, will monitor that those countermeasures for the Involuntary Resettlements are properly taken in appropriate manner and will present his advice as necessary.

(2) Countermeasures to ease Negative Effects during the Project in the Environmental Social Considerations

It is proposed that construction works at traffic congestion area, a section from Sta.0+000 to Sta.1+900, is to be carried out during night time hours to avoid any inconvenience to the people in the area. Nevertheless, some countermeasures are still considered to deal with negative effects to the living environment of the people, which might occur particularly in construction at congested areas. Assumed negative effects and countermeasures to be taken are described on the following Table 2.2-2.

Table 2.2-2 Assumed Negative Effects and Mitigation Measures

Classification of Effect	Negative Effect for Environmental and Social Consideration	Countermeasures/ Measures for Mitigation
Vibration/Noise	Vibration and noise arisen from construction equipments and vehicles in operation	<ul style="list-style-type: none"> - To employ equipments with features for generating less vibration and noise as much as possible. - To adopt work methods generating less vibration/noise. - To enforce proper work procedures and work schedule.
Dust	Dust pollution arisen from construction and traffic vehicles traveling on site	<ul style="list-style-type: none"> - To spray water on road regularly. - To enforce speed limit for vehicles. - To maintain road in condition and clean regularly.
Traffic Congestion	Road congestion due to traffic restriction on traveling vehicles during construction	<ul style="list-style-type: none"> - To post traffic sign properly on site. - To station traffic control guide properly on site. - To maintain good road surface regularly. - To enforce proper work procedures and work schedule.
Water Contamination	Water contamination due to unconscious flow out of materials such as earth materials, stone, bituminous material, oil into nearby water channel	<ul style="list-style-type: none"> - To implement proper work procedure to prevent any unfavorable flow out into water channel in the area.
Waste Disposal	Environmental pollution due to inadequate disposal of construction waste.	<ul style="list-style-type: none"> - To designate disposal area for proper treatment of waste materials.

The consultant makes efforts in providing IRC with possible supports to minimize negative effects attributable to the Project by taking part in Public Information Meetings as necessary, for exchanging information and understandings with the people.

2.2.2 Basic Plan

2.2.2.1 Review on Design Criteria for Road Design

(1) Design Standards

Following standards adopted in the B/D are not changed.

- AASHTO: High Capacity Manual, 1965
- AASHTO: Guide for Design of Pavement Structure, 1993
- ESCAP, UN: Asian Highway Classification and Design Standards
- MPWT, Cambodia: Road Design Standard (Part 1, 2, 3) (mostly similar to Road Structure Design, Japan Road Association)

(2) Design Speed

Design Speed for Stage 4 section is classified as follows based on traffic volume, road condition and road side situation.

- From Sta.0+000 to Sta.2+000: 40km/hr
- From Sta.2+000 to Sta.4+000: 60km/hr

(3) Geometrical Structure Standards

- Geometrical road alignment due to the changes of design speed is not considered but road banking and transition length of road width is to be modified.

Table 2.2-3 Geometry Standards

Design Speed	80km/hr	60km/hr	40km/hr
Minimum Horizontal Curve Radius	280m	150m	60m
Maximum Longitudinal Gradient	4%	5%	7%
Minimum Curve Radius for substitution for Easement Curve	900m	500m	250m
Minimum Easement Curve Length	70m	50m	35m
Minimum Ratio of Lane Transition	1/40	1/30	1/20

2.2.2.2 Review on Road Structure

(1) Typical Cross Section of the Road

Composition of the road width and pavement structure is shown on typical section drawings in the Basic Drawings (refer to Appendix 6). Modifications from the B/D are described in the following.

Chba Ampov market section from Sta.0+100 to Sta.0+300

- Width of side walk is modified to 2.5m from 5.0m for providing more parking spaces. (Assuming the wide side walk is occupied by vehicles for parking)
- Width of median strip is modified to 3.0m from the existing width of 2.0m for providing spaces for turning traffic at intersection areas.
- Parking spaces are provided between motorbike lanes and side walks and adopted a 45degree parking pattern due to limited space width of 6.5m
- Width of vehicle lane is reduced to 3.25m from the typical width of 3.50m.
- For the area from the abutment of the Monivong Bridge, overlay pavement of 5.0cm adopted in the design considering that the present surface conditions are relatively fair and the area is too congested for the work to remove entire existing pavement.

4-lane section from Sta.0+300 to Sta.1+800

- Width on median strip is modified to 4.5m, much wider than the original design of 1.0m as a result of the latest change of Provisional Road Width (PRW) that is 20.0m from 15.0m.
- Embankment slope with sodding on lower lands along the road are fixed at 1:2 and gabion mattresses are placed to accommodate the road embankment inside PRW where higher embankment required.

2-lane section from Sta.1+800 to Sta.4+000

- Topographic profile along the road has been changed due to various land filling works, which requires appropriate drainage systems for surface water on the roads.
- In the B/D, the cement treated slope protection was adopted for preventing slope erosion by wave action at the time of flooding. But due to the land filling as mentioned above, embankment filling with sodding is considered enough sufficient instead of cement treated slope protection.
- Surface of the wet low land consisting of muddy soil is replaced by about 1.0m with sand material prior to the embankment filling.
- Existing street trees are maintained as much as possible at present positions. But most of trees are re-planted or newly planted at every 10.0m interval to be incorporated into the modification of width of the roads.

(2) Design of Road Structures

Road structures such as curbs, side walk, and safety facilities are shown in details in the Basic Drawing (refer to Appendix 6). Profiles of road structures on the 4-lane section in congested area are modified in dealing with requirements to specific features of the road utilization.

Curbs for Side walk

Mount-type curbs that are accessible for vehicles are proposed for side walk on a 4-lane section considering that private vehicles are mostly parked inside houses or under house canopies in Cambodia.

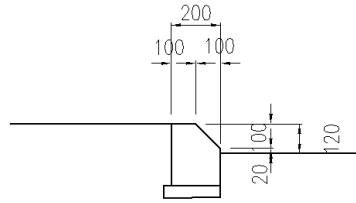


Figure 2.2-1 Mount-type Curb

Divider Block for Dividing Side walk from Motorbike lane

Divider blocks of asphalt concrete with height of 15mm are provided at the boundary between side walk and motorbike lane for pedestrian's safety and easy access for vehicles entering private lands and parking spaces that are existing continuously in the 2-lane section. Projected surface of divider blocks are painted with white color.

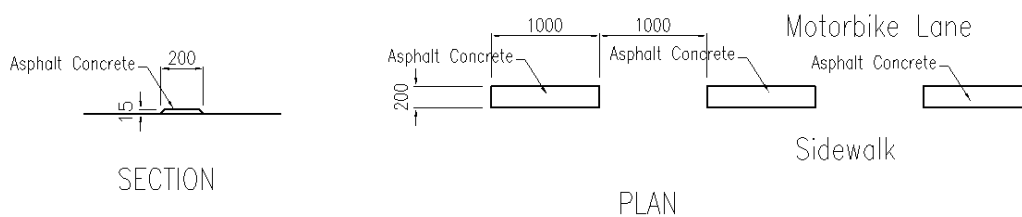


Figure 2.2-2 Asphalt Concrete Divider Block

Edge Treatment of Asphalt Surface Course

Deference of 4.0 cm in height between the surface of vehicle lane and motorbike lane interferes with motorbikes when moving onto vehicle lane for overtaking. The asphalt edge line of vehicle lane is given a profile to have moderate ramp in view of safety traffic as shown bellow.

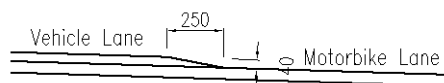


Figure 2.2-3 Profile of Edge of Asphalt Surface Course

(3) Drainage Plan for Surface Water

Drainage Network

Drainage system for road surface water is presented in the plan and longitudinal drawings. Locations of discharge points are proposed on the east bank of the Bassac river at the Monivong bridge and in creeks on Clamatage side as well as on lower areas along the roads.

Local authorities will modify the locations of discharge point after completion of the Project when the original locations become inadequate due to changes of land profile attributed to local development project in the future.

Drainage System for 4-lane section

L-shaped concrete ditches are installed on the side of motorbike lane parallel to side walk and discharge surface water to drainage concrete pipes under the side walk. The connection of L-shaped ditches and underground concrete pipes are at every 10.0 m to 20.0 m. Concrete pipes are prefabricated at fabrication yard and sizes of concrete pipes are determined based on discharge calculation results specifying a minimum pipe diameter of 60 cm and foundation structures corresponding to the traffic condition as well as the earth cover required. A maintenance basin is installed at about every 50.0 m of the pipe line. The basins have enough dimensions for proper connections of the pipes and the bases of the basins are designed lower than connected pipes by 30.0 cm for proper sedimentation. A cover of the basin made of ductile iron matches the elevation of side walk.

Drainage System for 2-lane section

Longitudinal gradient is less in this section and necessary discharge gradient is attained by variation in elevation of the in-situ concrete ditches. Based on the discharge calculation result (refer to Appendix 7-1), width of 40.0 cm for all ditches are proposed. Detachable pre-cast concrete covers are provided every 2.5 m while other covers are concrete fixed for preventing unnecessary damages by vehicles traveling on the covers. At every 50.0 m interval, a sedimentation basin equipped with 180 degree hinged and non-detachable grating covers is installed. Pipe culverts drainage covered 360 degree with concrete are installed under ground at intersections while concrete ditches with fixed concrete covers are installed at every access to private lands.

Calculation of Discharge

Catchment area and drainage gradient are as shown in longitudinal section drawings. Width of catchment area is limited to vehicle lane, motorbike lane and side walk except private lands along the road. Possible water flow from adjacent private lands is taken into account in the calculation so as to attain proper discharge volume with allowance.

A rational formula is adopted for calculation of discharge volume. Rainfall intensity applied in the calculation is $I=2555.07/(10+25.48)^{-0.93}=71.1(\text{mm/hr})$ for the 10 minutes continuous rainfall intensity of the 2 year probability rainfall intensity as proposed in the Feasibility Study on Flood control and Drainage System in Phnom Penh conducted in 1999 and as adopted in the B/D. The discharge calculation conforms to “Road Drainage” published by Japan Road Association. Details of the calculation is attached in Appendix 7-1.

(4) Design on Traffic Safety Facilities and Ancillary Facilities

Street Lighting

Street lights are installed inside median strips at every 40.0 m interval in 4-lane section. Type of the street light is similar to existing street lights in Phnom Penh.

Traffic Light

For intersections at Sta.0+100, Sta.0+310 and Sta. 1+090 having heavier cross traffic and U-turn traffic volume in 4-lane section, traffic lights are proposed in order to regulate safely these cross traffic with thru traffic. Traffic lights for pedestrians are also proposed at Sta.1+550. Type of the traffic light is similar to the existing in Phnom Penh.

Road Marking

Road markings such as center line, lane line, side line, crosswalk, stop line, arrow mark and parking line are painted on the road. Paint material is a heat application type with white color.

Reflected Centerline Stud (Cat-eye)

Cat-eyes are installed every 25.0 m on centerline of the road and every 5.0 m at both ends of median strips and the run off area between 4-lane and 2-lane section respectively.

Hump (Rumble Strip)

Rumble strips are provided on both side of a crosswalk at Sta.3+920 to force oncoming vehicles to reduce their speed for safety traffic.

Road Sign

As for regulatory signs, Speed Limit sign is placed every 200.0 m and Traffic Direction sign as well as Stop sign are placed as necessary while such warning sign as Crosswalk sign, Intersection sign and Merge Lane sign are also placed as necessary. Detailed locations of road sign are presented in the basic design drawings.

2.2.3 Basic Design Drawing

Major contents of the Project are shown in Table 2.2-4 and Basic Drawings of this survey are attached in Appendix 6.

Table 2.2-4 Major Contents of the Project

Item		Current Condition/Outline of Work	Major Works	
			Whole Project (Stage-1to4)	Stage-4
1. Road Improvement	Road Widening	Existing average width of carriageway is 6.5m and mixed traffic of vehicle and motorbike causing traffic accidents	Road Length 55.98km (Sta.0+000-55+980) 4-lane: 1.80km 2-lane: 54.18km	Road Length 4.00km (Sta.0+000-4+000) 4-lane: 1.80km 2-lane: 2.20km
	Road Elevation	Existing elevation is only 30cm above the flood level in 2000	Elevation to be raised for most sections	Elevation to be raised by about 50cm to 70cm
	Pavement	Pavement of 6.5m wide carriageway is seriously damaged by floods	Pavement on carriageway, bike lane and sidewalk for 55.98km.	Pavement on carriageway, bike lane and sidewalk for 11.20km.
2. Widening of Road Shoulder	Market Area	Lack of parking area causing traffic jam	3 nos.	-
	Bus Stop/ Evacuation Space	Bus stop and evacuation space for livestock during flood.	25 nos.	6 nos.
	School/Hospital	Students/pedestrians causing traffic jam	School: 31 nos. Hospital: 9 nos.	School: 2 nos. Hospital: 0 no.
3. Bridge Construction (PC Girder)	Bailey bridges with narrow width and low load capacity causing poor travel performance.	Total length of 3 bridges: 240.6m (68.8+103.0+68.8m) 2 bridges for replacement 1 bridge for construction	-	
4. Pipe/Box Culvert Construction	Existing 4 culverts malfunctioning due to deposit clogging. Lack of opening causing higher floodwater level in Phnom Penh and disturbing farming on the other side.	Total of 8 nos. (Box: 91.8m, Pipe 50.1m) *Pipe Culvert: 2nos. (rehabilitation) *Box Culvert 6 nos. (2 for rehabilitation, 4 for new construction)	-	
5. Road Drainage Facility	Lack of drainage facility causing traffic jam and traffic accidents.	Side Ditch length: 6,641m Drainage Pipe length: 5,122m	Side Ditch length: 4,411m Drainage Pipe length: 3,997m	
6. Revetment/ Riverbed Protection	Revetment	Slope erosion occurring at inlet/outlet opening	3 places at bridges 8 places at culverts	-
	Riverbed Protection	Riverbed scouring occurring at inlet/outlet opening	3 places at bridges 8 places at culverts	-
7. Measures for Slope Erosion	Greenbelt	Slope erosion due to water stream and waves at bridge areas and road curves.	Total length of Greenbelt: 2,800m	-
	Wet Masonry	Slopes around culverts being eroded.	Total length: 1,060m at Mekong side	-
8. Measures for Soft Ground	Replacement by Selected Soil	Existing soft ground to be replaced by selected soil prior to embankment work.	15.08km at Mekong side 44.28km at Calmatage side	-
	Replacement by Sand	Soft soil under water to be replaced by sand.	1.91km at Mekong side 2.16km at Calmatage side	1.11km at Mekong side 1.44km at Calmatage side
9. Intersection Improvement	Traffic jam and traffic accident frequently occurring at busy intersection like Chbar Ampov.	Improvement at 4 locations: Both sides of Chbar Ampov, Niroth Pagoda and Tiger Beer intersections	Improvement at 3 locations: Both sides of Chbar Ampov and Niroth Pagoda intersections	
10. Ancillary Facilities	Traffic Light	Traffic lights needed at Chbar Ampov and Niroth Pagoda area for mitigation of traffic congestion and safety traffic.	4 intersections: 13 nos. traffic light for vehicle 24 nos. for pedestrian	4 intersections: 13 nos. traffic light for vehicle 24 nos. for pedestrian
	Street Lighting	Street lighting needed at median strip on 4-lane sections on a par with existing street lights for safety environment.	49 nos.	49 nos.
	Gabion Mat for Slope	Gabion mat needed at toe of slope to confine road embankment according to modification of ROW	Total length: 6,170m	Length: 6,170m
	Road Marking/ Traffic Sign	Road marking and traffic sign to be installed appropriately to control safety traffic.	Road marking: centerline, laneline and sideline Crossing: 39 places Traffic sign: 153 nos.	Road marking: centerline, laneline and sideline Crossing: 13 places Traffic sign: 96 nos.
	Median Strip	Median strip to be installed for traffic safety.	Total length: 1,681m	Length: 1,681m
	Curb	Road curbs to be installed for traffic safety.	Total length: 16,800m	Length: 3,431m
	Guardrail	Guardrail to be installed at approach of bridges and culverts.	Mekong side: 180m Calmatage side: 180m	-
	Guide Post	Guide post to be installed at curbs, bridges, culverts and higher embankment more than 5.0m	Total of 1,010 nos.	190 nos.

2.2.4 Implementation Plan

2.2.4.1 Implementation Policy

The basic conditions for implementing the project are as follows:

- This Project, if approved, will be implemented in accordance with the guidelines of Japan's Grant Aid after the signing of the Exchange of Notes between the Governments of Japan (GOJ) and the Kingdom of Cambodia.
- The Ministry of Public Works and Transport (MPWT) is responsible for implementing the Project.
- The detail design, assistance in tendering, and construction supervision of the Project will be undertaken by a Japanese consulting firm in accordance with a contract between the MPWT and the consultant.
- The construction will be undertaken by the successful Japanese tenderer according to the contract with the MPWT.

The basic policies in the implementation of the project are as follows:

- The Construction method is based on the method reviewed in Implementation Review Study of the Project.
- The matters to be undertaken by Cambodia Government such as Land acquisition, Relocation of Utilities, Construction of the 2nd Monivong Bridge, Installation of Large-diameter water pipe of Niroth Production Facilities-Phase 1 project, are assumed to be completed prior to the construction.
- In planning of construction schedule, embankment and cement stabilization work shall be carried out from December to May during dry season and sub-base course work shall be mostly completed by July, the small dry season.
- To secure the safety and smooth traffic flow during the construction, temporary diversion, appropriate traffic control method, temporary road occupation and one line alternate traffic, night-time work shall be planned.
- In planning of construction schedule, sidewalk paving work shall be carried out at final procedure in order not to damage by heavy vehicles traffic in case that sidewalk space will use for alternate traffic lane during paving work of opposite traffic lane.
- Surface course shall be placed and compacted long distance as much as possible at a time in order to reduce construction joint.
- All Construction equipments for the Project will be able to procured in Cambodia except for Stabilizer used for cement stabilization of sub-grade and Impact Crusher used in order to reduce flat rate of aggregate of asphalt concrete. Both machines will be procured in Japan.
- All Construction materials for the Project will be able to procured in Cambodia except for thermal insulation paint (in Japan), cast-iron manhole and steel grating (in Thailand).

2.2.4.2 Implementation Conditions

(1) Consideration for road traffic and local residents

In planning of construction method, full attention shall be paid to the local residents, passer and road traffic to secure their safety. The main plans are as follow.

Traffic management plan during construction

Traffic management plan to secure environmental preservation are shown divided into three sections as follow.

- Sta.0+000-Sta.0+250 (Four traffic lane section)
In this section, Chba Ampov market abuts on the road and the traffic congestion along this road is severe every morning and evening, and it is difficult to secure the space for temporary diversion during construction of road. Thus it is planned on night-time work for construction of the road part to take account of influence on the public traffic. The daily working schedule is planned that placing of asphalt binder course will be finish until morning in order that vehicles will be able to pass on the asphalt binder course on every morning.
- Sta.0+250-Sta.1+800 (Four traffic lane section)
The population around this area is therefore rapidly increasing with a consequent expansion of urbanization and a marked increase in the number of motor vehicles. Thus it is planned on night-time work for construction of the road part to take account of influence on the present road traffic. And Drainage work is planned that excavated materials should be removed out of site at once not to disturb public people to pass.
- Sta.1+800-Sta.4+000 (Two traffic lane section)
In this section, since the traffic flow volume is little in comparison with above sections, night-time work is not considered. Road occupation for construction is planned about 300~600m length and Traffic Controller should be backward and forward. And temporary diversion for road traffic should secure a road width of 6m (3m×2line).

Road traffic safety measures

- Japanese safety supervisor is arranged who is responsibility for safety measures.
- As safety measures for the night-time work, Traffic Controller, electronic signboard, safety signboard, safety-fence, LED tube etc are planned to be installed to prevent accident.
- Safety measures for the construction of road are as follow.
 - Installation of safety signboard (before 200m of construction site)
 - Traffic Controller are deployed
 - Installation of concrete safety fence between construction site and public road.

- Regulate max driving speed set 20 km/hr in construction zone and install of sufficient numbers of Speed Limit Signboards for warning.
- Traffic Controllers are deployed at entrance of construction site to control of smooth passage of public traffic and construction equipment.
- Safety education (e.g., ①the car should slow down speed near populated area and school zone ②the car should observance of traffic regulations) should be provided to the drivers.

(2) Environmental Considerations during Construction

- To reduce dust by watering on the dusty roads
- The wastes from construction (e.g., fuels and oils used in the construction equipments) shall be treated and disposed of according to the LAW and guidelines.
- Since the surrounding buildings are old and there is a lot of buildings with disorderly extensions, there is a possibility that the construction activities may affect the buildings even with the little vibration. Therefore proper consultation with the authorities concerned, together with stakeholders and the local community is required prior to the construction. In addition the adoption of low vibration methods shall be considered in the selection of construction equipment and construction methods.

2.2.4.3 Scope of Works

Responsibilities of both Japanese and Cambodia governments are shown on Table 2.2-5.

Table 2.2-5 Responsibilities of Both Governments

Items	Contents	Undertaken by		Remarks
		Japan	Cambodia	
Procurement of materials and equipment	Procurement and delivery	○		
	Tax exemption and customs clearance		○	
	Maintenance/improvement of delivery route		○	
Preparation work	Leasing temporary work areas	○		For camp, work yards
	Land acquisition and Resettlement		○	
	Other preparation work	○		
Relocation and / or removal of Public Utilities	Removal of obstructions on the road		○	Electrical pole, cable, Signboard, Road sign etc
	Removal of Underground utilities		○	Water pipe, optic cable etc
Construction works		○		

2.2.4.4 Construction Supervision Plan

A Japanese consultant will carry out the detailed design, assistance in tendering and construction supervision in accordance with the contract between the MPWT and the consultant.

(1) Detailed Design

Major works in the detailed design to be carried out by the consultant are as follows:

- Commencement meeting with the executing agency of the Government of Cambodia and site survey
- Detailed design and preparation of drawings
- Procurement plan (construction material and equipment) and cost estimate

The necessary time for the detailed design is estimated 2 months

(2) Assistance in Tendering

Major items of the services in the assistance in tendering are as follows:

- Preparation of tender documents (conducted simultaneously with the detailed design)
- Tender publication
- Pre-qualification
- Assistance in tendering
- Tender evaluation
- Contract facilitation

The necessary time for the assistance in tendering is 4 months

(3) Construction Supervision

The Consultant will carry out the supervision of the construction works executed by the contractor. Major items of the construction supervision are as follows:

- Inspection and approval of site survey
- Inspection and approval of construction plan
- Quality control
- Progress control
- Measurement of work
- Inspection of safety aspects
- Final inspection and hand-over

The necessary construction supervision periods are 12 months

2.2.4.5 Quality Control Plan

Quality control plan for concrete work are shown on Table 2.2-6, and quality control plan for earthwork and pavement work are shown on Table 2.2-7.

Table 2.2-6 Quality Control Plan for Concrete Work

Item	Test	Test Method (Specification)	Frequency of Test
Cement	Physical property test	JIS R 5201~3	Once before trial mix or when the material brand is changed.
Fine aggregate	Physical property test	JIS A 1103、1109 etc.	Once before trial mix or when supplying place is changed.
	Sieve analysis	JIS A 1102	Once before trial mix or when supplying place is changed.
Coarse aggregate	Physical property test	JIS A 1110, 1121 etc.	Once before trial mix or when supplying place is changed.
	Sieve analysis	JIS A 1102	Once before trial mix or when supplying place is changed.
Water	Quality tes	JSCE-B101	Once before trial mix or when supplying place is changed.
Concrete	Slump test	JIS A 1101	Once every 50m ³ for each category
	Moisture content test for sand	JIS A 1111	Once a day
	Compressive strength test	JIS A 1108	6 specimens per 100 m ³ in each category (3 specimens for 7 days strength test and 3 specimens for 28 days strength test)

Table 2.2-7 Quality Control Plan for Earthwork and Pavement Work

Item	Test	Test Method (Specification)	Frequency of Test
Embankment	Density test (compaction test)	JIS A 1214	Once in every 5,000m ³ (once every 500 m ³ in sub-grade)
Base course / Sub-base course	Sieve analysis	JIS A 1102	Once before placement or when supplying place is changed.
	CBR	Hosou-shikenhou 2-3-1	Once before placement or when supplying place is changed.
	Site density test (compaction test)	Hosou-shikenhou 2-5-3	Once every 1,000 m ²
Asphalt pavement	Temperature of asphalt mixture		Every truck
	Los Angels abrasion test	Hosou-shikenhou	Once every 1,500m ² or when the material source is changed

2.2.4.6 Procurement Plan

(1) Construction Materials

Procurement plan of the major materials is shown in Table 2.2-8.

Construction materials necessary for the Project are mostly available in Cambodia.

Table 2.2-8 Material Procurement Plan

Item	Country origin			Remarks
	Cambodia	Japan	Third Country	
<u>Construction Materials</u>				
Boulder (for Gavion)	○			47km away from Monivong Bridge
Base course	○			47km away from Monivong Bridge
Sub-base course	○			47km away from Monivong Bridge
River sand	○			Mekong river (Sta-2km point)
Embankment Material	○			Sta-25km + 3~4km
Cement (soil improvement)	○			Phnom penh
Asphalt concrete	○			10km away from Monivong Bridge
Reinforcing bar	○			Local Procurement (import from Thai)
Steel round bar	○			Local Procurement (import from Thai)
Diesel	○			Phnom Penh
Gasoline	○			Phnom Penh
Prime coat, Tack coat	○			Phnom Penh
Geotextile sheet	○			Phnom Penh
Mix Concrete	○			Phnom Penh
Curb stone	○			Phnom Penh
Cast iron manhole cover			○	Thailand
Traffic signal			○	Thailand
Street light	○			Local (import from Vietnam)
Concrete pipe	○			Site fabrication
Thermal insulation paint		○		Japan
<u>Temporary Materials</u>				
Timber	○			Phnom Penh
Plywood	○			Phnom Penh
Welding rod	○			Phnom Penh
Oxyacetylene gas	○			Phnom Penh

(2) Construction equipment

Construction equipments necessary for the Project are mostly available from local contractors. Since there are some lease companies, prices are approximately expensive compared with contractors one.

Stabilizer used for cement stabilization of sub-grade and Impact Crusher used in order to reduce flat rate of aggregate of asphalt concrete, both machines will be procured in Japan.

Table 2.2-9 Procurement Plan of Major Equipment

Item	Type	Lease/ Purchase	Country			Transportation route
			Local	Third Country	Japan	
Backhoe	0.28m ³	lease	○			
Backhoe	0.5m ³	lease	○			
Backhoe	0.8m ³	lease	○			
Bulldozer	3t	lease	○			
Bulldozer	15t	lease	○			
Bulldozer	21t	lease	○			
Motor grader	3.1m	lease	○			
Road roller	10~12t	lease	○			
Tire roller	8-20t	lease	○			
Vibratory roller	0.8~1.1t	lease	○			
Vibratory roller	3~4t	lease	○			
Vibratory roller	15~18t	lease	○			
Road Stabilizer	2.0m	purchase			○	Yokohama~ Sihanoukville~Site
Water sprinkler truck	6m ³	lease	○			
Dump truck	10t	lease	○			
Asphalt Finisher		lease	○			
Asphalt Distributor		lease	○			
Truck	2t, 4t	lease	○			
Impact Crusher	53t/h	purchase			○	Yokohama~ Sihanoukville~Site
Wheel Crane	20t	lease	○			
Truck Crane	2.9t,4t	lease	○			
Trailer	20~40t	lease	○			

2.2.4.7 Implementation Schedule

The implementation schedule of the Project is shown on Table 2.2-10.

Table 2.2-10 Implementation Schedule

Item		Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Detail design stage	Detail design	Site survey	■	(Total 0.33months)														
		Design, Cost estimate	■			(Total 1.67months)												
		Tendering service	■					(Total 4.0months)										

Item		Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Implementation stage	STA0km-1+800	Preparation	■															
		Road earthworks		■				Excavation, Replacement, Embankment										
		Slope protection work				■		Subgrade, Cement stabilization										
		Paving work					■				Sub-base course		Base course, Binder course					
													■		Surface course			
		Drainage work				■												
	STA1+800-4km	Road earthworks		■				Excavation, Replacement, Embankment										
		Slope protection work				■		Subgrade, Cement stabilization										
		Paving work				■				Sub-base course		Base course		Binder & Surface course				
		Drainage work						■										
		Roadside facility											■					
	Temporary work							■						■				
	Site clearing														■			(Total 12.0months)

2.3 Obligations of the Royal Government of Cambodia

The following measures should be undertaken by the Royal Government of Cambodia on condition that the Grant Aid by the Government of Japan is extended to the Project.

- To provide data and information necessary for the Project.
- To relocate existing utilities such as power poles, power cable, optical cable and water pipes, etc.
- To manage the other projects harmoniously related to this project such as water supply project of “Niroth Production Facilities” etc.
- To bear commissions to the bank in Japan for its banking services based upon the Banking Arrangement, namely the advising commission of the “Authorization to Pay” and payment

commission.

- To ensure prompt unloading, tax exemption, customs clearance at the port of disembarkation in Cambodia and prompt internal transportation of the materials and equipment for the Project.
- To exempt Japanese nationals engaged in the Project from customs duties, internal taxes and other fiscal levies, which may be imposed in Cambodia with respect to the supply of the products and services under the verified contracts.
- To accord Japanese nationals, whose services may be required in connection with the supply of the products and the services under the verified contract, such facilities as may be necessary for their entry into Cambodia and stay therein for the performance of their work.
- To provide necessary permission, licenses and other authorizations for implementing the Project.
- To maintain and use properly and effectively the facilities constructed under the Project.
- To coordinate and solve any issues related to the Project which may be raised from third parties or inhabitants in the Project area during implementation of the Project.
- To bear all the expenses, other than those covered by the Japan's Grant Aid, necessary for the Project.

The Royal Government of Cambodia should execute the resettlement of the Project affected people (PAPs) including the followings.

- Agreement on compensation consent from PAPs;
- Confirmation to budgetary arrangement for resettlement compensation
- Compensation payment to PAPs; and
- Rehabilitation of life on PAPs

2.4 Project Operation Plan

(1) Operation and Maintenance System

Maintenance of the Project road after completion will be undertaken by MPWT and Departments of Public Works and Transport of the Municipality/Provinces and those obliged to maintain the Project road. The demarcation of maintaining the Project road is as follows:

Sta.0+000 - Sta.3+300	:	Phnom Penh Municipality
Sta.3+300 - Sta.4+000	:	Kandal Province

Jurisdictionally, Departments of Public Works and Transport of Municipality/Provinces belong to both MPWT and Municipal/Provincial governments. Demarcation of tasks related to maintenance of roads between the Municipal/Provincial Departments and the MPWT is as follows:

- Daily maintenance works such as cleaning of road surface ditch and culverts, slope

vegetation management, maintenance of lighting, etc. are executed by the Municipal/Provincial Departments using the maintenance budgets of Municipal/Provincial governments.

- Repair/rehabilitation works such as crack sealing and pothole patching of pavement, repair of bridge revetment and riverbed protection, etc. are executed by the Municipal/Provincial Departments in some cases and by the MPWT in other cases.

In the former case, the necessary budget for specific tasks is requested to the MPWT and the work is executed using the budget when approved. The inspection to assess the necessity of the works, decide the scope of works and estimate the budget is usually conducted jointly with the MPWT and the Ministry of Economy and Finance.

In the latter case, the Maintenance Management Office set up in the General Directorate of Public Works is in charge.

(2) Maintenance Works to be Done

Necessary maintenance works for the Project road are as follows:

- Daily Maintenance : Routine inspection, cleaning of road / side walk / ditch/culverts, maintenance of slope planting, and maintenance of lighting, etc.
- Repair/Rehabilitation : Sealing of pavement crack, repair of pothole, repair of guidepost, repair of wet masonry / gabion, repair of slope damage and repair of older damages, etc.

The daily maintenance and the repair will be done by the Municipal/Provincial Departments of Public Works and Transport and by the MPWT respectively.

Although the road and drainages to be improved/constructed in this Project have high durability and weather resistance, the repair works of gabion structures at the drainage outlet may possibly be necessary after the floods. Since the repair works of gabion structures have been carried out frequently in Cambodia, no technical difficulty is expected in executing those repair works. Extensive repairs will not be required for a fairly long time for other structures. No technical difficulty is expected in executing daily maintenance works as well. It is considered possible for the road to be properly operated and maintained under the present system.

2.5 Project Cost Estimation

2.5.1 Initial Cost Estimation

The total project cost necessary to implement this Project is estimated at 16.61 Million Yen. The costs to be borne by both governments, Japan and Cambodia based on the scope of works for both

governments as previously stated and respective details are estimated as follows on the conditions shown in (3) below.

This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.

(1) Cost Borne by the Government of Japan

Total Cost approximately 1,290 Million Yen

Improvement of National Road No.1, (Phnom Penh – Neak Loueng Section Sta.0+000~ Sta.4+000) 4km long.

Table 2.5-1 Cost Borne by the Government of Japan

Item		Roughly Estimated Cost (Million Yen)		
Facility	Road way	Earth Work	363	1,237
		Pavement	548	
		Drainage	245	
		Ancillary Facilities	81	
Detailed Design /Construction & Supervision		53		
Total		1,290		

(2) Cost Borne by the Government of Cambodia

Total Cost approximately 3,807 Thousand US\$ (equivalent to 371 Million Yen)

Table 2.5-2 Cost Borne by the Government of Cambodia

Item	Roughly Estimated Cost	
	US\$ in Thousand	Equivalent JPN Yen in Million
Bank Charge	6.7	0.7
Compensation to PAPs	3,000.0	292.6
Relocation of Power Line	120.0	11.7
Relocation of Fiber Optical Cable	50.0	4.9
Relocation of Water Pipe	630.0	61.5
Total	3,806.7	371.3

(3) Conditions in Cost Estimate

- Time of Cost Estimate : March 2009
- Exchange Rate : 1US Dollar = 97.54 Yen
- Construction Period : as shown in the Implementation Schedule
- Others : This Project is implemented in accordance with the system of Japan's Grant Aid.

2.5.2 Maintenance Cost Estimation

The annual costs of the maintenance works are roughly estimated at US\$ 55,000 as detailed in Table 2.5-3.

When the Project is completed, both routine inspection and daily maintenance work are undertaken by the Department of Public Works and Transport those belong to Municipality and Province. And repair and rehabilitation are undertaken by MPWT.

Table 2.5-3 Maintenance Plan and Cost Estimate

1. Routine Inspection (Undertaken by the Departments of Public Works and Transport of Municipality/Province : per 56 km)

Facility	Inspection Item	Frequency	Number of Staff	Equipment	Quantity	Cost (US\$/year)
Road		12 times a year (4 days/time)	2 persons	scoop, hammer, sickle, barricade, pick-up truck	Worker: 96 man-day /year	960
Pavement	crack, deformation, pothole, etc.					
Sholder/slope	erosion, collapse, etc.					
Pavement marking	injury, deformation, stain, splitting					
Guide post	damage					
Revetment	crack, damage, collapse, etc.				Pick-up: 48 veh-day /year	2,880
Drainage	sedimentation of soils, obstacle					
Bridge						
Pavement	crack, deformation, pothole, etc.					
Drainage	existence of soil, obstacles					
Pavement marking	injury, deformation, stain, splitting					
Structure	damage on bridge surface/ abutment/ pier					
Revetment/ Riverbed protection	crack, damage, collapse, etc.					
Ancillary facilities	damage of lighting, apparatus to attach utilities, handrail etc.					
Culvert						
Structure	displacement, damage					
Revetment/ Riverbed protection	crack, damage, collapse, etc.					
					Subtotal (56km)	3,840
					per 4 km	274

2. Daily maintenance work (Undertaken by the Departments of Public Works and Transport of Municipality/Province)

Facility	Work Item	Frequency /	Unit	Quantity	Unit Cost	Amount
Facility	Fertilizer, trimming	1 time / year	m ²	4,500	0.54	2,430
Center medium grassing	trimming	1 time / year	m ²	4,682	0.65	3,043
Side walk + Shoulder/slope	cleaning, cutting grass	2 times / year	m ²	38,458	0.05	1,923
street lighting	Electric Consumption	49 end × 0.4 × 365 days × 8hr	kwh	57,232	0.17	9,729
					Subtotal (4km)	17,125

3. Repair/Rehabilitation (Undertaken by the MPWT)

Facility	Work Item	Frequency /	Unit	Quantity	Unit Cost	Amount
Side Ditch	cleaning, repair of damage	1 time / 2years	m	4,360	3.00	13,080
Drainage Pipe	cleaning, repair of damage	1 time / 2years	m	3,918	4.64	18,180
Pavement (Potholes)	patching	1 time / years (Asphalt Concrete)	t	38,458	0.05	1,923
Pavement marking	re-marking	10% of the Total Q'ty / year	m ²	270	16.30	4,401
					Subtotal (4km)	37,584
Total						54,983

The total budgets appropriated for the road maintenance by office in charge in the last three years are shown in Table 2.5-4.

Table 2.5-4 Total Maintenance Budgets in the Last Three Years

(Unit : US\$)

Year		2006	2007	2008
MPWT		14,902,700	22,149,500	22,101,800
Municipality and Province	DPWT of Phnom Penh	2,004,800	1,181,300	1,831,600
	DPWT of Kandal Province	93,400	642,400	588,400
	Total of Municipality and Province	2,098,200	1,823,700	2,420,000

Sources: Each general affairs department of MPWT, Phnom Penh Municipality and Kandal Province

The required costs for the routine inspection and daily maintenance of the Project road are 17,399 US\$/yr accounting for about 0.7~1.0% of the total budgets of the two (2) concerned Municipal/Provincial DPWTs in 2006~2008, appropriated for the road maintenance and the required costs for repair works of the Project road is 37,584 US\$/yr accounting for about 0.2%~0.3% of the budget of the MPWT for the road maintenance in 2006~2008. No financial problem in budgets is expected.

2.6 Other Relevant Issues

To implement the Project efficiently, the following matters should be considered;

(1) Resettlement

Resettlement of this Project during Stage-1 and Stage-2 sections (around 45km length) have been well executed by IRC to do sharing information with Japanese side according to JICA Guidelines. Based on this, the following actions should be kept executing timely by IRC.

- to make up the Resettlement Action Plan timely and to succeed its following-up
- to fully explain the RAPs on the compensation unit price/timing/payment method and etc.
- practical enforcement of the function by the Grievance Committee.

(2) Relocation/Removal of the existing Public Utilities

To implement this Project, the relocation/removal of the existing Public Utilities is quite necessary, therefore the relocation plan shall be established properly and the necessary funds shall be acquired by the Regencies.

The result of testing pits for Public Utilities done in 2007 showed in Appendix-7.2 Plan of

Public Utilities that can be utilized for establishing the relocation plan and the scope of works and rough quantities are described in Chapter 3.3.

The location of Public Utilities to be relocated shall be basically near the shoulder far from the road center in order to maintain them easily.

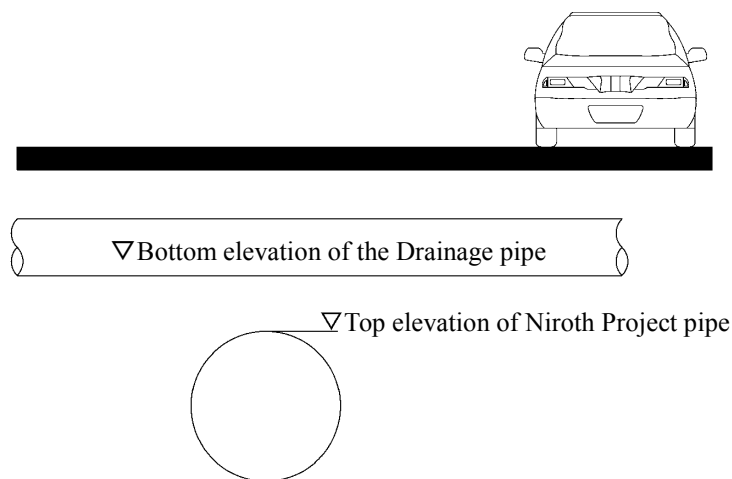
(3) Niroth Production Facilities-Phase 1 Project (Niroth Project)

The installation of the large diameter water supply pipe (D1,600mm) is now planned (refer to Appendix 7.3), called as Niroth Project and will be tendered in near future by Phnom Penh Water Supply Authority (PPWSA) to be layed under/along the National Road No.1, and that Contract would be Design-Built type.

The large diameter water supply pipe of Niroth Project shall be installed enough underneath of the drainage pipe of this Project and should be clearly mentioned in their Tender Condition at the following crossing points of the both Project, refer to Table 2.6-1.

Table 2.6-1 Elevation of the Pipe at the crossing location of the both Projects

No	Sta.	Bottom elevation of the Drainage pipe (m)	Top elevation of Niroth Project pipe (m)
1	0+120	8.65	8.07
2	1+097	8.27	7.67
3	2+580	9.12	8.52



Chapter 3 Project Evaluation and Recommendations

3.1 Project Effect

The purpose of the Project is to improve a section of the National Road No.1, which is about 56.0km stretch from Phnom Penh to Neak Loueng. The damaged and deteriorated road pavement and embankment are observed along the road and become serious problems for smooth and safe traffic flow.

The Project is to be implemented to restore the function and capacity of the National Road No.1 as an international traffic artery in Cambodia by widening the road and replacing temporary bridges, which are considered as the causes for the problems.

The direct beneficiaries by the implementation of the Project are the residents of 1.33 million in Phnom Penh and 1.26 million in Kandal Province where the Project is located. The indirect beneficiaries are entire population of 13.39 million in Cambodia. (Figures from the census 2008)

The direct and indirect positive effects by the Project implementation are described below in Table 3.1-1, and Table 3.1-2. The negative effects are described in the Table 3.1-3 and Table 3.1-4.

Table 3.1-1 Direct Positive Effects by Implementation of the Project

Present Conditions and Issues	Counter Measures to be planned in the Project	Effect and its Extent by the Project Implementation
<p>1. Function as Arterial National Road</p> <ul style="list-style-type: none"> - Narrow road width; - Congestion with vehicles and motorcycles being mixed together; - Bridges with one lane; <p>The above are causing low efficiency of traffic flow, and congestion, which are significantly disturbing the function of road as a trunk road.</p>	<p>Widening of the road width by separating vehicle lane and motorbike lane, and replace or new construction of bridges.</p> <ul style="list-style-type: none"> - 4-lane section: 1.8 km (Starting - Sta. 1+800) - 2-lane section: 54.18 km (Sta. 1+800 - Ending) - Bridge replacement/construction: 3 nos. 	<ul style="list-style-type: none"> - To achieve functions of the National Road such as improvement of traffic capacity, reduction of travel time, upgrading of traveling performance and traffic safety. - To improve functions of the National Road
<p>2. Function as Lifeline</p> <p>As for market areas, bus stop/emergency evacuation space, and schools/hospitals, inconveniences to the people are caused by the following issues.</p> <ul style="list-style-type: none"> - Absence of roadside service facilities - A lack of parking space and sidewalk 	<p>Installation of the roadside service facilities at such places as</p> <ul style="list-style-type: none"> - Small-scale market area: 3 nos. - Bus stop: 20 nos. - School/hospital area: 40 nos. <p>for the conveniences of the people especially, people from rural community or villages.</p>	<ul style="list-style-type: none"> - Mitigating traffic congestion enhances activities in the market places and provides safety evacuation space for livestock along the road at the time of flood and safety traffic environment to the people around school and hospital areas.
<p>3. Travel Time</p> <ul style="list-style-type: none"> - Average traveling speed is 30 km/h from Phnom Penh to Neak Loueng for 56 km distance. - Travel time is 1.5 hours 	<ul style="list-style-type: none"> - Construction of economical and durable road structure and pavement providing high travel performance. 	<ul style="list-style-type: none"> - Vehicle travel speed becomes 80kph except in congested areas. - Travel time can be shortened up to 45 - 50 minutes.

Present Conditions and Issues	Counter Measures to be planned in the Project	Effect and its Extent by the Project Implementation
<p>4. Heavy Cargo Traffic</p> <p>Two bridges to be replaced are temporary Bailey bridges with one lane and limited vehicle loads of 15 tons.</p>	<ul style="list-style-type: none"> - Construction of new bridges with upgraded design active loads of HS20-44. 	<ul style="list-style-type: none"> - Bridges become more capable for heavy cargoes to pass through and provide efficiency of cargo service.
<p>5. Flood Countermeasures</p> <p>(1) Water level of the Mekong River and opening facilities on the NR No.1</p> <ul style="list-style-type: none"> - There were two (2) pipe culverts and two (2) box culverts before the year 2000 flood. However, one (1) pipe culvert and one (1) box culvert among these four culverts were nonfunctional. - Two (2) openings were excavated when Phnom Penh municipality were in danger of flooding with water level of 10.16m at its peak. Two Bailey bridge were built afterward at the both places. - Flood countermeasures are still insufficient due to poor water conveyance even after additional four (4) box culverts were installed. <p>(2) Road Elevation</p> <p>The difference between the present road surface elevation and flood level in 2000 is only 30 cm on average. Consequently, overflow on the road occurred at three (3) places (total length: 1.1 km) in the year 2000 flood.</p> <p>(3) Slope Damages</p> <p>At the time of flood, damages on bank slopes occurred frequently by the flow especially at road curves, bridge areas and around flow colliding slopes.</p> <p>(4) Refuge Space</p> <p>Residents evacuating on the road at the time of flood deteriorate functions of the road.</p>	<p>Construction of additional openings.</p> <ul style="list-style-type: none"> - New construction of one bridge - Replacement of two (2) bridges - New construction of six (6) box culverts; and - New construction of two (2) pipe culverts. <p>Raising the road surface elevation by 70 cm on average</p> <ul style="list-style-type: none"> - Retentions for slope protection to mitigate the negative effect of water flow are constructed at areas where damages are likely to occur. - Widening of road shoulder for refuge space at twenty five (25) bus stops 	<ul style="list-style-type: none"> - Reduces the flood risk by lowering the water level of about 11 cm in the Mekong River near the Phnom Penh Municipality. <p>No overflow occurs in the event of flood;</p> <ul style="list-style-type: none"> - Enhance travel safety; and - Improve the durability of road structures. <ul style="list-style-type: none"> - Maintain stable embankment of the road by revetment works for slope protection. - At the time of flood, maximum of 3,000 residents can be accommodated at refuge spaces.
<p>6. Drainage Facilities</p> <p>No rainwater drainage facilities within urban areas such as Chbar Ampov, Kokir Market, and Neal Loueng.</p> <ul style="list-style-type: none"> - Inundated road pavement due to rainwater is causing degradation of traffic function and limiting of traffic safety. 	<p>Installation of road drainage facilities as follows:</p> <ul style="list-style-type: none"> - U-shaped side ditch: L=6,641m - Drainage pipe: L=5,122m 	<ul style="list-style-type: none"> - Secure smooth traffic flow and improve traffic safety by installing road drainage facilities.

Present Conditions and Issues	Counter Measures to be planned in the Project	Effect and its Extent by the Project Implementation
<p>7. Traffic Safety Road width is almost 6.5m on average. - Mixed traffic of vehicles with motorcycles causes high occurrences of traffic accident.</p>	<p>Improvement of traffic safety by separating traffic lanes for vehicles and motorbikes and installing following traffic safety facilities.</p> <ul style="list-style-type: none"> - Road marking: centerline, lane, sideline, pedestrian crossing - Traffic sign: regulatory signs (speed limit), warning signs (sharp curve, school), guide signs - Guardrails/guideposts: at bridges and culverts, embankments with height more than 5 m. 	<ul style="list-style-type: none"> - Expect reduction of traffic accidents by separating traffic lanes for vehicles and motorbikes. - Achieve traffic safety to cope with growing demand of traffic volume and high-speed vehicles by installing of various traffic safety facilities.

Table 3.1-2 Indirect Positive Effects by Implementation of the Project

Present conditions and Issues	Counter Measure under the Project	Effect and its Degree of the Project Improvement
<p>1. Smooth Flow of Goods and Peoples Narrow road width and easily damaged road structure by flood deteriorate functions of the national trunk road and limit the smooth flow of goods and people.</p>	<p>Upgrading the road structures and improve functions of the national trunk roads.</p>	<p>Improvement of functions of national trunk road</p> <ul style="list-style-type: none"> - reduces transportation time and cost encouraging the exchange of goods and people.
<p>2. Socio-Economic Activities Socio-Economic activities are not activated enough due to inadequate distribution of goods and people.</p>	<p>Improvement of functions as the national trunk road and the lifeline for communities.</p>	<p>Promote socio-economic activities as a result of increased exchange of goods and people.</p>
<p>3. Upgrade of Living Standards of residents along the Road High transport cost of agricultural products due to long transport time and poor access to schools/hospitals and urban facilities.</p>	<ul style="list-style-type: none"> - Improvement of travel performance and traffic capacity. - Installation of roadside service facilities 	<p>Upgraded living standard of the residents along the road as a result of;</p> <ul style="list-style-type: none"> - Improved transport performance of agricultural product. - Improved access to schools, hospitals and urban facilities encouraging school attendance of children along the road.

Table 3.1-3 Direct Negative Effects by Implementation of the Project

Issues	Counter Measures (Counter Measures taken by the Project and others)
<p>1. Increase in Traffic Accident NR1 has functions as life road for residents along the road. Traffic accident may increase due to high speed driving after the improvement work.</p>	<ul style="list-style-type: none"> - Enlighten all road users about traffic safety consciousness and knowledge by holding traffic safety education to pupils, students and residents. - Promoting driving moral through safety campaign and effective control of speedy driving.
<p>2. Effect by New Opening Water flows into Colmatage side through new openings may cause erosion of agricultural land or residential area and moreover, possible effect on fauna and flora in the area.</p>	<p>I.R.C compensates for damages upon confirmation by PAPs and Ministry of Water Resources and Meteorology. Due to difficult assessment of the effect on ecosystem, the Environmental Baseline Survey was conducted in March 2005, and the Follow up Survey will be conducted further to confirm the effect.</p>
<p>3. Overloaded Vehicle Improvement of functions of the road as a national trunk road may enhance increasing traffic volume as well as overloaded vehicles, which result in damage to the road structure and more traffic accidents.</p>	<p>Truck scales are provided in the Project. Cambodian side shall enforce the control of overloaded vehicles by utilizing the facility to prevent road damages and traffic accidents.</p>

Table 3.1-4 Indirect Negative Effects by Implementation of the Project

Issues	Counter Measures (Counter Measures under/over and above the Project)
<p>1. Increase of HIV/AIDS Improved road activates the human interchange, which may spread the infection of HIV/AIDS.</p>	<p>To enlighten all Project employees about fundamental knowledge and preventive measures of HIV/AIDS through safety meetings during the construction stage.</p>

3.2 Recommendations

The Government of Cambodia is expected to fulfill the following items, issues and recommendations, in order to execute the project satisfactorily and maintain the positive effects of the Project:

(1) Issues

- As for agreements related to involuntary resettlement, Cambodian side should proceed with appropriate procedures based on the schedule and present necessary reports to Japanese side as agreed.
- For proper road maintenance, periodic inspections and repair works are particularly essential for items such as road pavement, unnecessary deposit and debris in drainage system, revetment and riverbed protection and vegetation on embankment slope in order to achieve high traveling performance and maximize durability of road structures. It is also important to secure the sufficient budget for road maintenance, which is approximately US\$ 55,000.00/year as described in paragraph 2-5-2. And Cambodian

government is considered capable to allocate the amount for the maintenance work.

- With regard to the water flowing into the Calmatage side through additional openings i.e. bridges and culverts, the close attention should be paid to its negative effects that may occur on residents and natural environment in the area.

Particularly for the area where no water channel exists, careful observation is required for possible scouring on farmland or inhabited area due to the effect of water flow. It is also important to conduct a close monitoring during rainy season and establish a warning system including an information network among residents for immediate countermeasures when any negative effect is observed.

- As a result of the road improvement, it is predicted that high speed traffic will be realized . In order to achieve traffic safety, various safety educations enlightening the people on safety regulations, traffic moral and traffic manner are essential. Furthermore, it is also recommended to conduct periodically traffic safety campaigns for the people.
- It is indispensable to confirm whether PAPs, the socially vulnerable involved in the resettlements issues, have recovered their livelihoods and already been integrated in the society. In addition, it is recommended to help the people to make their better living by hiring them in the road construction and even such jobs such as road cleaning work, traffic control guide around school, hospital area after the construction.
- It is recommended that Cambodian side shall utilize the results of Environmental Baseline Survey conducted in March 2005, and implement monitoring works properly after completion of the Project.
- Currently, the traffic around the intersection on Phnom Penh side of the Monivong Bridge is severely congested, which requires immediate improvement of the intersection upon completion of on going construction of the Second Monivong Bridge. Moreover, improvement of connecting roads with National Road No.1 is inevitable in order to maximize effects to be brought by the Project.

(2) Recommendation

In order to maximize effects of the Project and its sustainability through implementation of sufficient maintenance work and necessary measures for traffic safety, Technical Assistance Program for system formulation and establishment of guidelines for maintenance work and traffic safety is recommended for implementation.

APPENDICES

1. Member List of the Study Team
2. Study Schedule
3. List of Parties Concerned in Cambodia
4. Minutes of Discussions
5. List of Collected Data
6. Basic Drawings
7. Technical Data
 - 7.1 Calculation of Discharge of Road Drainage
 - 7.2 Plan of Public Utilities
 - 7.3 Plan of Niroth Production Facilities – Phase 1 Project

Appendix 1 Member List of the Study Team

No.	Name	Job Title	Affiliation
1	Mr. TAKEUCHI Hiroshi	Team Leader	Director Transport and ICT Division 1, Economic Infrastructure Department, JICA
2	Mr. NAKAYA Hiroaki	Cooperation Planning	Deputy Director Grant Aid and Technical Cooperation Division, International Cooperation Bureau, Ministry of Foreign Affairs
3	Mr. IMAI Ken	Administration Environmental and Social Considerations for NR1	Assistant Director Project Management Division, Grant Aid and Loan Support Department, JICA
4	Mr. MIYAZAKI Akihiro	Administration Environmental and Social Considerations	Assistant Director Environmental and Social Considerations Review Division, Office for Environmental and Social Considerations Review and Credit Risk Analysis, JICA
5	Mr. SAKABE Hidetaka	Project Coordination	Assistant Director Transport and ICT Division 3, Economic Infrastructure Department, Project Study Division, JICA
6	Mr. HIRAOKA Kazuyuki	Chief Consultant Road Planning	Katahira & Engineers International
7	Mr. OSHITA Soemu	Deputy Chief Consultant Road Design	- ditto-
8	Mr. MORITA Shuichi	Environmental and Social Considerations / Topographic Survey	- ditto-
9	Mr. YOSHIOKA Shunsaku	Construction Planning / Cost Estimation	- ditto-
10	Mr. TAMAKI Ryuichi	Cost Estimation (assignment in Japan)	- ditto-
11	Mr. OKAMOTO Yoichi	Cost Estimation	- ditto-

Appendix 2 Study Schedule

No. of Day	Date	Official						Consultant				
		Takeuchi (Team Leader)	Nakaya	Imai	Miyazaki	Sakabe	Hiraoka (Chief Consul)	Morita	Oshita	Yoshioka	Okamoto	
1	22-Feb-09(Sun)	Engaging in other mission	Internal meeting		Arriving at PNP	Internal meeting	Arriving at PNP	Preparation in PNP	Arriving at PNP	Arriving at PNP		
2	23-Feb-09(Mon)	Engaging in other mission	Engaging in other mission	Arriving at PNP	Engaging in other mission	Engaging in other mission	Preparation for the Survey					
3	24-Feb-09(Tue)	Engaging in Other mission					Discussion with MPWT Site Visit, Report to EOJ					Arriving at PNP
4	25-Feb-09(Wed)						AM : Joint Discussion with MPWT, IRC, MPP, EDC, TC and PPWSA PM : Discussion on M/D					Field Survey
5	26-Feb-09(Thu)						Signing of M/D, Report to JICA Leaving PNP					Field Survey
6	27-Feb-09(Fri)					Arriving at NRT						Field Survey
7	28-Feb-09(Sat)											Field Survey
8	1-Mar-09(Sun)											Field Survey
9	2-Mar-09(Mon)											Field Survey
10	3-Mar-09(Tue)											Field Survey
11	4-Mar-09(Wed)											Report to MPWT and JICA Leaving PNP
12	5-Mar-09(Thu)											Arriving at NRT

Appendix 3 List of Parties Concerned in Cambodia

MPWT (Ministry of Public Works and Transport)

Mr. Tauh Chankosal	Secretary of State
Mr. Kem Borey	Director General, Directorate of MPWT
Mr. Chhim Phalla	Inspector, General Department of Inspectorate, MPWT
Mr. Tsuyoshi Kubota	JICA Adviser to MPWT, Road Management
Dr. Yit Bunna.	Director Public Work Research Center
Mr. Chhim Phalla.	PIU NR1

IRC (Inter-Ministerial Resettlement Committee)

Mr. Nhean Leng	Chairman, Under Secretary, MEF
Mr. Sim Samnang	Deputy Chief, Resettlement Department, MEF
Mr. Hiv Panhavuth	Chief of Administration and Finance, Resettlement Department, MEF
Mr. Pich Socheate	Deputy Chief of Bilateral, Resettlement Department, MEF

PPWSA (Phnom Penh Water Supply Authority)

Mr. Long Naro	Deputy General Director, PPWSA
Mr. Tuy Bunsereyryth	Deputy Chief of Technical Officer, PPWSA

MPP (Municipality of Phnom Penh)

Mr. Sam Piseth	Deputy Director of General Affairs, MPP
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EDC (Electricite du Cambodge)

Mr. Iv Visal	Director, Distribution Department, EDC
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Telecom Cambodia

Mr. Hun Pros	Deputy Director of ICT Department, EDC
Mr. Po An	Deputy Director of ICT Department, EDC

Camintel

Mr. Chea Samnang	Operation Manager, Camintel
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SAFEGE

Mr. Dahan Stephane	Team Leader, SAFEGE
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SINO-PACIFIC CONSTRUCTION CONSULTANCY CORPORATION

Mr. Lai Long Zhao	Project Manager, 2nd Monivong Bridge Project
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Embassy of Japan in Cambodia

Mr. Junichi Hoshikura

Second Secretary, Embassy of Japan

JICA Office in Cambodia

Mr. Kazuhiro Yoneda

Resident Representative, JICA Cambodia

Mr. Shingo Morihata

Assistant Resident Representative, JICA Cambodia

Mr. Akira Yamashita

Project Formulation Advisor, JICA Cambodia

Ms. Mayuko Shimakage

Project Formulation Staff, JICA Cambodia

Mr. Seak Pengkeang

Program Officer, Infrastructure Division, JICA Cambodia

Appendix 4 Minutes of Discussions

**Minutes of Discussions
on the Preparatory Survey
on the Project for the Improvement of National Road No. 1
(Phnom Penh – Neak Loeng Section)
in the Kingdom of Cambodia**

Based on the results of the Basic Design Study and the Implementation Review Study, the Government of Japan decided to conduct a Preparatory Survey on the project for the Improvement of National Road No. 1 (Phnom Penh - Neak Loeng Section) (hereinafter referred to as "the Project") and entrusted the survey to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

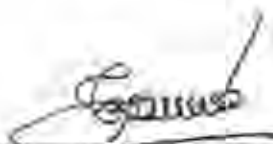
JICA sent to Cambodia the Preparatory Survey Team (hereinafter referred to as "the Team"), headed by Mr. Hiroshi Takeuchi, Director for Transport and ICT Division 1, Economic Infrastructure Department, JICA, which is scheduled to stay in Cambodia from February 22 to March 6, 2009.

The Team held discussions with the concerned officials of the Royal Government of Cambodia. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

Phnom Penh, February 28, 2009



Hiroshi Takeuchi
Leader
Preparatory Survey Team
Japan International Cooperation Agency



H.E. Tram Iv Tek
Minister
Ministry of Public Works and Transport
Royal Government of Cambodia



H.E. Nhean Leng
Under Secretary of State
Ministry of Economy and Finance
Royal Government of Cambodia

ATTACHMENT

1. Purpose of the Preparatory Survey

- (1) To confirm the current condition of the section between starting point and Sta 4+000.
- (2) To discuss with the Cambodian side, conduct the site survey and collect the necessary data and information necessary to review the Basic Design Study and the Implementation Review Study.

2. Design of the Road

- (1) The Cambodian side explained that the Provisional Road Width (PRW) on the section from the starting point to Sta. 1+900 is 20m from the road center line in both sides, which was informed by the Note Verbal dated on October 31, 2008 from the Royal Government of Cambodia to the Japanese Embassy in Phnom Penh.
- (2) Both sides confirmed that the design of the road made in the Basic Design Study Report would be reviewed in line with the above-mentioned PRW.
- (3) The Team explained that retaining wall would be remained at some parts of the road in Stage-4, even the PRW is 20m from the center line.
The Cambodian side agreed on above-mentioned fact and making explanation to the people in the area of Stage-4 at the public consultations in order to avoid any confusion among the people.
- (4) Both sides confirmed that the construction section in Stage-4 will be determined on the basis of the boundary of the Second Monivong Bridge which will be notified officially from the Municipality of Phnom Penh City by February 27, 2009.
- (5) Both sides confirmed that the water pipe lines which would be put into place by PRWSA should be located further from the centerline than the shoulder of the existing road.
- (6) The team requested the Cambodian side to provide the drawings of Second Monivong Bridge and both of treated water transmission and raw water transmission so that the Team could design the plan of the road and make new cost estimation. The Cambodian side agreed to provide those drawings to the Team by March 5, 2009.

3. Environmental and Social Considerations for the section of Stage-4 of the Project

- (1) The Team explained the necessity of the Resettlement Action Plan (RAP) as follows:
 - The Cambodian side should hold public consultations on the RAP including the policy, compensation method before the beginning of payment for PAPs in Stage-4 in an appropriate manner.
- (2) The Cambodian side explained that the RAP already had been prepared for Stage-4 together

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with other stages; however IRC should modify the RAP because its compensation rates for lands would be added based on land price survey and design of the road had been changed in some respects for stage-4.

- (3) The compensation to PAPs in Stage-4 should be paid based on the replacement cost as adopted for PAPs in Stage-1, Stage-2 and Stage-3.
- (4) As for the compensation for lands between the PRW specified by Phnom Penh Municipality announcement dated June 2, 1999 and the PRW 20m from the road center line in both sides in the section between the starting point and Sta.1+900, its payment should be implemented according to the land price survey.

4. Relocation of Public Utilities

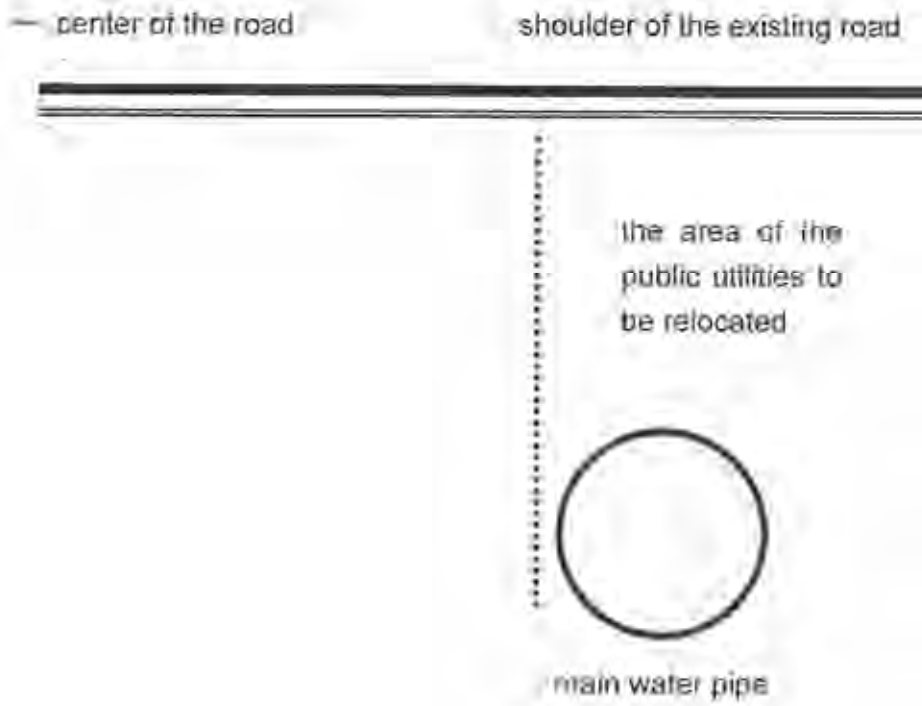
- (1) The Cambodian side agreed on the following items requested by the Team:
 - Public utilities, including optical fiber cable, power cable, tertiary water pipe, and telecommunication lines, should be relocated outside of the main water pipe as shown in Annex 1,
 - All information on the relocation of the public utilities should be shared in writing among the related organizations.
- (2) The Team strongly requested that MPWT should make the coordination among the related parties to the relocation of public utilities in order to make smooth improvement work in Stage-4, to which MPWT agreed.
- (3) The Cambodian side agreed the implementation procedure for the relocation of public utilities as shown in Annex 2.

5. Schedule of the study

- (1) The Team will proceed to further studies in Cambodia by March 5, 2009.
- (2) JICA will prepare the report in English and send it to the Royal Government of Cambodia around the end of July 2009.

6. Other issues

- (1) The Cambodian side shall identify and provide all necessary information on the soil borrow pits necessary for the filling works of Stage-4.



Flow Chart of Public Utilities Relocation

Duration	Activities	Leading Organization
2.0 Months	Confirmation of Utilities to be relocated	The Consultant
1.0 Month	Inform to MPWT	The Consultant
	Arrange the Meeting	MPWT
1.0 Month	MPWT call Meeting with involved organization in relocation (method, time, estimation etc.)	MPWT <ul style="list-style-type: none"> • IRC (Resettlement) - T.C (Optical Fiber Cable) • E.D.C (Power Cable & Posts) - PPWSA (Water Pipe) • Police (Traffic Control)
2.0 Months	Make and Submit the Estimates	Each Organization
	Examine the Estimates	IRC
3.0 Months	Examine the Estimates	MEF (Ministry of Economy and Finance)
1.0 Month	Examine the Estimates	Prime Minister Office
1.0 Month	Approval of the Estimate	MEF
2.0 Months	Allocation of Budget	MEF
1.0 Month	Tender & Contract	Contractors & Each Organization
Total 14.0 Months	Relocation	Contractors & Each Organization

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Appendix 5 List of Collected Data

No.	Name of Data	Form of Data	Original / Copy	Agency of Issuance	Year of Issue
1	Drawings of the New Monivong Bridge	Drawing	Copy	Overseas Cambodian Investment Corporation	2008
2	Drawing indicating Project Boundary (w/ Signature)	Drawing	Copy	Overseas Cambodian Investment Corporation	2009
3	Specification for Water Supply Pipe for the Proposed PPWSA Project	Abstract of Specifications	Copy	Phnom Penh Water Supply Authority	
4	Drawings of the Proposed PPWSA Project	Drawing	Copy	Phnom Penh Water Supply Authority	
5	Work Schedule of the Proposed PPWSA Project	Drawing	Copy	Phnom Penh Water Supply Authority	2009
6	Drawing for lifting of elevation of Maintenance Manhole	Drawing	Original	Phnom Penh Water Supply Authority	2009
7	Sub-Degree on Environmental Impact Assessment	Sub-Degree	Copy	Royal Government of Cambodia	1996
8	Sub-Degree on Water Pollution Control	Sub-Degree	Copy	Council of Ministers, Royal Government of Cambodia	1999
9	Sub-Degree on Solid Waste Management	Sub-Degree	Copy	Council of Ministers, Royal Government of Cambodia	1999
10	Sub-Degree on Air and Noise Pollution Control	Sub-Degree	Copy	Council of Ministers, Royal Government of Cambodia	2000
11	Land Law	Book	Copy	Royal Government of Cambodia	2001
12	Labor Law	Book	Copy	Royal Government of Cambodia	1998
13	Law on Land Traffic	Book	Copy	Royal Government of Cambodia	2006
14	Road Design Standard	Book	Copy	Ministry of Public Works and Transport	2003

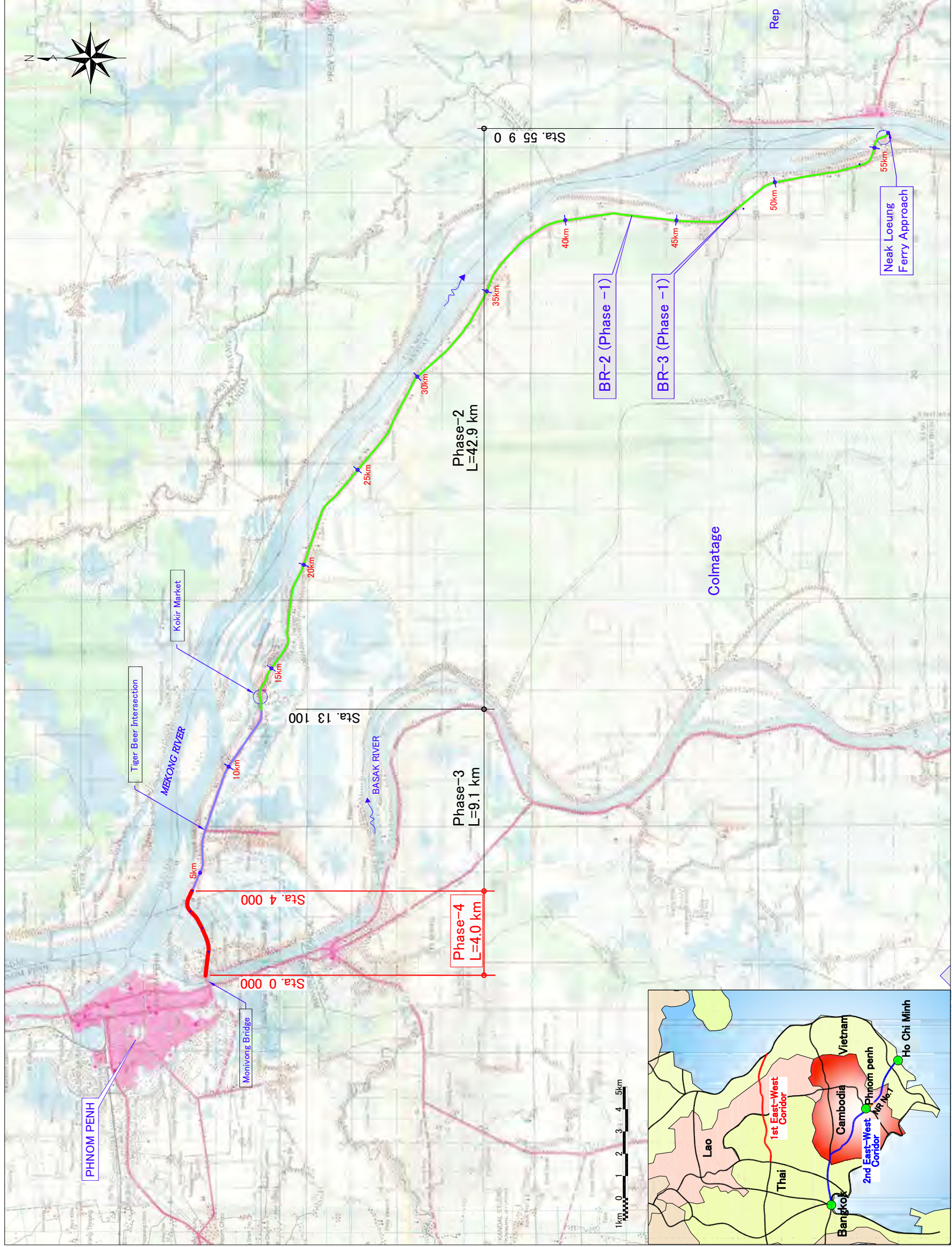
PREPARATORY STUDY REPORT
ON
THE PROJECT FOR IMPROVEMENT
OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOUENG SECTION)
IN
KINGDOM OF CAMBODIA
BASIC DRAWINGS

JULY 2009

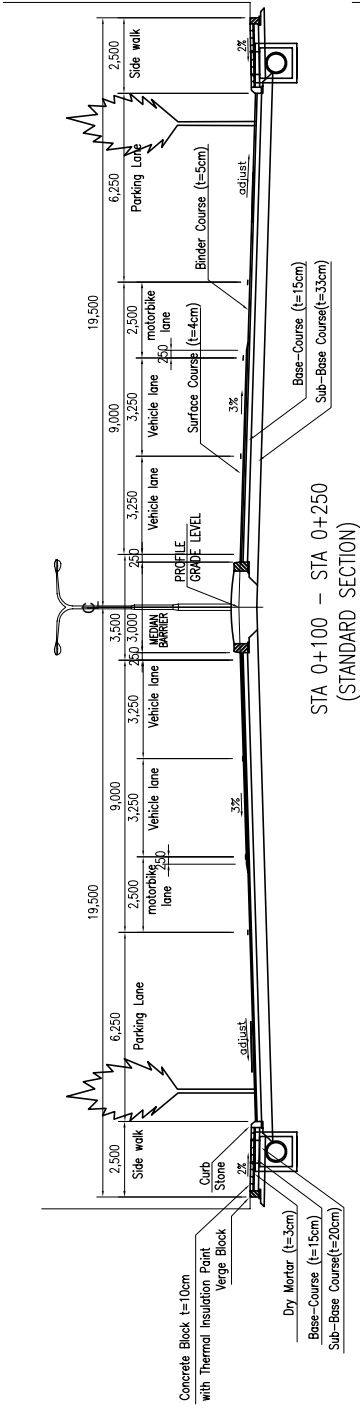
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

CONTENTS OF DRAWINGS

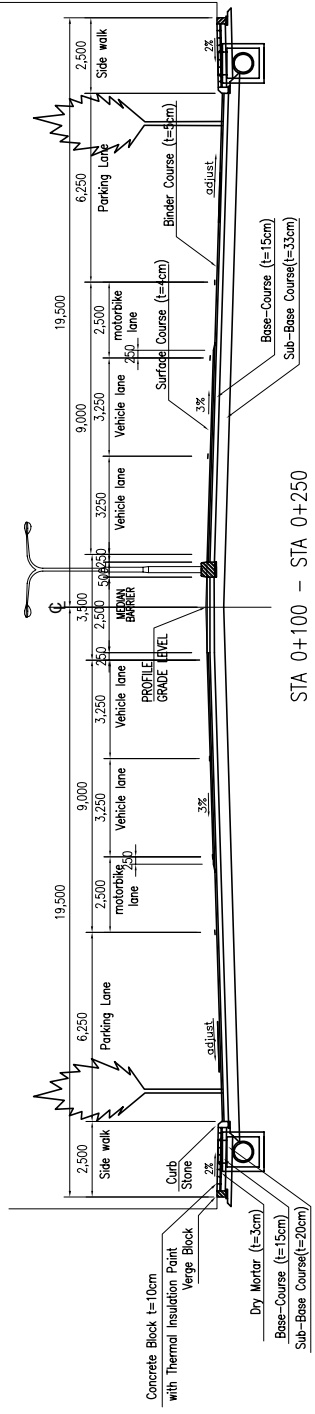
1) LOCATION MAP	G - 1
2) TYPICAL CROSS SECTIONS	G - 2
3) PLAN	PL - 1 ~ 13
4) PROFILE	PR - 1 ~ 13
5) CROSS SECTION	CS - 1 ~ 20
6) REPLACEMENT OF EXISTING SOFT GROUND	CS - 21
7) ROAD STRUCTURES OF CURB STONE, MEDIAN BARRIER, SIDEWALK BLOCK, ETC.	RS - 1
8) ACCESS ROADS	RS - 2
9) BUS BAY DETAIL	RS - 3
10) DRAINAGE STRUCTURES	DR - 1 ~ 4
11) TRAFFIC LIGHT AND MARKING LAYOUT AT INTERSECTIONS	M - 1 ~ 2
12) ROAD MARKING DETAIL	M - 3
13) ROAD SIGN DETAIL	M - 4
14) KILOMETER POST AND CAT EYE DETAIL	M - 5
15) SAFETY FACILITIES (RUMBLE STRIPS)	M - 6



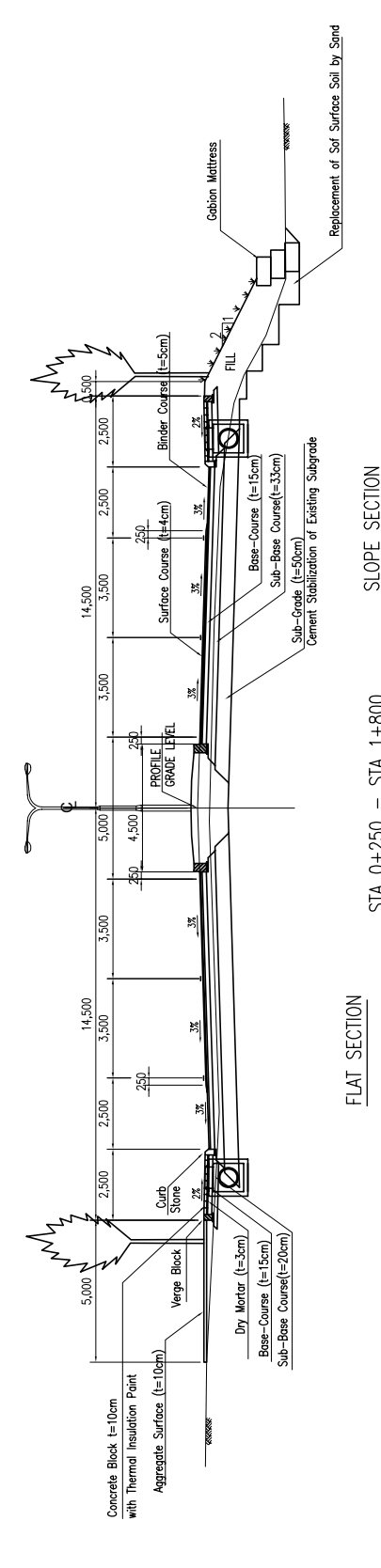
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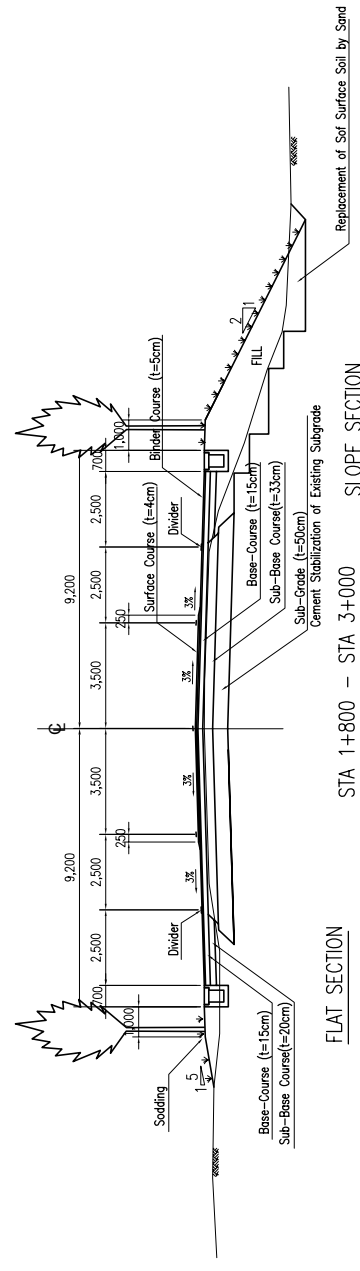
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(STANDARD SECTION)



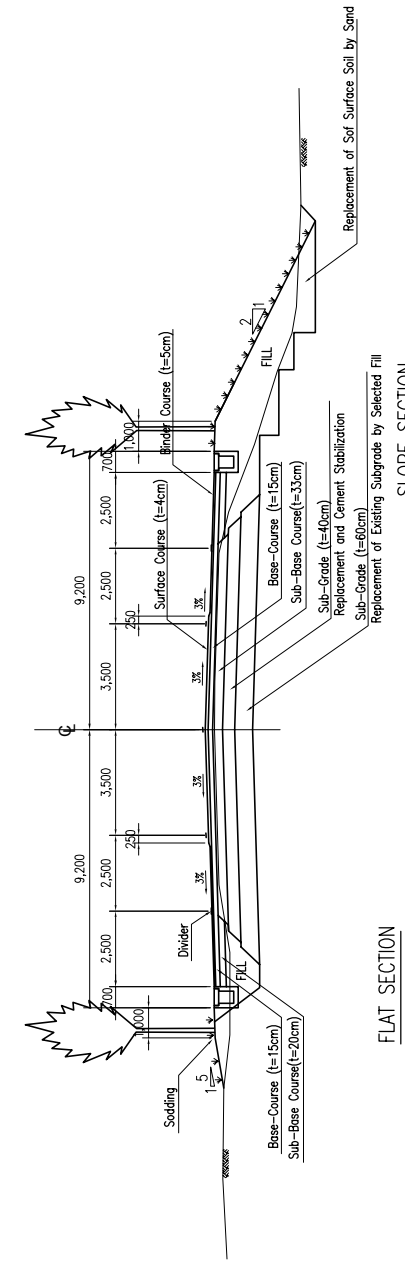
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(LEFT TURN LANE SECTION)



STA 0+250 - STA 1+800



STA 1+800 - STA 3+000



STA 3+000 - STA 4+000

MINISTRY OF
PUBLIC WORKS AND TRANSPORT
(MPWT)

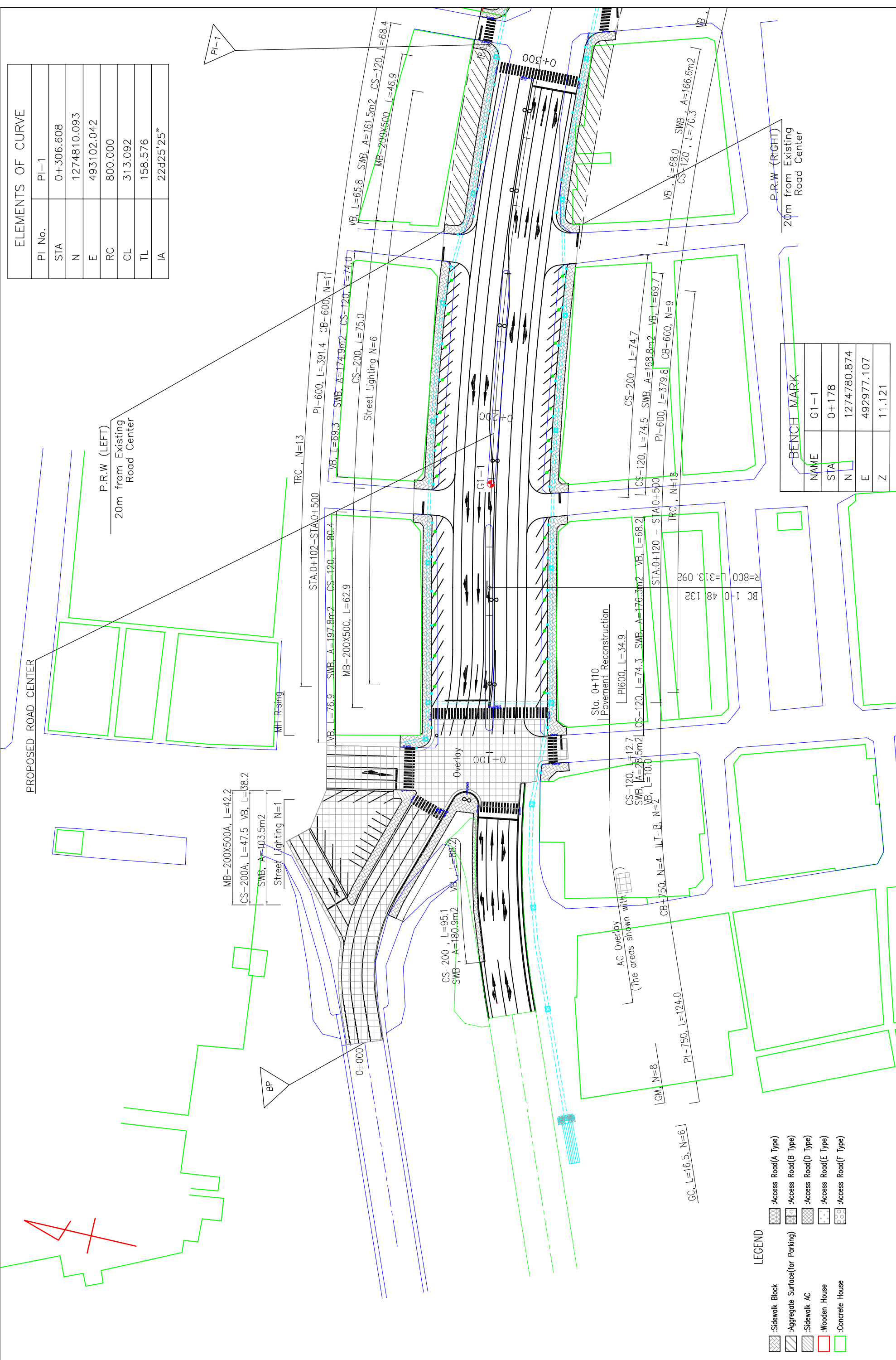
PREPARATORY STUDY ON THE PROJECT
FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1
(PHNOM PENH-NEAK LOEUNG SECTION)
IN THE KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

TITLE :
TYPICAL CROSS SECTION

SCALE
1:250

Drawing No.
Sheet No.
G - 2



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E	493102.042
RC	800.000
CL	313.092
TL	158.576
IA	22d25'25"

BENCH MARK	
NAME	G1-1
STA	0+178
N	1274780.874
E	492977.107
Z	11.121

LEGEND	
[Symbol]	:Sidewalk Block
[Symbol]	:Aggregate Surface(for Parking)
[Symbol]	:Sidewalk AC
[Symbol]	:Wooden House
[Symbol]	:Concrete House
[Symbol]	:Access Road(A Type)
[Symbol]	:Access Road(B Type)
[Symbol]	:Access Road(D Type)
[Symbol]	:Access Road(E Type)
[Symbol]	:Access Road(F Type)

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			PLAN (STA.0+00-STA.0+300)		

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E	493102.042
RC	800.000
CL	313.092
TL	158.576
IA	22d25'25"



PI-1

PROPOSED ROAD CENTER

P.R.W (LEFT)
20m from Existing
Road Center

P.R.W (LEFT)
20m from Existing
Road Center

P.R.W (RIGHT)
20m from Existing
Road Center

STA.0+102 - STA.0+500 PI-600, L=391.4 CB-600, N=11
STA.0+500 - STA.1+097 PI-600, L=596.7 CB-600, N=13
VB, L=391.0 SWB, A=974.2m2 CS-120, L=393.3

VB, L=391.0 SWB, A=974.2m2 CS-120, L=393.3

MB-200X1000 L=47.0

A=161.5m2 CS-120, L=68.4

400X500 L=46.9

CS-200, L=387.6

Street Lighting N=13

CS-200, L=387.1

VB, L=311.0 SWB, A=770.5m2 CS-120, L=313.7

PI-600, L=379.8 CB-600, N=9

STA.0+120 - STA.0+508

AC-E, W=1.5, L=8.0, H=2.0

R=

L=633.640

FC 1-0 361.224

AC-E, W=1.5, L=8.0, H=2.0

AC-E, W=1.5, L=8.0, H=3.0

PI-600, L=575.2 CB-600, N=12

STA.0+508 - STA.1+097

AC-F, W=4.0, L=5.0

BL

LEGEND

	:Sidewalk Block		:Access Road(A Type)
	:Aggregate Surface(for Parking)		:Access Road(B Type)
	:Sidewalk AC		:Access Road(D Type)
	:Wooden House		:Access Road(E Type)
	:Concrete House		:Access Road(F Type)

MINISTRY OF
PUBLIC WORKS AND TRANSPORT
(MPWT)

PREPARATORY STUDY ON THE PROJECT
FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1
(PHNOM PENH-NEAK LOEUNG SECTION)
IN THE KINGDOM OF CAMBODIA

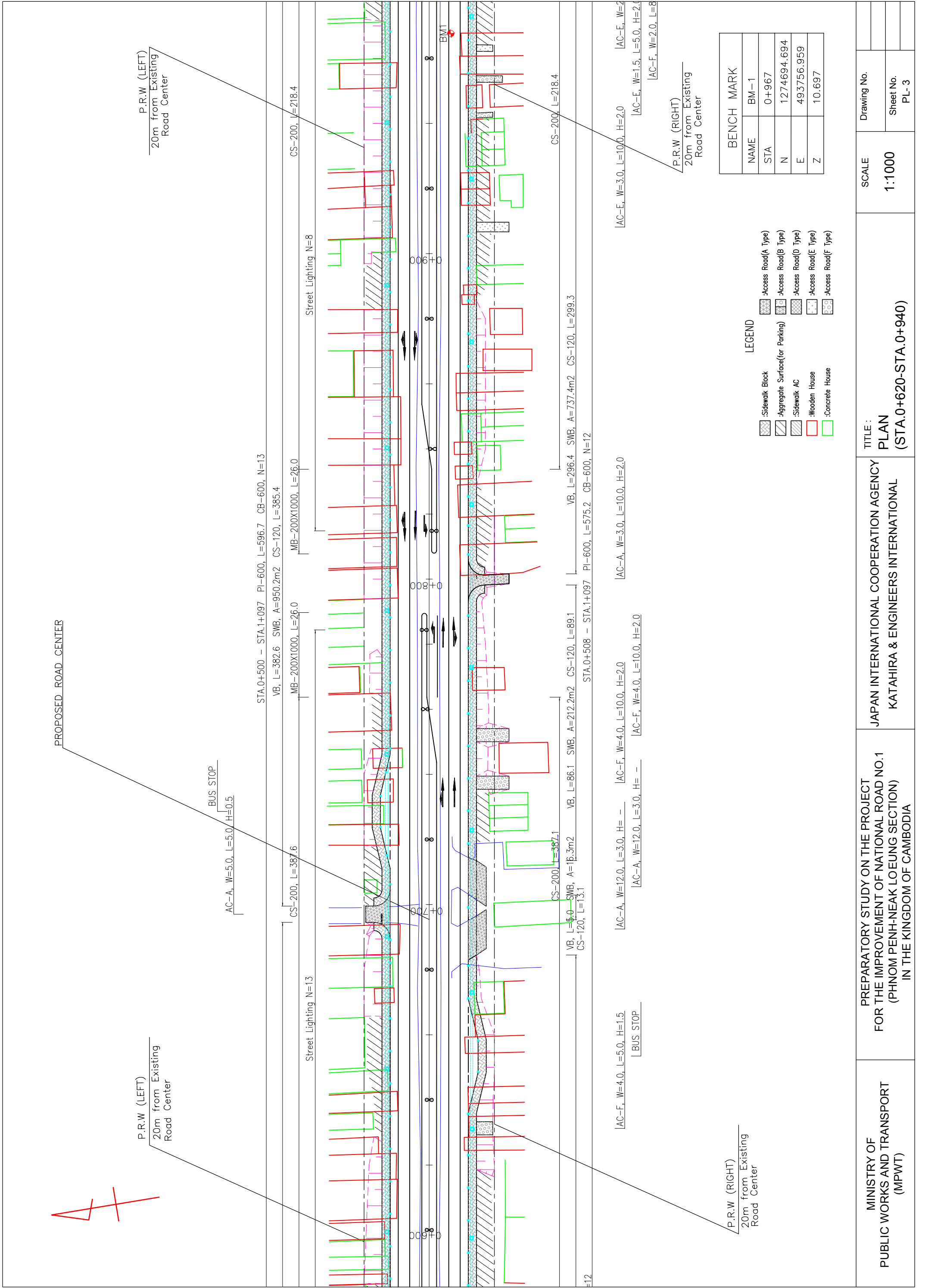
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

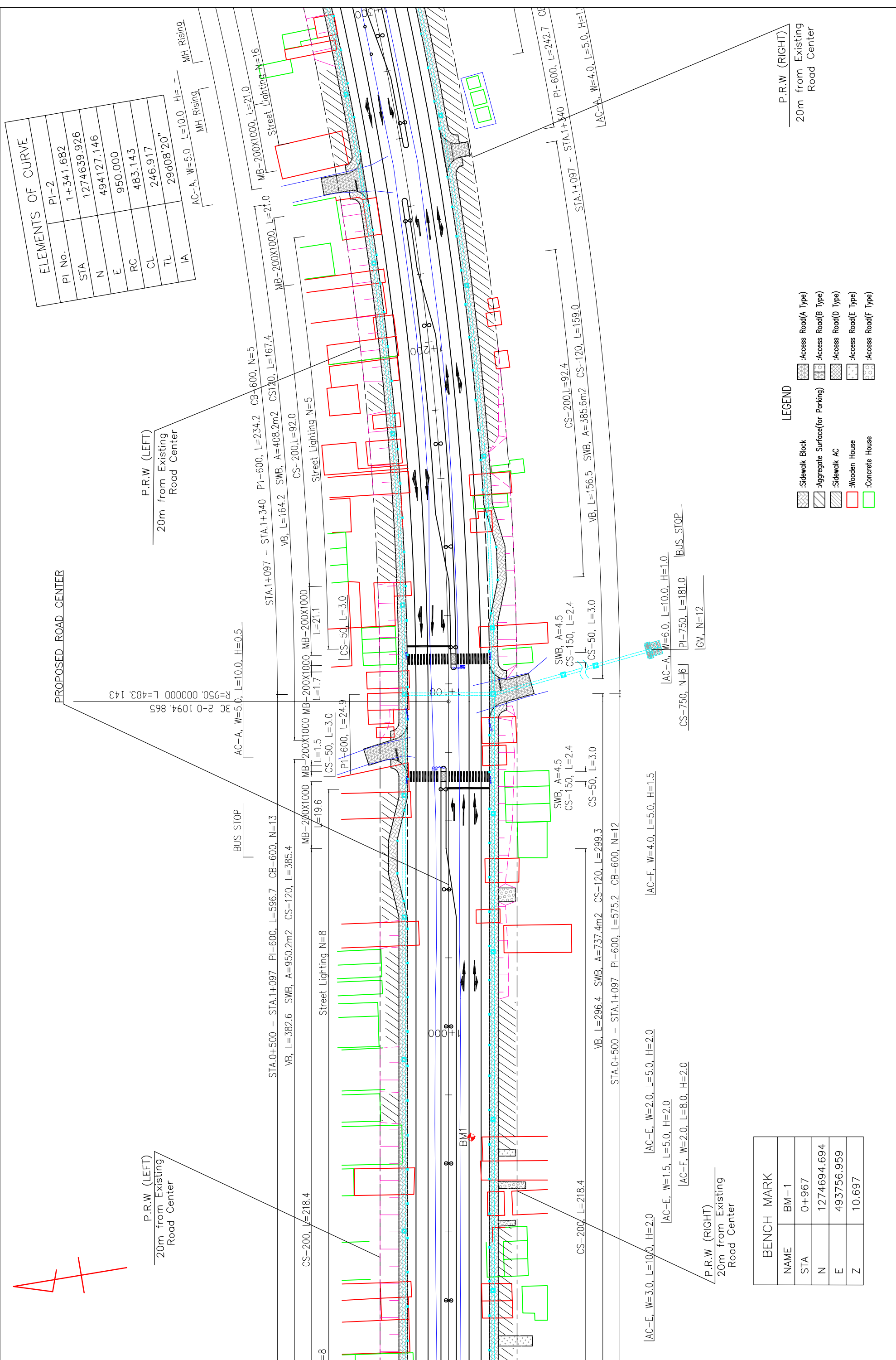
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SCALE
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Sheet No.
PL-2



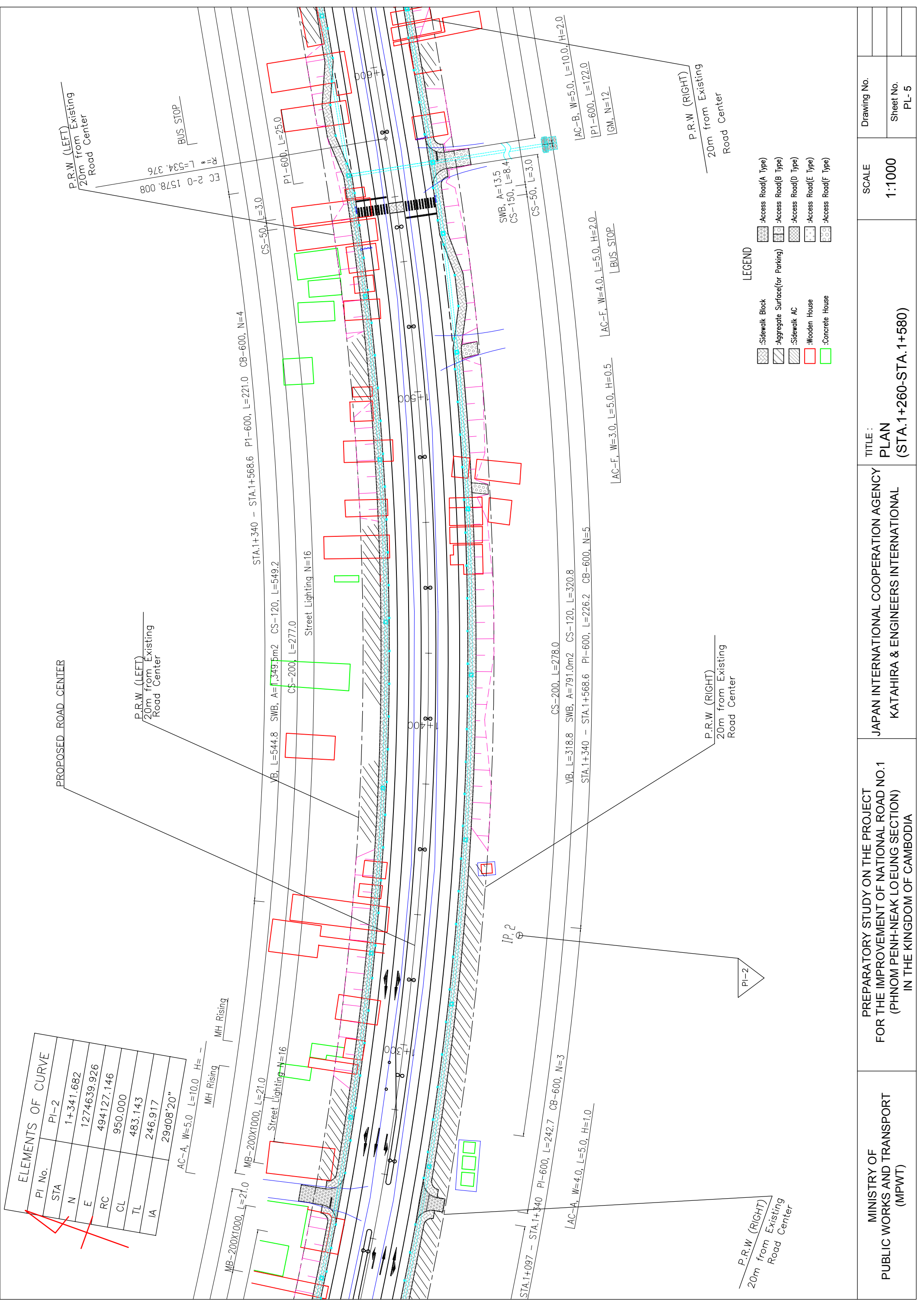


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E	950.000
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IA	

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E	493756.959
Z	10.697

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[Pattern]	:Sidewalk AC
[Pattern]	:Wooden House
[Pattern]	:Concrete House
[Pattern]	:Access Road(A Type)
[Pattern]	:Access Road(B Type)
[Pattern]	:Access Road(D Type)
[Pattern]	:Access Road(E Type)
[Pattern]	:Access Road(F Type)

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :
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	SCALE	Drawing No.	
	1:1000	Sheet No.	
		PL-4	



ELEMENTS OF CURVE		
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E	494127.146	
RC	950.000	
CL	483.143	
TL	246.917	
IA	29d08'20"	

- LEGEND
- :Sidewalk Block
 - :Aggregate Surface (for Parking)
 - :Sidewalk AC
 - :Wooden House
 - :Concrete House
 - :Access Road(A Type)
 - :Access Road(B Type)
 - :Access Road(D Type)
 - :Access Road(E Type)
 - :Access Road(F Type)

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)

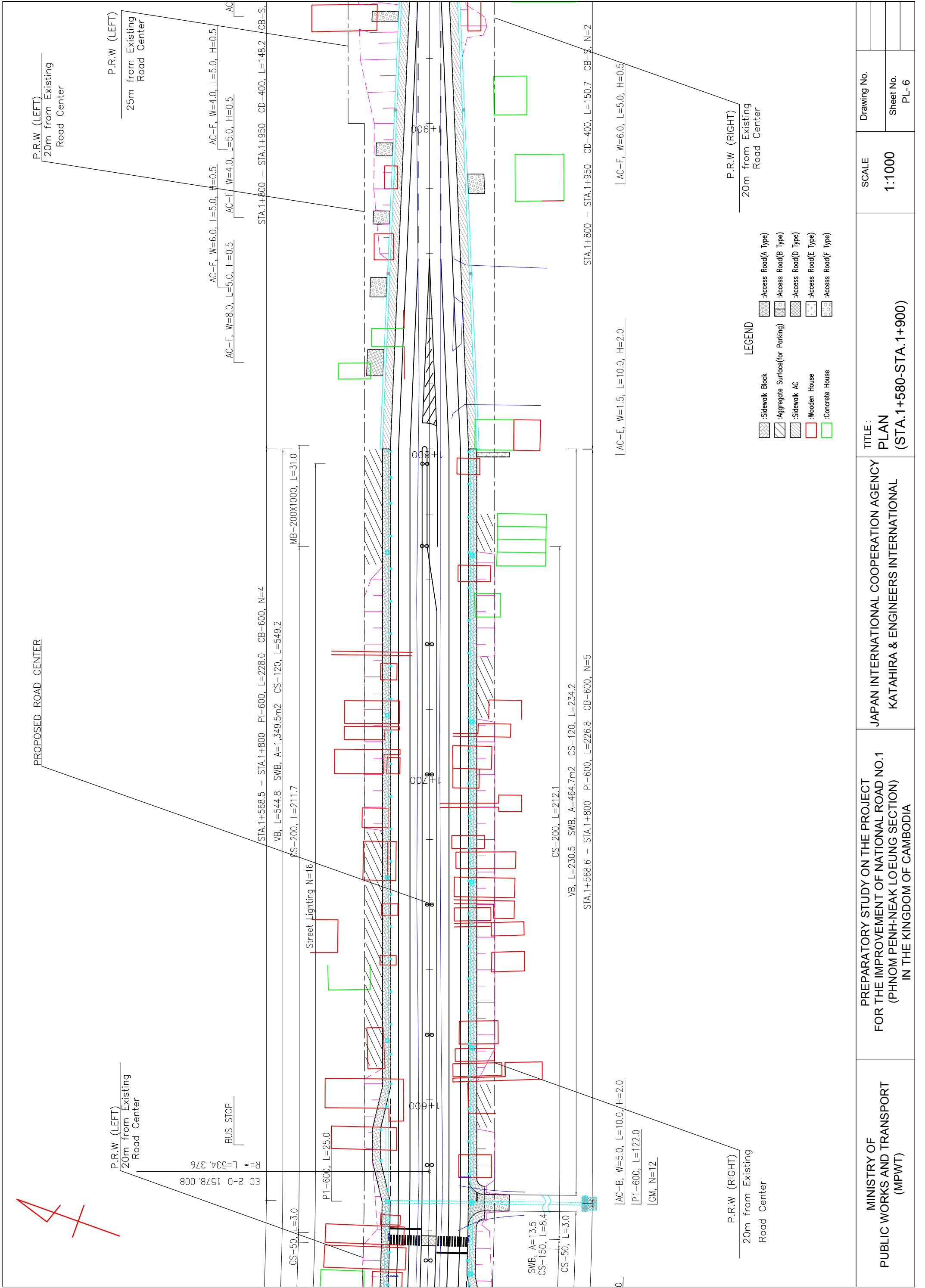
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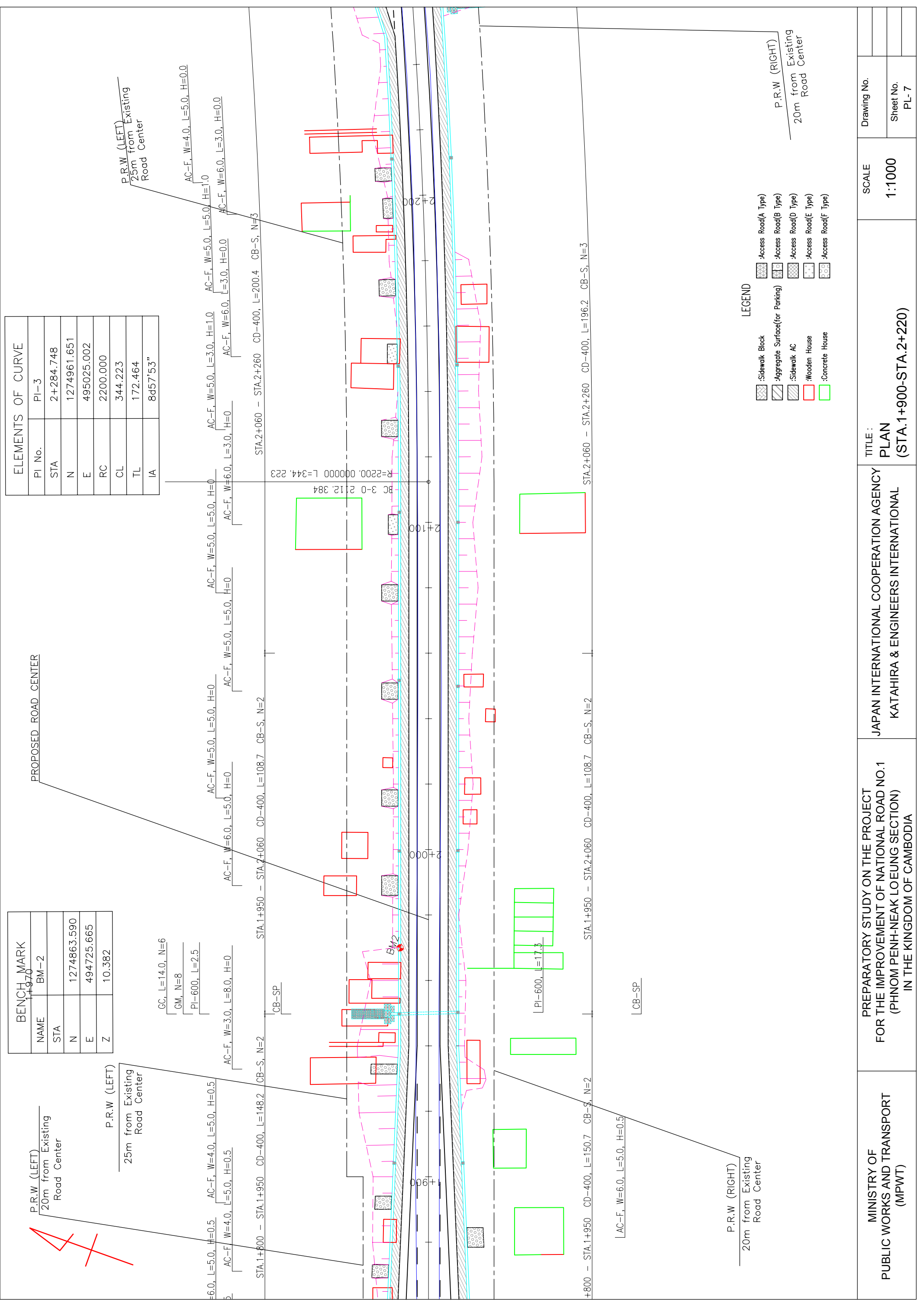
JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL

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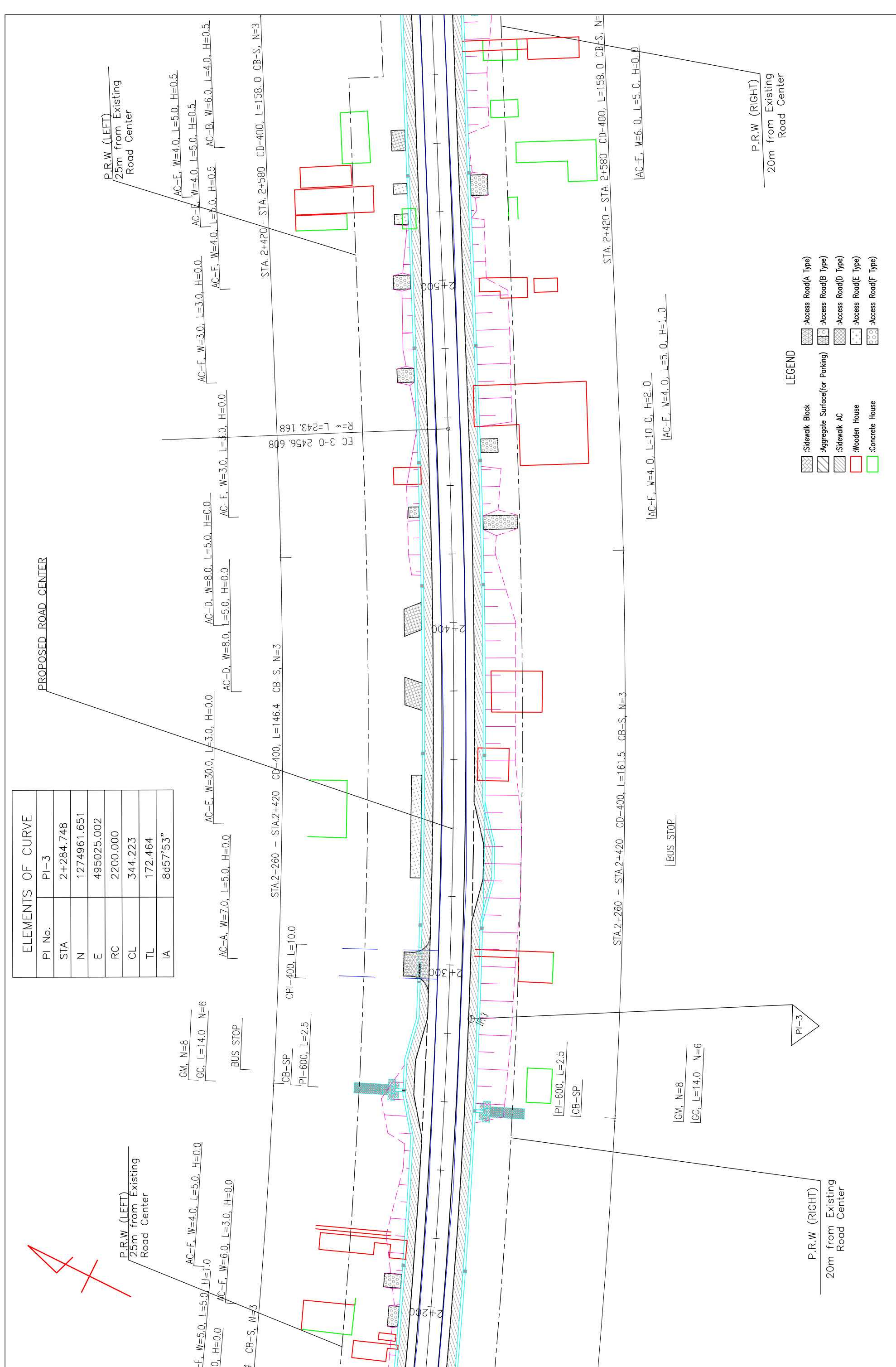
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MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : PLAN (STA.1+900-STA.2+220)	SCALE	Drawing No.
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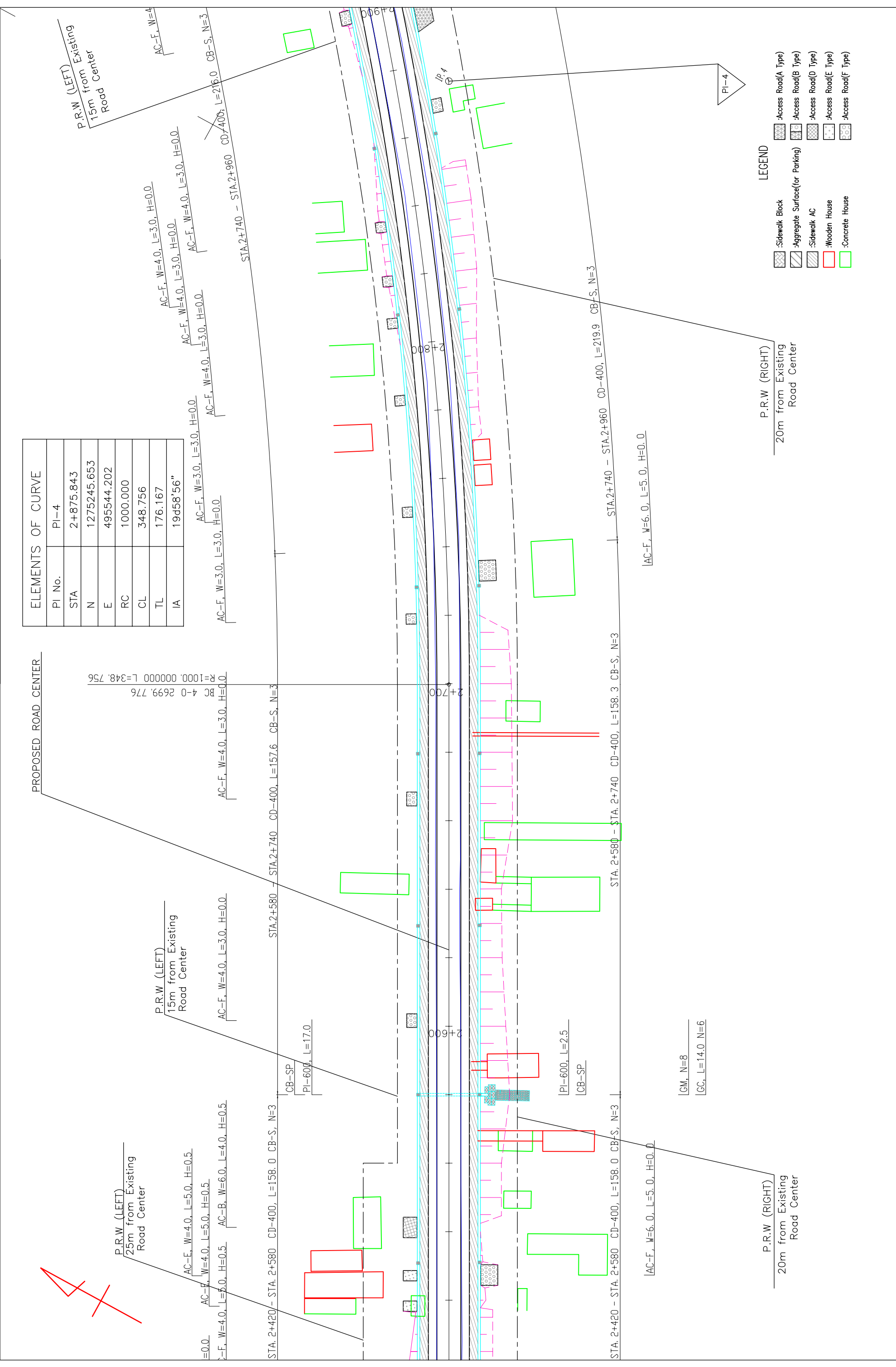
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IA	8d57'53"



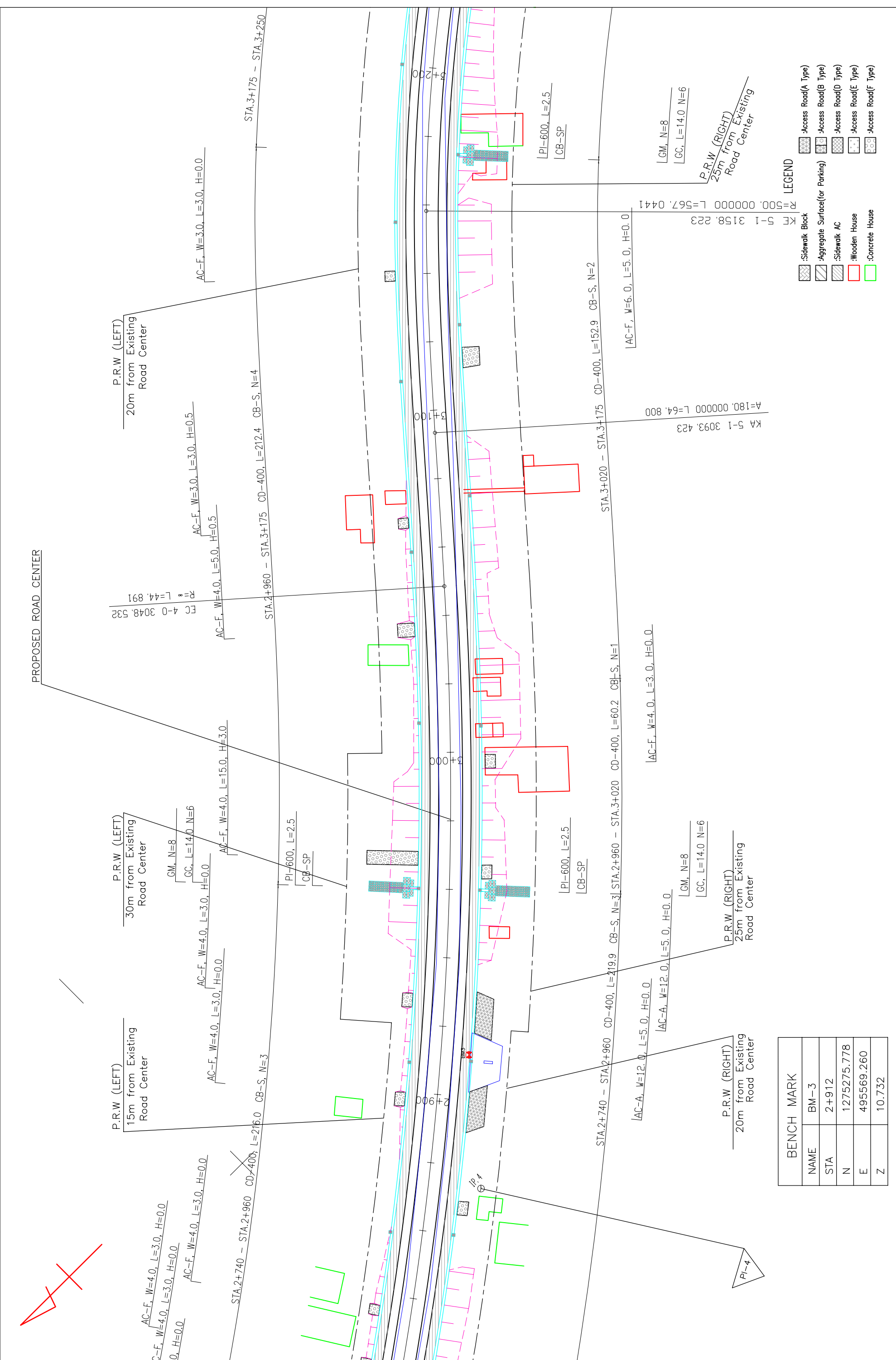
LEGEND

- :Sidewalk Block
- :Aggregate Surface(for Parking)
- :Sidewalk AC
- :Wooden House
- :Concrete House
- :Access Road(A Type)
- :Access Road(B Type)
- :Access Road(D Type)
- :Access Road(E Type)
- :Access Road(F Type)

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : PLAN (STA.2+220-STA.2+540)	SCALE 1:1000	Drawing No. _____
			Sheet No. PL- 8	_____	



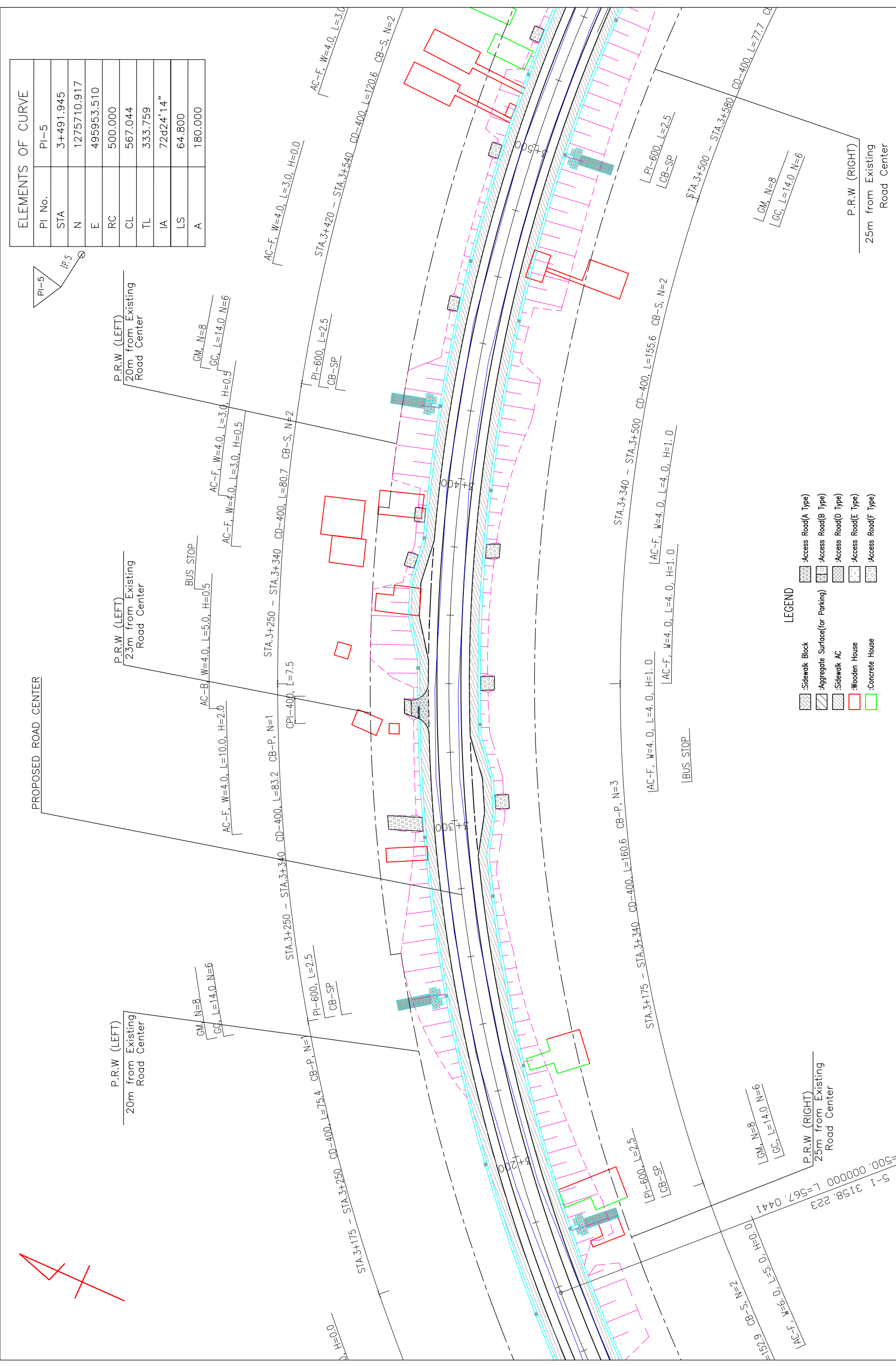
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			PLAN (STA.2+540-STA.2+860)	1:1000	Sheet No. PL-9



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E	495569.260
Z	10.732

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : PLAN (STA.2+860-STA.3+180)	SCALE	Drawing No.
				1:1000	Sheet No. PL-10

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E	495953.510
RC	500.000
CL	567.044
TL	333.759
IA	72d24'14"
LS	64.800
A	180.000



LEGEND

	:Sidewalk Block		:Access Road(A Type)
	:Aggregate Surface(for Parking)		:Access Road(B Type)
	:Sidewalk AC		:Access Road(D Type)
	:Wooden House		:Access Road(E Type)
	:Concrete House		:Access Road(F Type)

P.R.W (RIGHT)
25m from Existing
Road Center

P.R.W (LEFT)
20m from Existing
Road Center

P.R.W (LEFT)
23m from Existing
Road Center

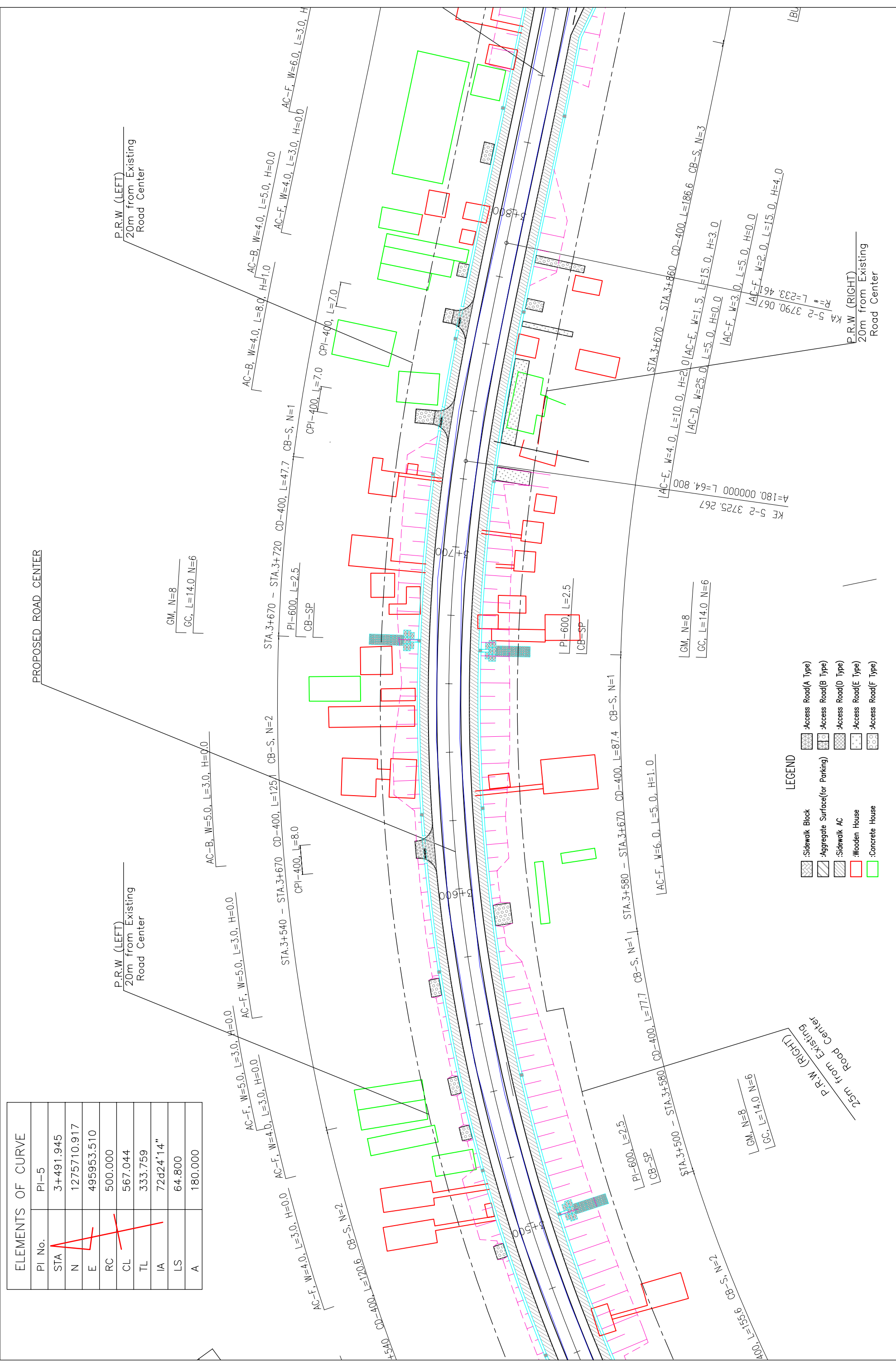
P.R.W (LEFT)
20m from Existing
Road Center

PROPOSED ROAD CENTER

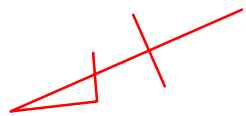


MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			PLAN (STA.3+180-STA.3+500)	1:1000	
					Sheet No. PL-11

ELEMENTS OF CURVE	
PI No.	PI-5
STA	3+491.945
N	1275710.917
E	495953.510
RC	500.000
CL	567.044
TL	333.759
IA	72d24'14"
LS	64.800
A	180.000



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			PLAN (STA.3+500-STA.3+820)	1:1000	Sheet No. PL-12



PROPOSED ROAD CENTER

P.R.W (LEFT)
20m from Existing
Road Center

P.R.W (LEFT)
20m from Existing
Road Center

P.R.W (RIGHT)
20m from Existing
Road Center

P.R.W (RIGHT)
20m from Existing
Road Center

GM, N=8
GC, L=14.0 N=6

AC-B, W=4.0, L=5.0, H=0.0
AC-F, W=4.0, L=3.0, H=0.0

AC-B, W=4.0, L=5.0, H=0.0
AC-F, W=4.0, L=6.0, H=0.0

AC-F, W=3.0, L=10.0, H=3.0

S, N=1

STA.3+720 - STA.3+987 CD-400, L=239.2 CB-P, N=4

CPI-400, L=7.0

CPI-400, L=6.0

CD-400, L=12.7
STA.3+987 - STA.4+00

PI-600, L=2.5

CPI-400, L=6.0

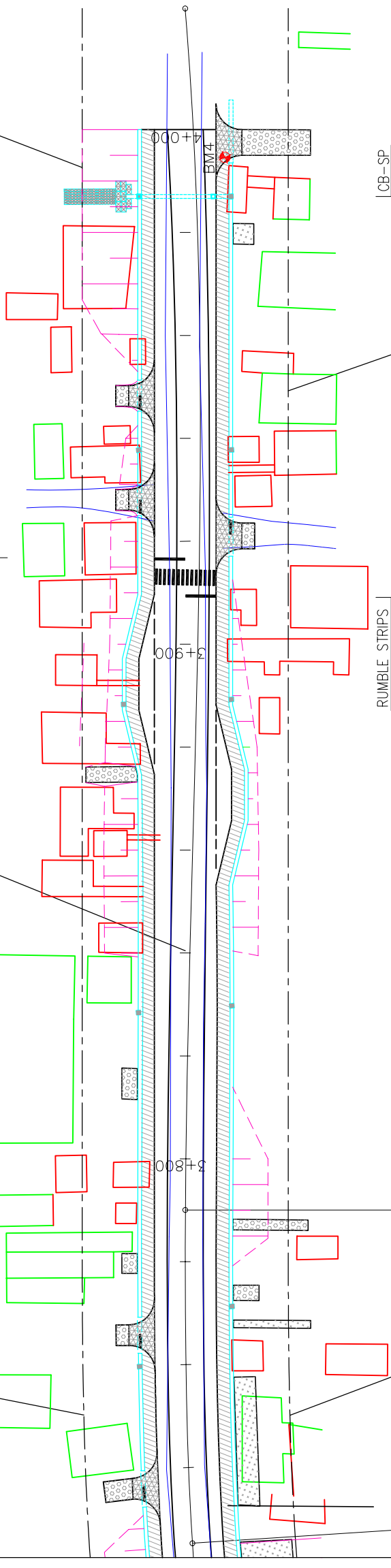
RUMBLE STRIPS

RUMBLE STRIPS

RUMBLE STRIPS

RUMBLE STRIPS

RUMBLE STRIPS



CPI-400, L=7.6

CPI-400, L=12.3

STA.3+860 - STA.3+987 CD-400, L=118.7 CB-S, N=2

STA.3+987 - STA.4+005 CD-400, L=6.2

STA.3+670 - STA.3+860 CD-400, L=186.6 CB-S, N=3

AC-E, W=4.0, L=10.0, H=2.0

AC-D, W=25.0, L=5.0, H=0.0

AC-E, W=4.0, L=10.0, H=2.0

AC-F, W=3.0, L=5.0, H=0.0

AC-F, W=2.0, L=15.0, H=4.0

AC-B, W=4.0, L=5.0, H=0.0

AC-B, W=5.0, L=15.0, H=2.0

AC-E, W=4.0, L=4.0, H=-

KE 5-2 3725.267
A=180.000000 L=64.800

KA 5-2 3790.067
R L=233.461

BUS STOP

CB-SP

BENCH MARK	
NAME	BM-4
STA	3+994
N	1275461.012
E	496502.513
Z	10.415

LEGEND

- :Sidewalk Block
- :Aggregate Surface(for Parking)
- :Sidewalk AC
- :Wooden House
- :Concrete House
- :Access Road(A Type)
- :Access Road(B Type)
- :Access Road(D Type)
- :Access Road(E Type)
- :Access Road(F Type)

MINISTRY OF
PUBLIC WORKS AND TRANSPORT
(MPWT)

PREPARATORY STUDY ON THE PROJECT
FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1
(PHNOM PENH-NEAK LOEUNG SECTION)
IN THE KINGDOM OF CAMBODIA

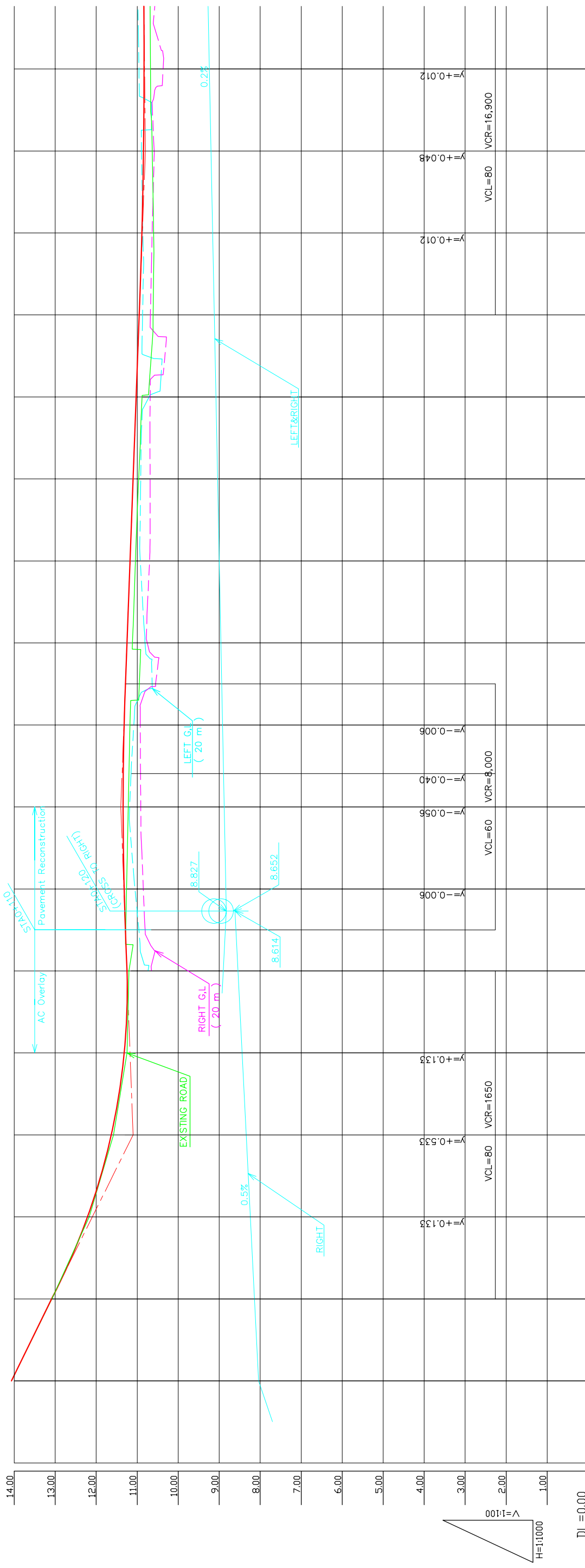
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

TITLE :
PLAN
(STA.3+820-STA.4+00)

SCALE
1:1000

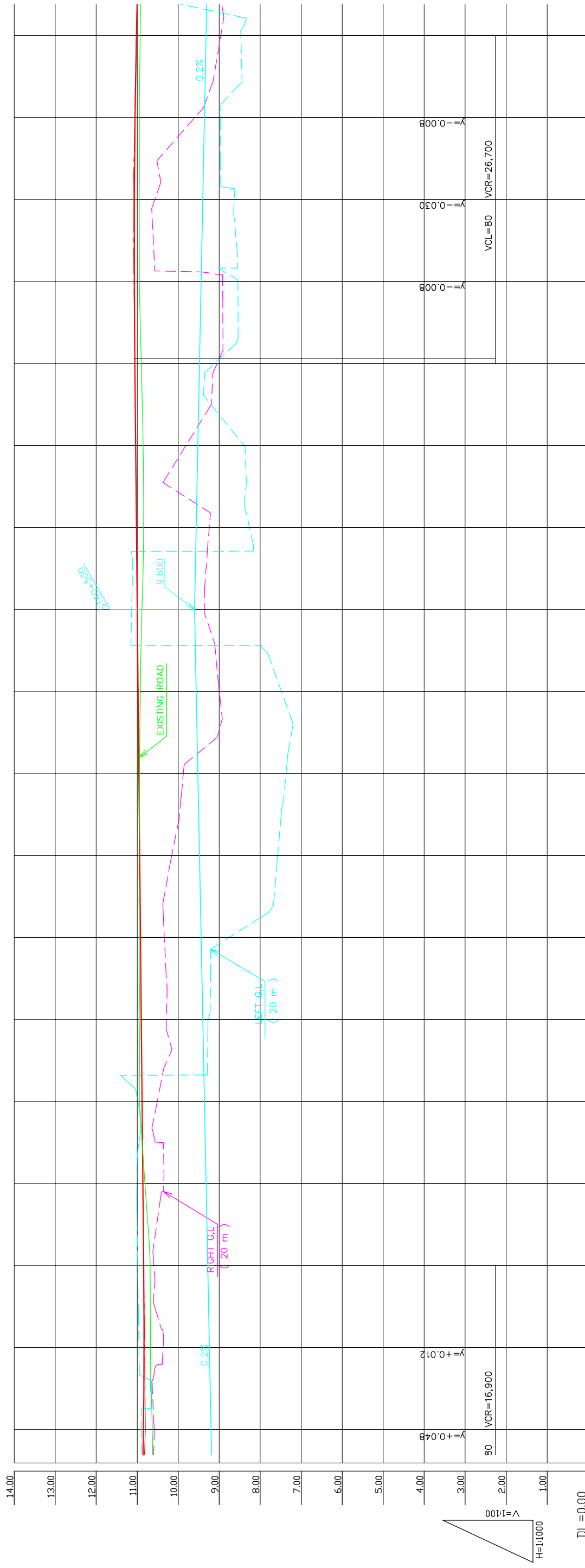
Drawing No.

Sheet No.
PL-13



VERTICAL ALIGNMENT	14.070	13.080	12.223	11.633	11.250	11.344	11.344	11.285	11.250	11.175	11.100	11.025	10.950	10.887	10.848	10.832	
HEIGHT	14.070	13.03	12.17	11.58	11.25	11.344	11.22	11.18	11.12	11.04	10.97	10.88	10.61	10.60	10.63	10.68	
PAVEMENT HEIGHT	14.070	13.080	12.223	11.633	11.250	11.344	11.22	11.18	11.12	11.04	10.97	10.88	10.61	10.60	10.63	10.68	
GROUND HEIGHT	14.070	13.03	12.17	11.58	11.25	11.344	11.22	11.18	11.12	11.04	10.97	10.88	10.61	10.60	10.63	10.68	
STATION	STA.0	+20	+40	+60	+80	+100	+120	+140	+160	+180	+200	+220	+240	+260	+280	+300	+320
HORIZONTAL CURVATURE					R=∞ L=313.092												
SUPER-ELEVATION																	

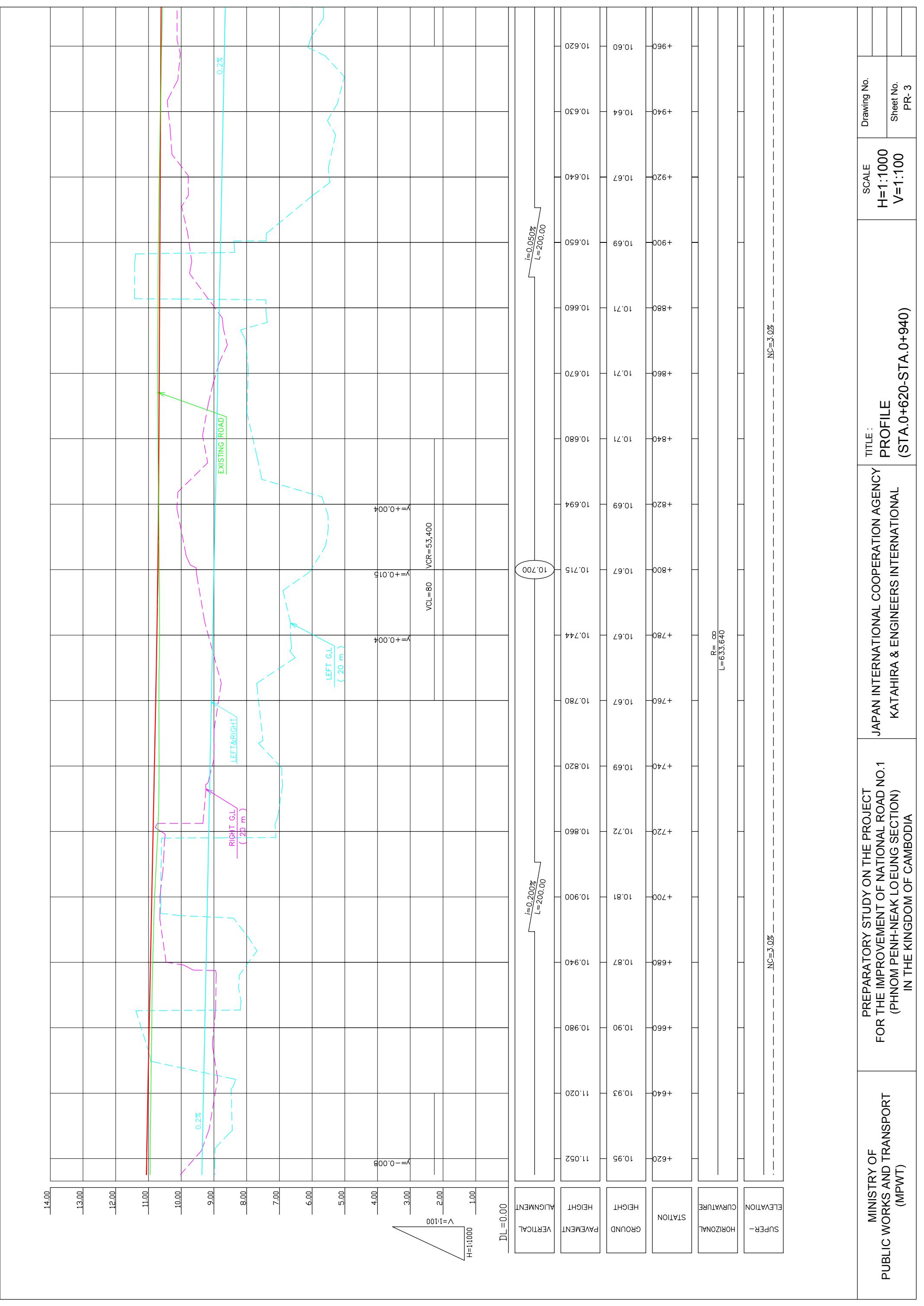
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE H=1:1000 V=1:100	Drawing No.
			PROFILE (STA.0+00-STA.0+300)		



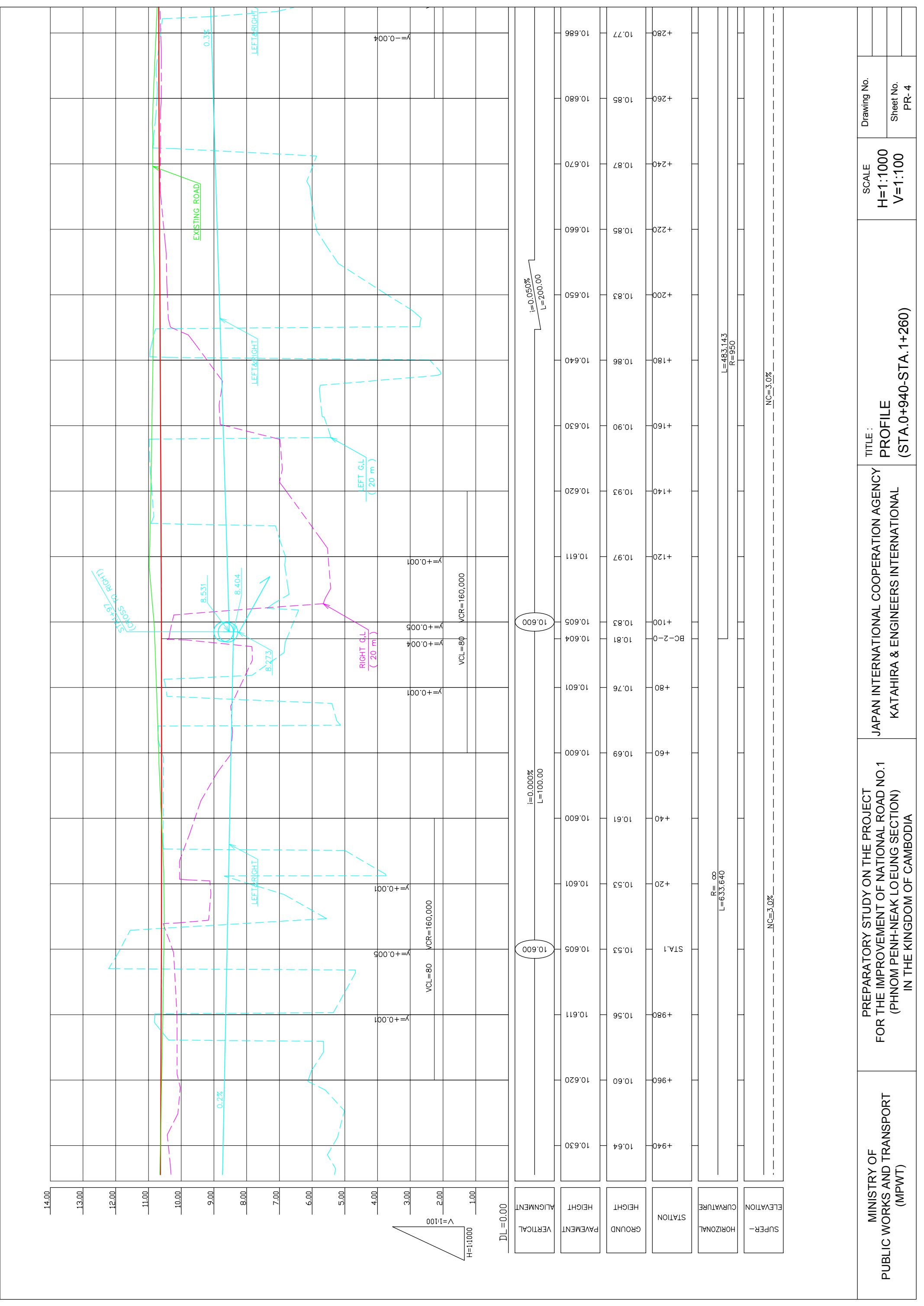
STATION	GROUND HEIGHT	PAVEMENT HEIGHT	ALIGNMENT VERTICAL
10.848	10.63	10.848	10.800
10.832	10.68	10.832	10.832
10.840	10.69	10.840	10.840
10.860	10.81	10.860	10.860
10.880	10.94	10.880	10.880
10.900	10.94	10.900	10.900
10.920	10.95	10.920	10.920
10.940	10.96	10.940	10.940
10.960	10.94	10.960	10.960
10.980	10.92	10.980	10.980
11.000	10.88	11.000	11.000
11.020	10.85	11.020	11.020
11.040	10.87	11.040	11.040
11.060	10.90	11.060	11.060
11.070	10.95	11.070	11.100
11.052	10.95	11.052	11.052
11.020	10.93	11.020	11.020

SUPER-ELEVATION: NC=3.0%
 HORIZONTAL CURVATURE: L=313.092, R=800
 STATION: EC-1-0
 CURVATURE: R=∞, L=633.640
 ELEVATION: NC=3.0%

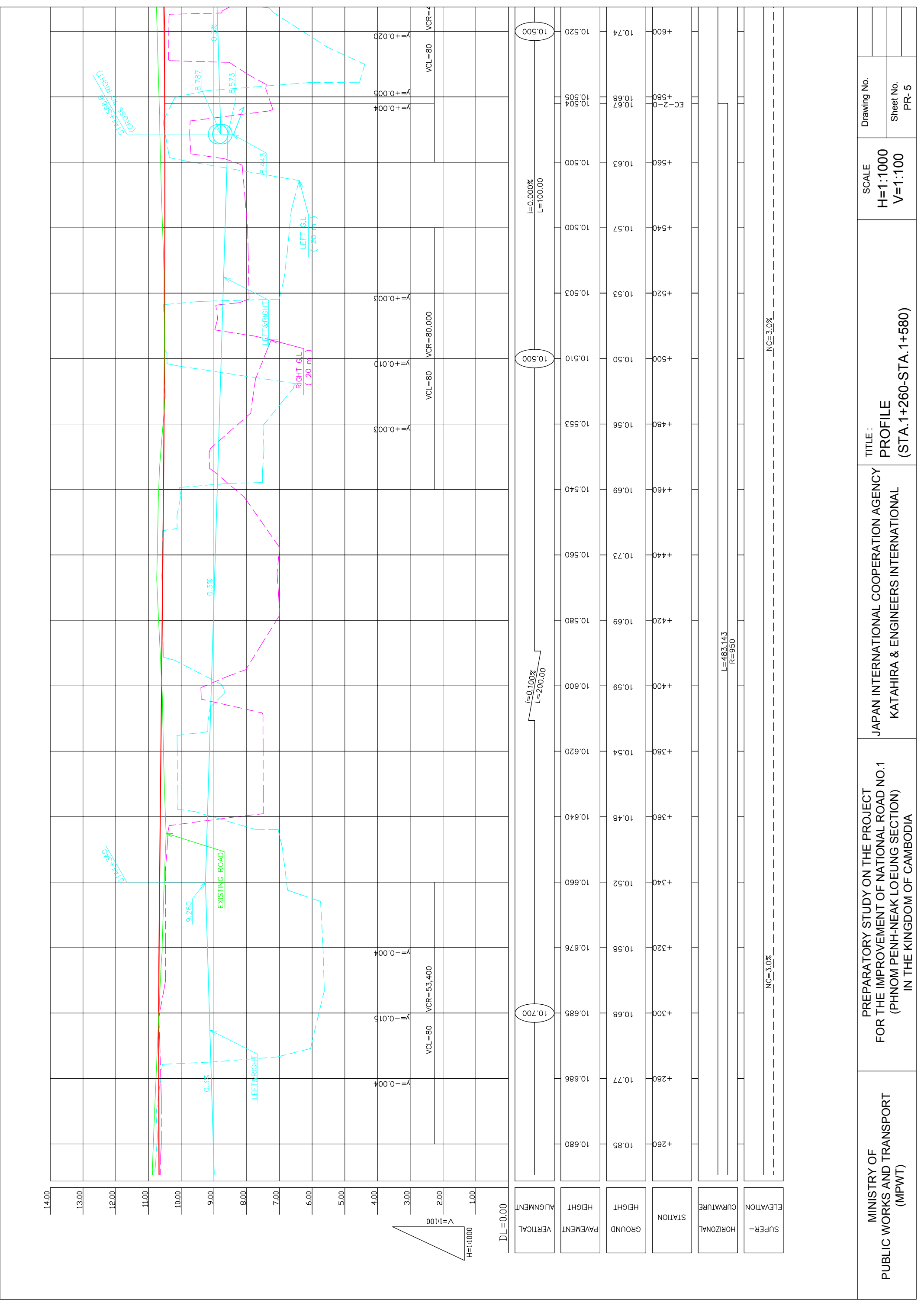
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE: PROFILE (STA.0+300-STA.0+620)	SCALE H=1:1000 V=1:100	Drawing No.
				Sheet No. PR-2	Drawing No.



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT) | PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA | JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL | TITLE: PROFILE (STA.0+620-STA.0+940) | SCALE: H=1:1000, V=1:100 | Drawing No. PR-3, Sheet No. PR-3



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE H=1:1000 V=1:100	Drawing No.
			PROFILE (STA.0+940-STA.1+260)		



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)

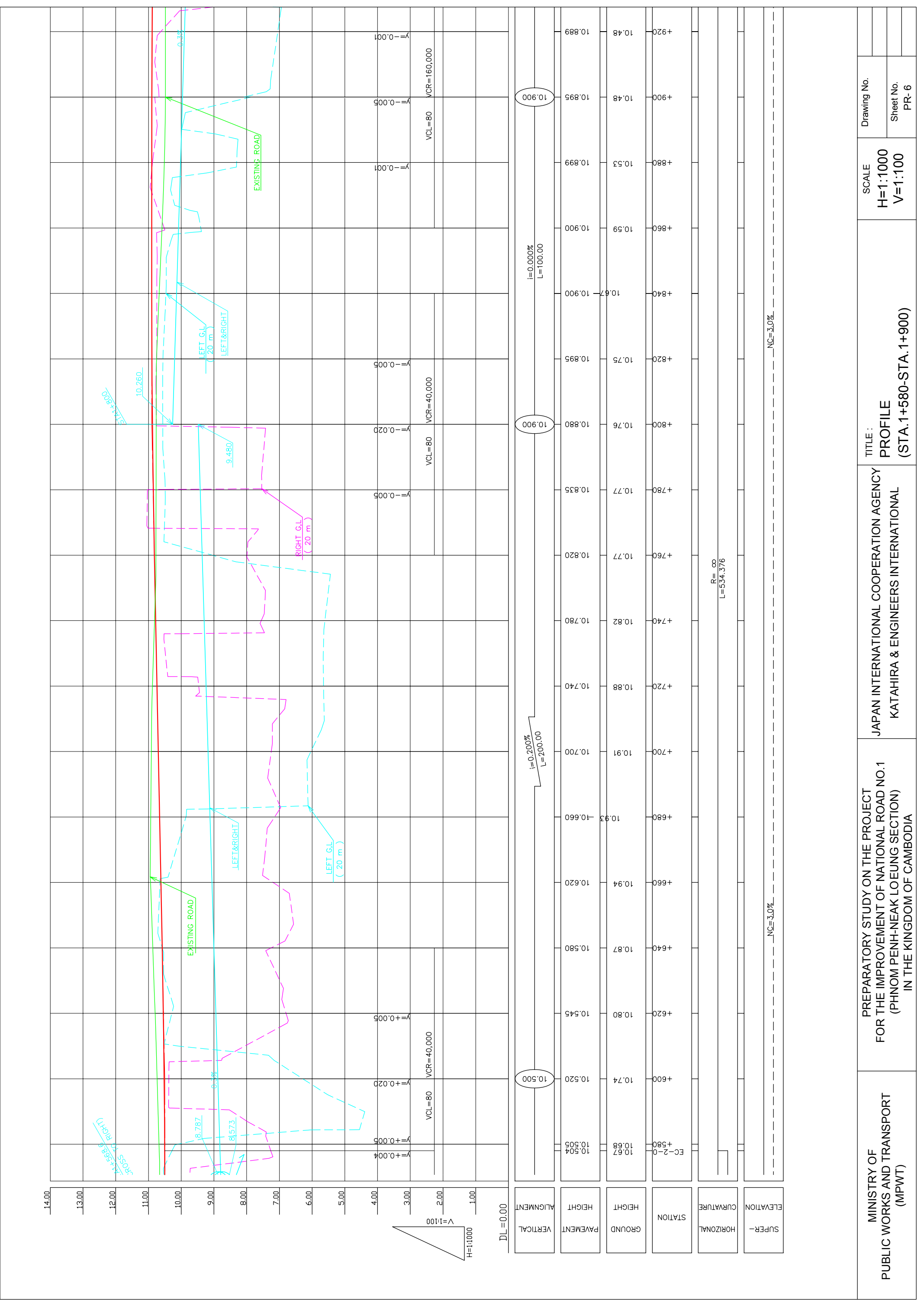
PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL

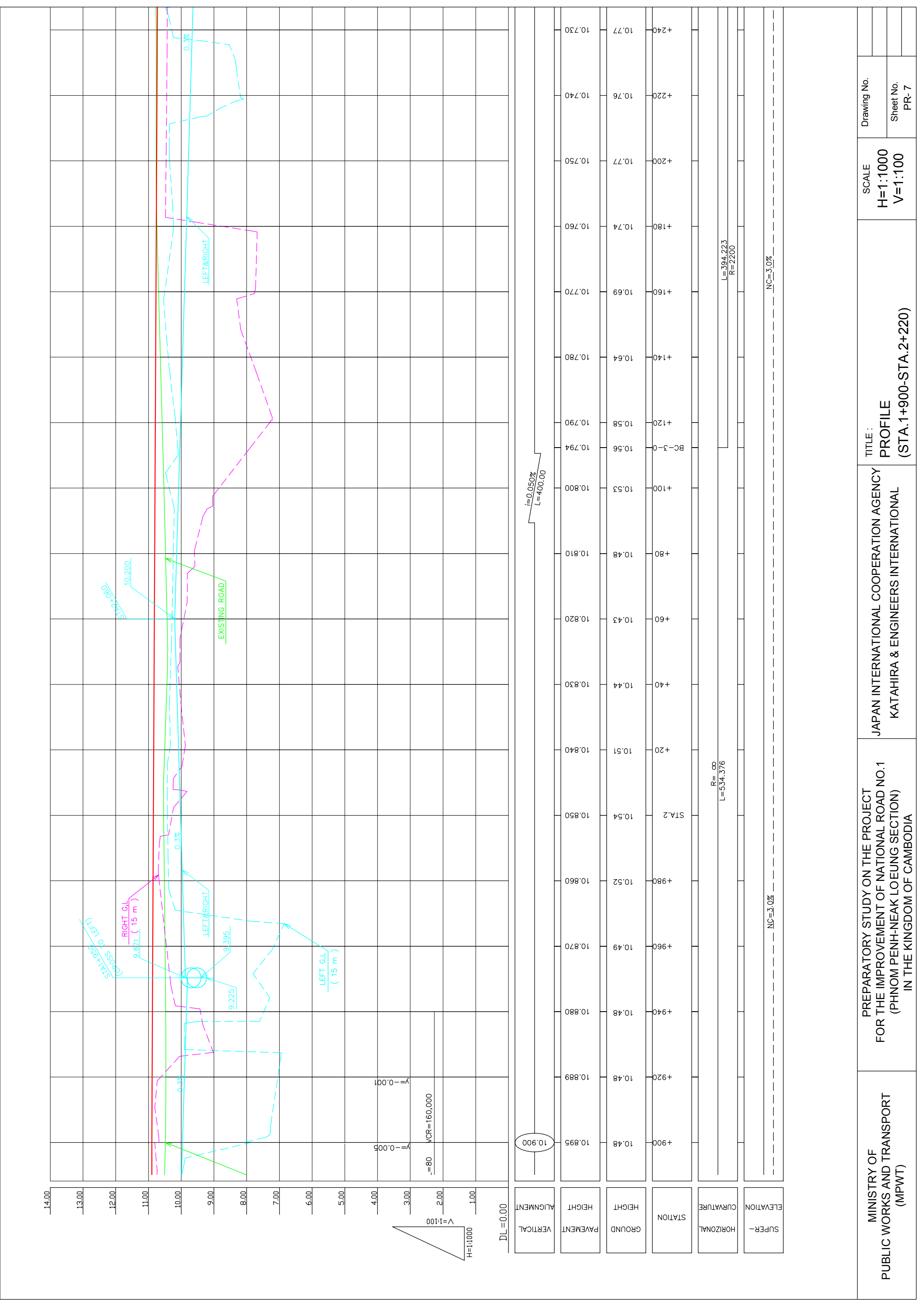
TITLE: PROFILE (STA.1+260-STA.1+580)

SCALE: H=1:1000 V=1:100

Drawing No. Sheet No. PR- 5

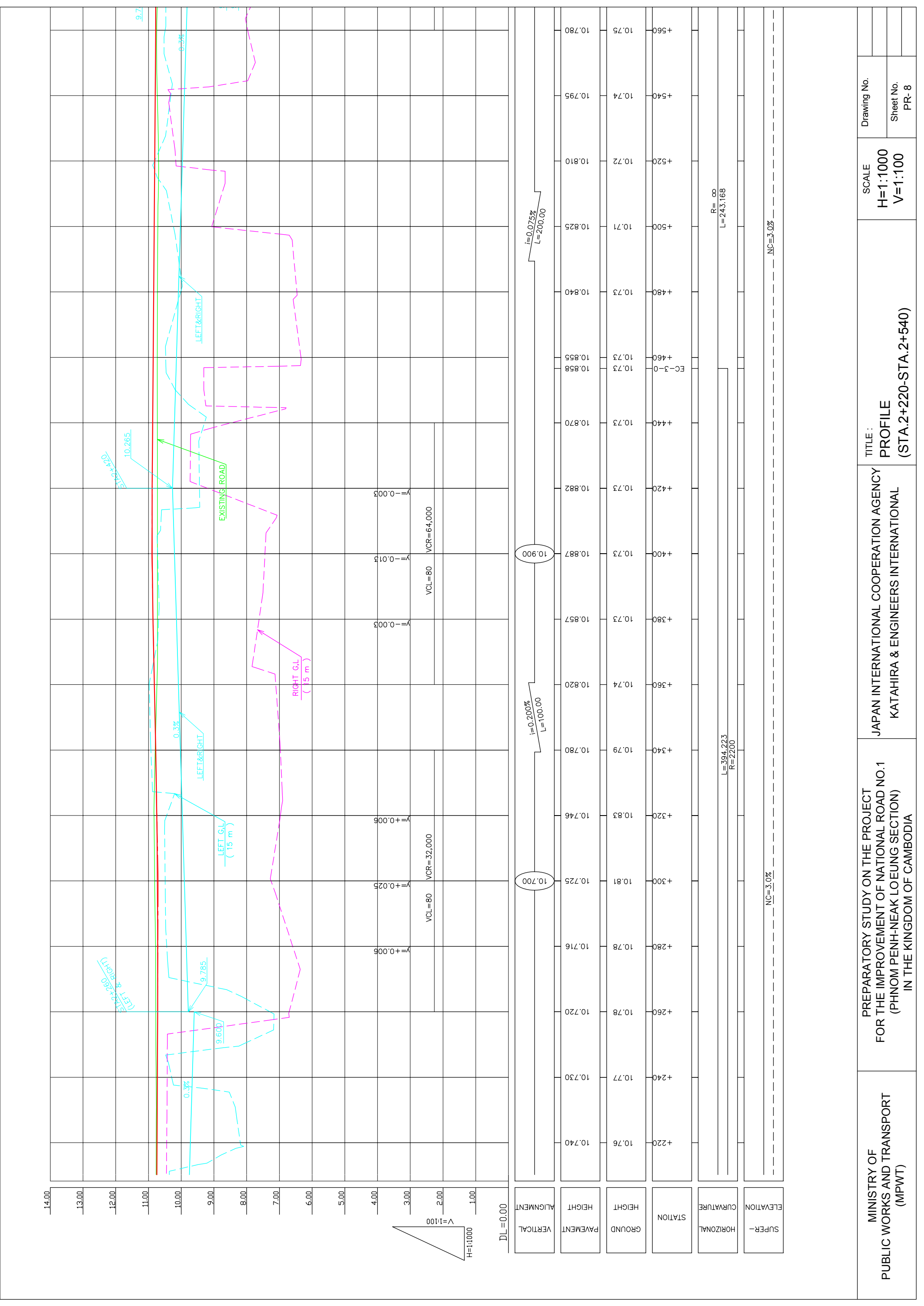


MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE H=1:1000 V=1:100	Drawing No.
			PROFILE (STA.1+580-STA.1+900)		



VERTICAL ALIGNMENT	PAVEMENT HEIGHT	GROUND HEIGHT	STATION	HORIZONTAL CURVATURE	SUPER-ELEVATION
10.900	10.895	10.48	+900		
		10.889	+920		
		10.880	+940		
		10.870	+960		
		10.860	+980		
		10.850	STA. 2		
		10.840	+20		
		10.830	+40		
		10.820	+60		
		10.810	+80		
		10.800	+100		
		10.794	BC-3-0		
		10.790	+120		
		10.780	+140		
		10.770	+160		
		10.760	+180		
		10.750	+200		
		10.740	+220		
		10.730	+240		

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : PROFILE (STA. 1+900-STA. 2+220)	SCALE	Drawing No.
				H=1:1000 V=1:100	Sheet No. PR- 7



Drawing No.
Sheet No.
PR- 8

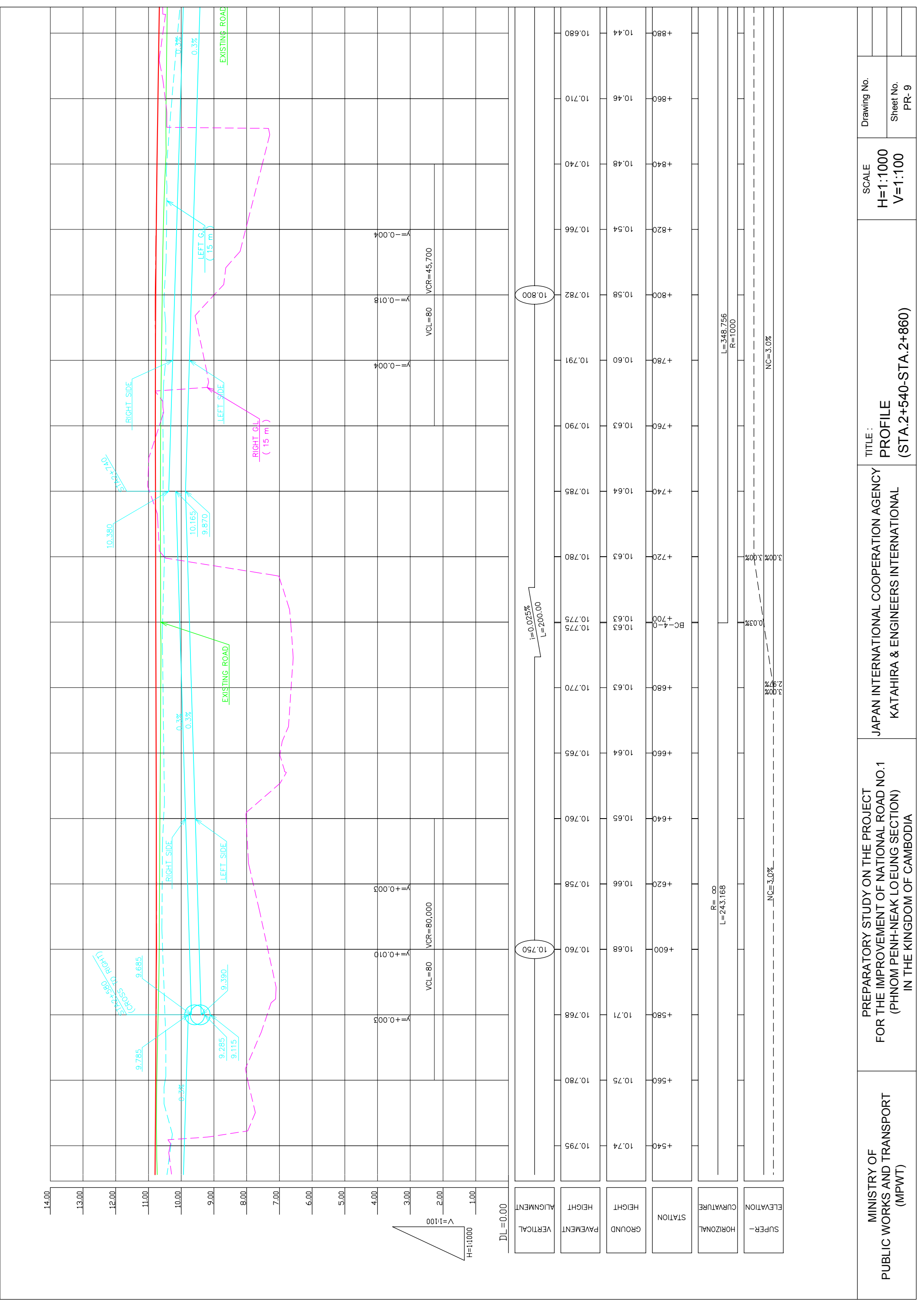
SCALE
H=1:1000
V=1:100

TITLE :
PROFILE
(STA.2+220-STA.2+540)

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

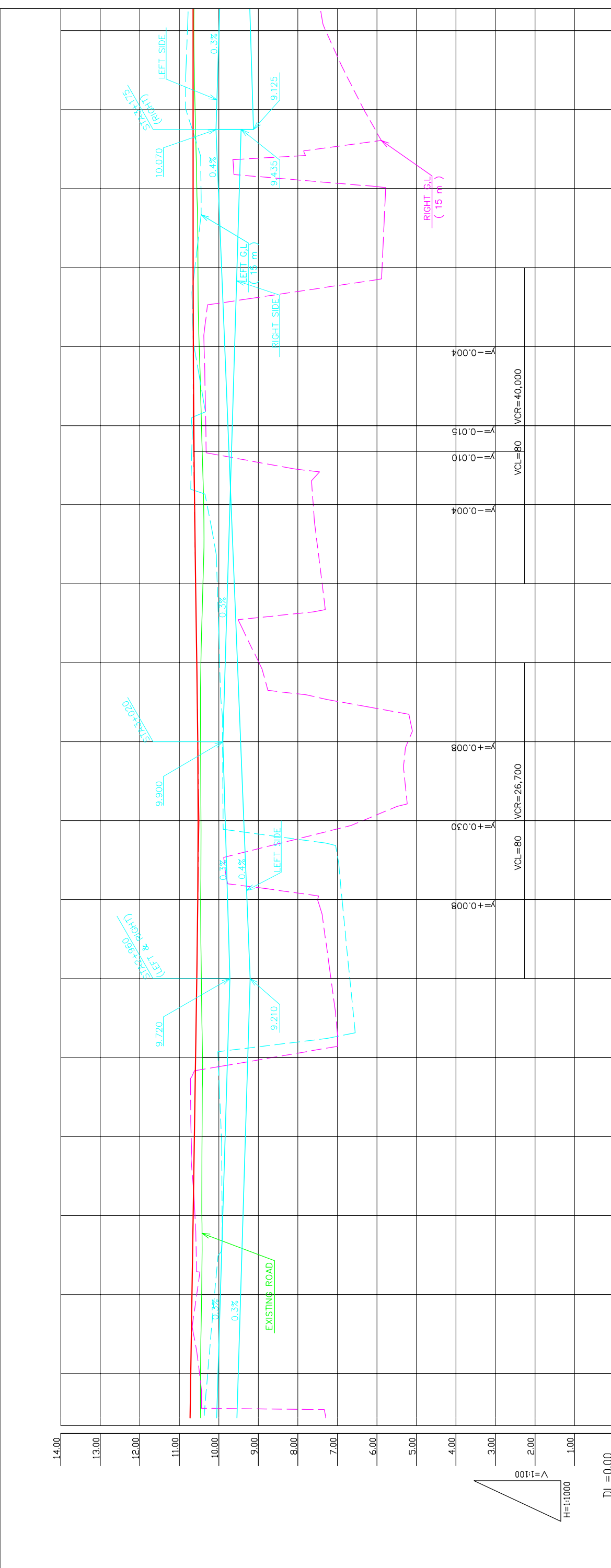
PREPARATORY STUDY ON THE PROJECT
FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1
(PHNOM PENH-NEAK LOEUNG SECTION)
IN THE KINGDOM OF CAMBODIA

MINISTRY OF
PUBLIC WORKS AND TRANSPORT
(MPWT)



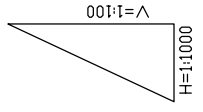
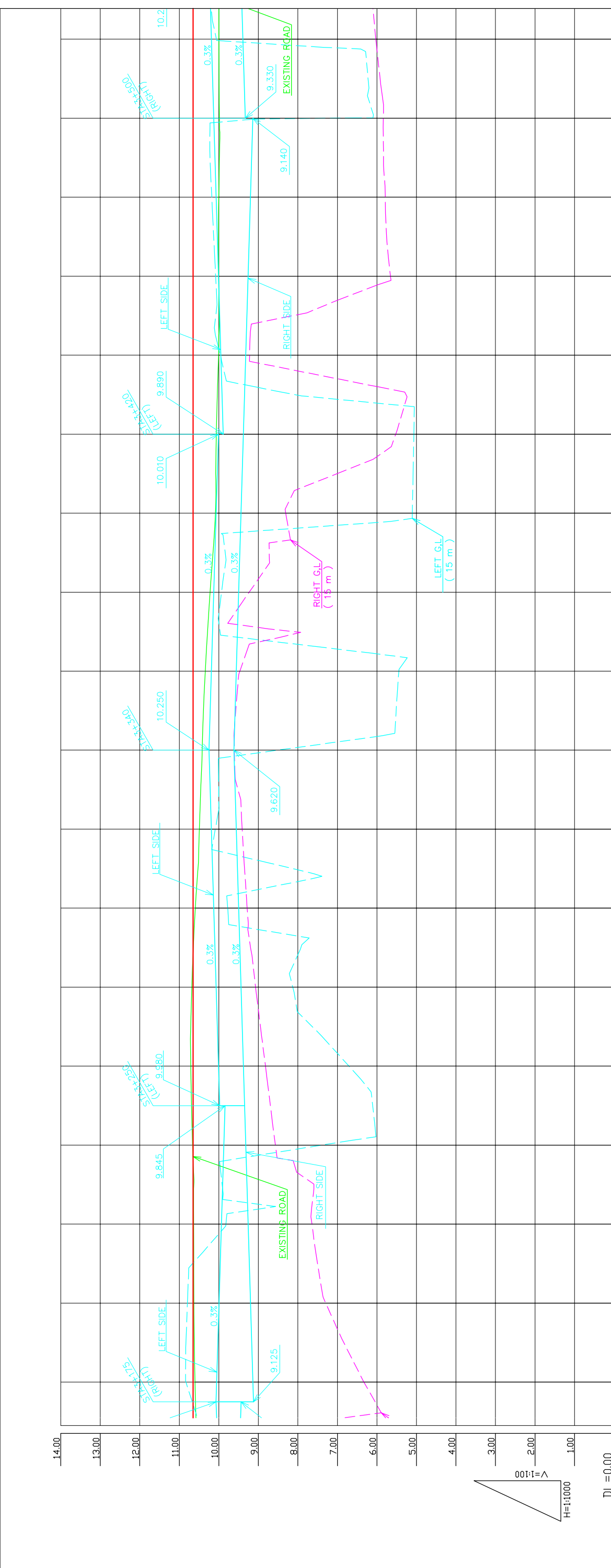
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : PROFILE (STA.2+540-STA.2+860)	SCALE	Drawing No.
				H=1:1000 V=1:100	Sheet No. PR- 9

SUPER-	10.780	10.782	10.784	10.786	10.788	10.790	10.792	10.794	10.796	10.798	10.800	10.802	10.804	10.806	10.808
ELEVATION	10.780	10.782	10.784	10.786	10.788	10.790	10.792	10.794	10.796	10.798	10.800	10.802	10.804	10.806	10.808
HORIZONTAL															
STATION															
HEIGHT															
PAVEMENT															
ALIGNMENT															
VERTICAL															



VERTICAL ALIGNMENT	PAVEMENT HEIGHT	GROUND HEIGHT	STATION	HORIZONTAL CURVATURE	SUPER-ELEVATION
10.710	10.46	10.44	+860		
10.680	10.44	10.44	+880		
10.650	10.43	10.43	+900		
10.620	10.43	10.43	+920		
10.590	10.41	10.41	+940	$L=348.756$ $R=1000$	$NC=3.0\%$
10.560	10.44	10.44	+960		
10.538	10.46	10.46	+980		
10.530	10.46	10.46	STA. 3		
10.538	10.46	10.46	+20		
10.560	10.45	10.45	+40		
10.572	10.43	10.43	EC-4-0		
10.590	10.40	10.40	+60		
10.616	10.39	10.39	+80	$R=\infty$ $L=44.891$	$NC=3.0\%$
10.630	10.42	10.42	KA-5-1		
10.635	10.44	10.44	+100		
10.646	10.50	10.50	+120	$L=64.800$ $A=180$	$NC=4.0\%$ $NC=4.0\%$
10.650	10.55	10.55	KE-5-1		
10.650	10.56	10.56	+160		
10.650	10.60	10.60	+180		
10.650	10.63	10.63	+200	$L=567.044$ $R=500$	

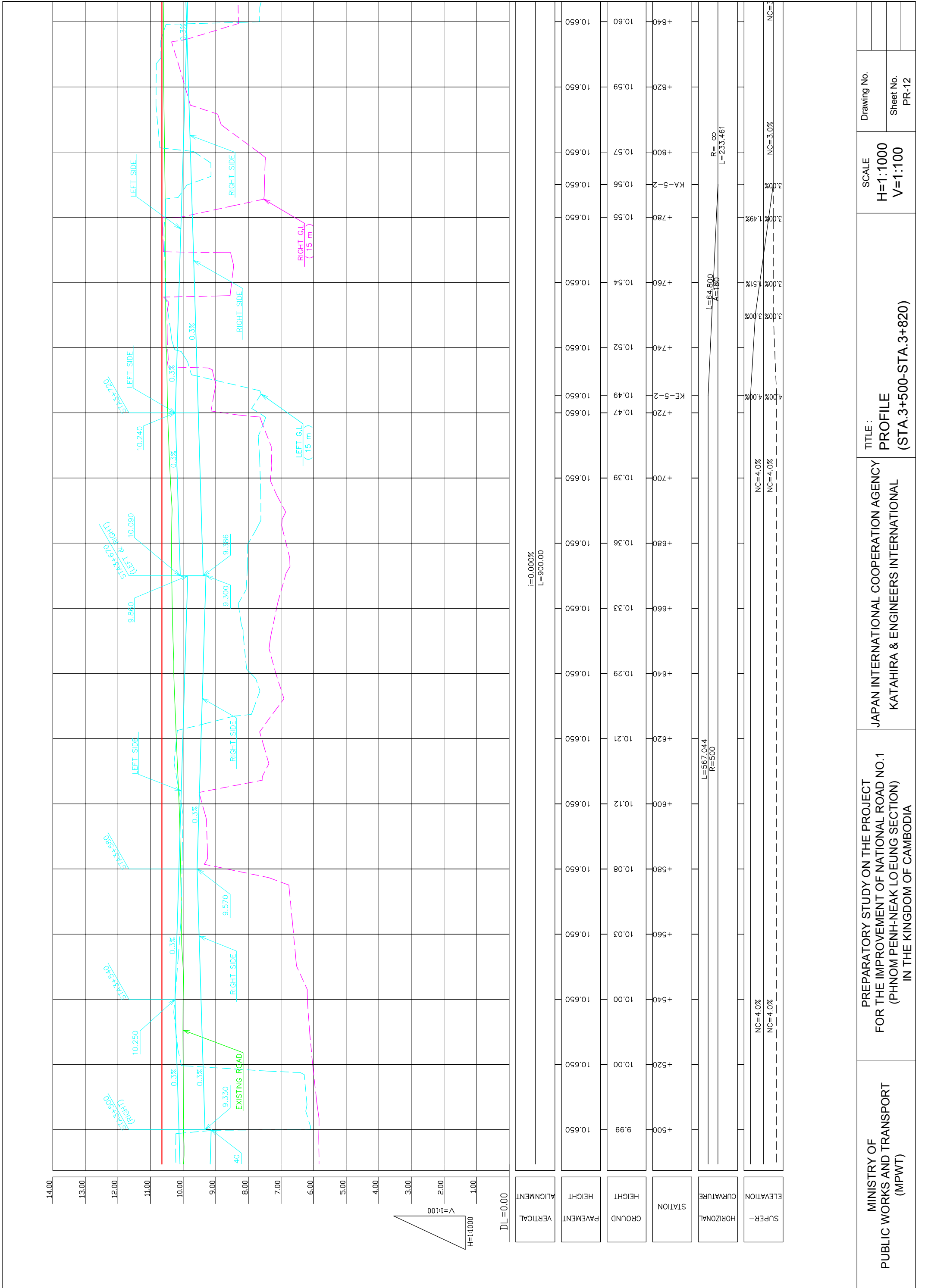
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : PROFILE (STA.2+860-STA.3+180)	SCALE H=1:1000 V=1:100	Drawing No. Sheet No. PR-10
---	--	---	---------------------------------------	------------------------	-----------------------------



DL=0.00

VERTICAL ALIGNMENT	i=0.000% L=900.00	
PAVEMENT HEIGHT	10.650	10.650
GROUND HEIGHT	10.60	10.63
STATION	+180	+200
HORIZONTAL CURVATURE	L=567.044 R=500	
SUPER-ELEVATION	NC=4.0% NC=4.0%	

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : PROFILE (STA.3+180-STA.3+500)	SCALE	Drawing No.
				H=1:1000 V=1:100	Sheet No. PR-11



VERTICAL ALIGNMENT	I=0.000% L=900.00	
PAVEMENT HEIGHT	10.650	10.650
GROUND HEIGHT	9.99	10.60
STATION	+500	+840
HORIZONTAL CURVATURE	L=567.044 R=500	L=64.800 A=180 R=∞ L=233.461
SUPER-ELEVATION	NC=4.0% NC=4.0%	NC=3.0% NC=3.0%

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)

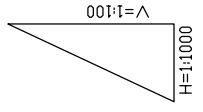
PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL

TITLE : PROFILE (STA.3+500-STA.3+820)

SCALE H=1:1000 V=1:100

Drawing No. Sheet No. PR-12



DL=0.00

VERTICAL ALIGNMENT	10.650									
PAVEMENT HEIGHT	10.650	10.650	10.650	10.650	10.650	10.650	10.650	10.650	10.650	10.650
GROUND HEIGHT	10.59	10.66	10.72	10.75	10.77	10.70	10.61	10.59	10.60	10.59
STATION	STA.4	+980	+960	+940	+920	+900	+880	+860	+840	+820
HORIZONTAL CURVATURE	R=∞ L=233.461									
SUPER-ELEVATION	NC=3.0%					NC=3.0%				

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)

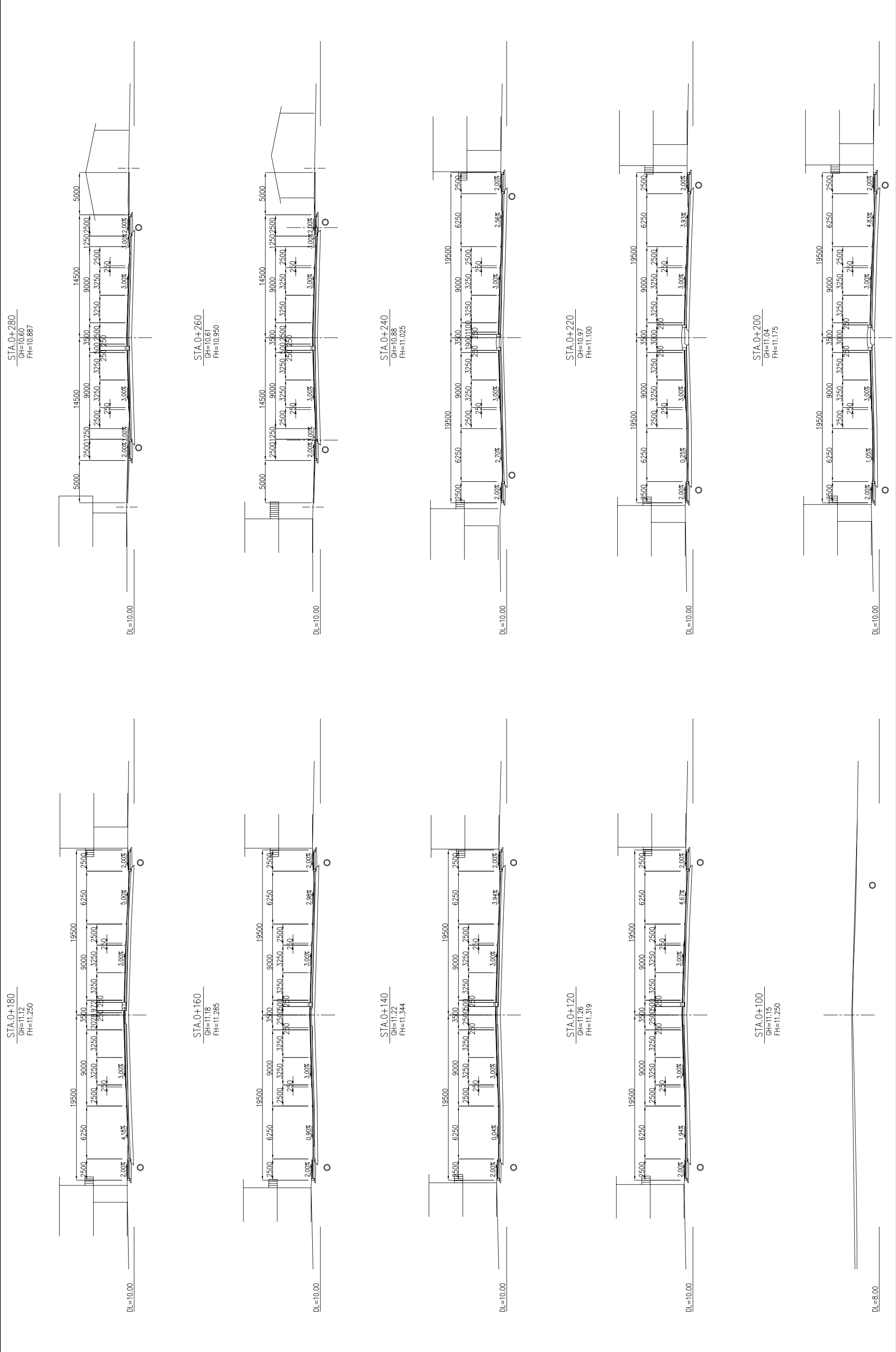
PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL

TITLE: PROFILE (STA.3+820-STA.4+00)

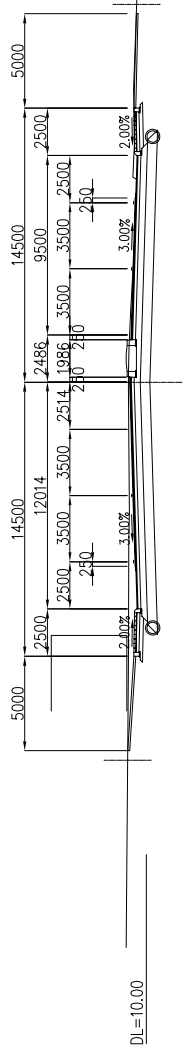
SCALE H=1:1000 V=1:100

Drawing No. Sheet No. PR-13



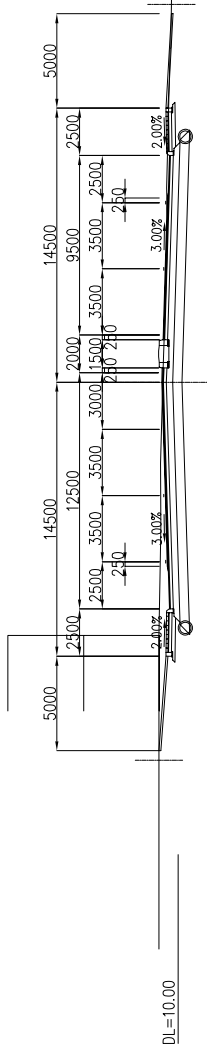
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : CROSS SECTION (STA.0+100-STA.0+280)	
			SCALE 1/200	Drawing No. Sheet No. CS- 1

STA.0+380
GH=10.84
FH=10.860



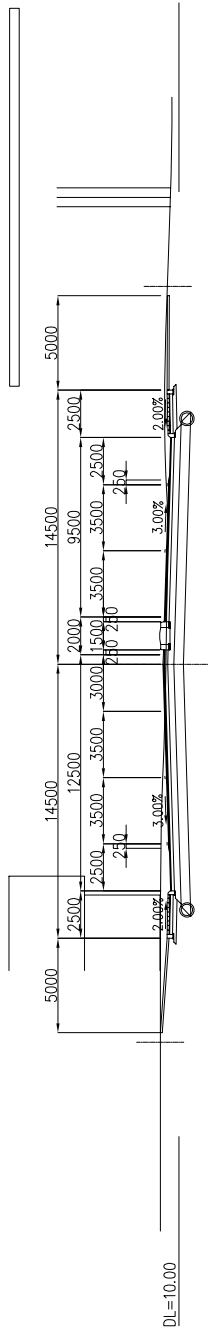
DL=10.00

STA.0+360
GH=10.81
FH=10.860



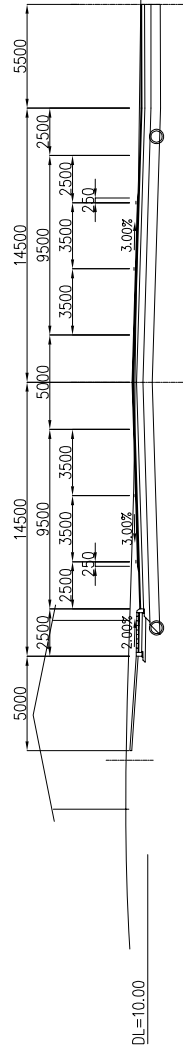
DL=10.00

STA.0+340
GH=10.69
FH=10.840



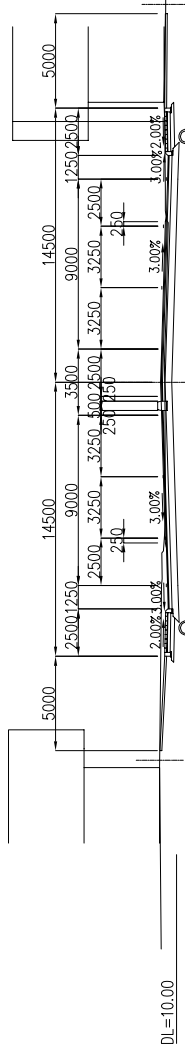
DL=10.00

STA.0+320
GH=10.68
FH=10.832



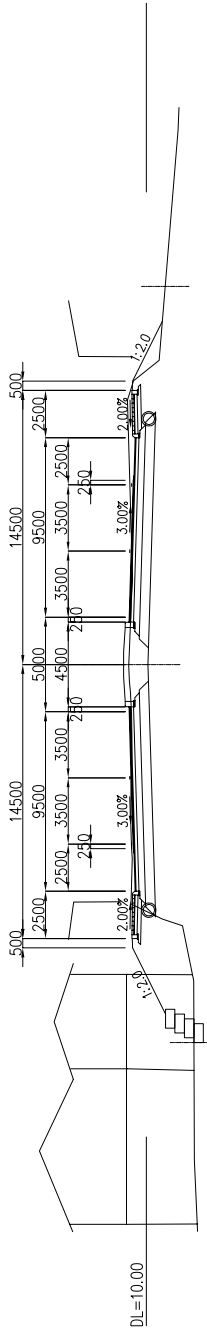
DL=10.00

STA.0+300
GH=10.63
FH=10.848



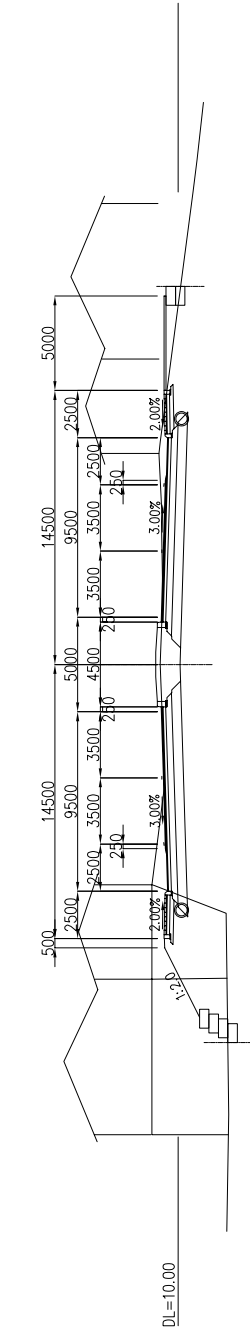
DL=10.00

STA.0+480
GH=10.92
FH=10.960



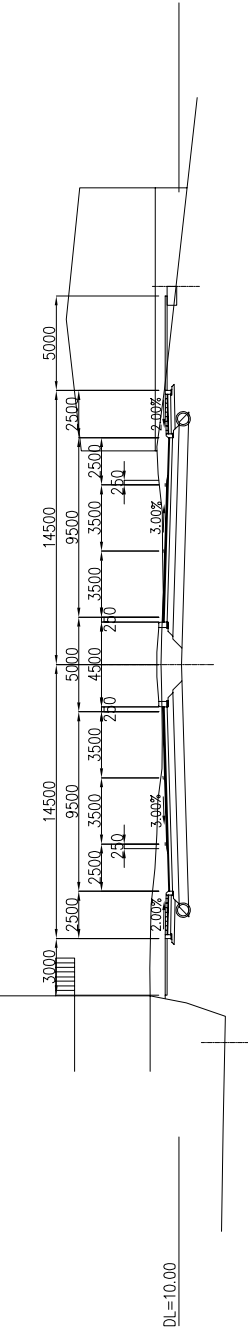
DL=10.00

STA.0+460
GH=10.94
FH=10.960



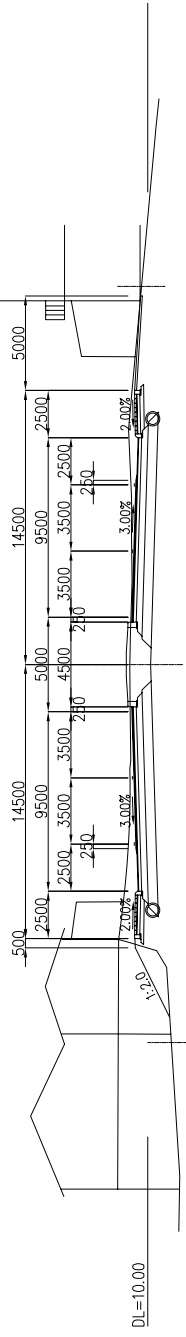
DL=10.00

STA.0+440
GH=10.96
FH=10.940



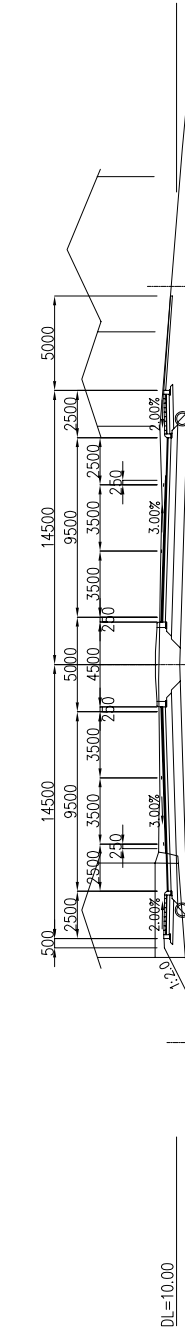
DL=10.00

STA.0+420
GH=10.95
FH=10.920



DL=10.00

STA.0+400
GH=10.94
FH=10.900



DL=10.00

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PUBLIC WORKS AND TRANSPORT
(MPWT)

PREPARATORY STUDY ON THE PROJECT
FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1
(PHNOM PENH-NEAK LOEUNG SECTION)
IN THE KINGDOM OF CAMBODIA

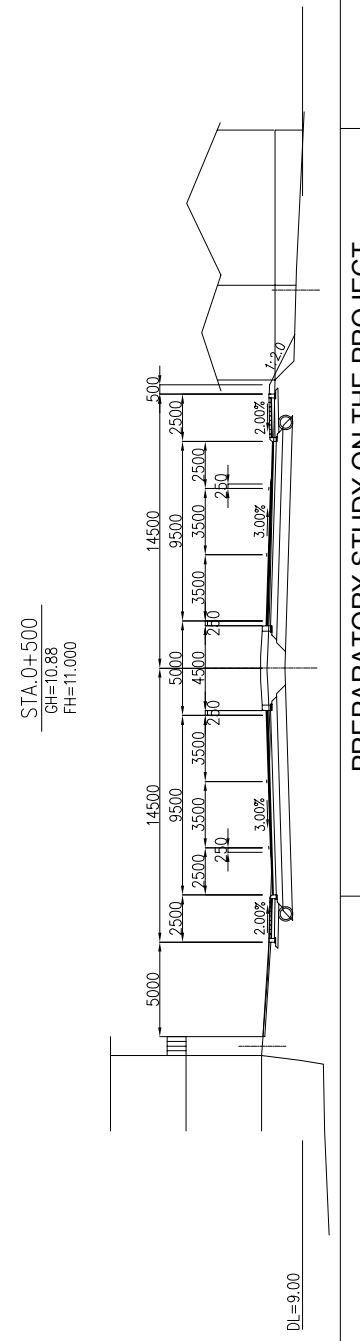
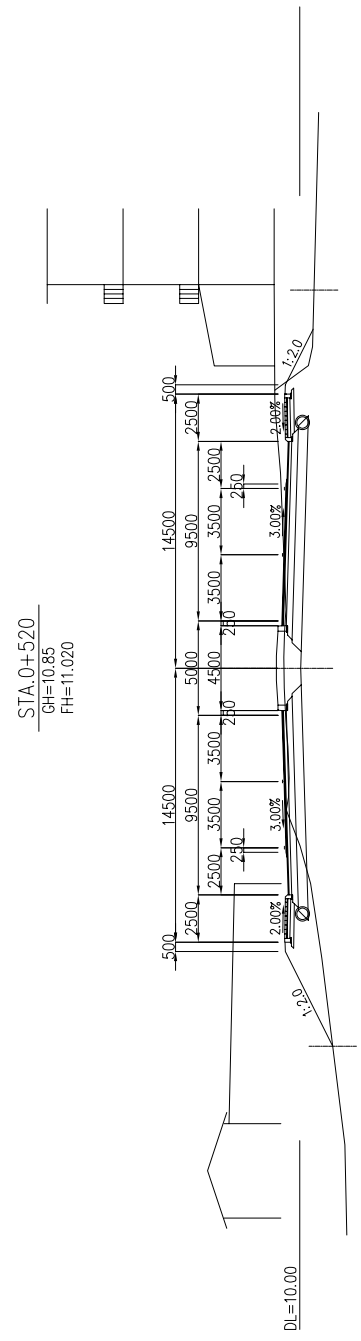
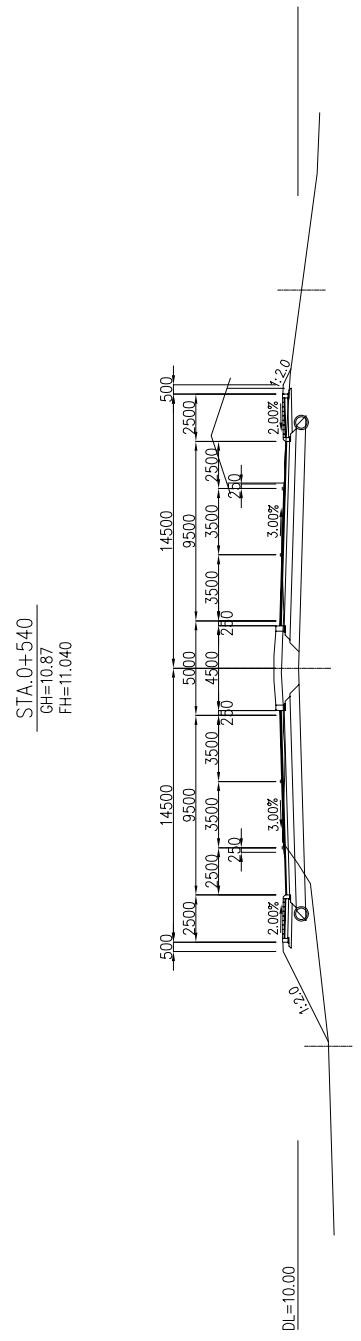
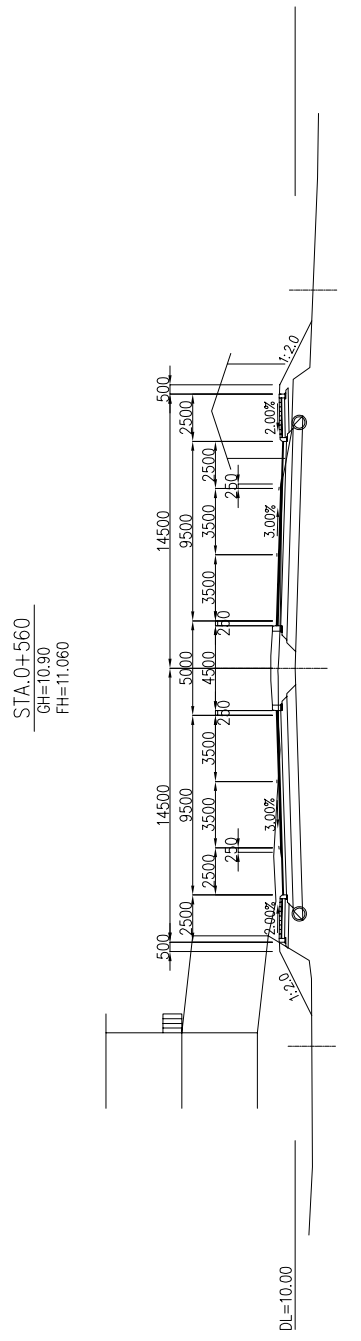
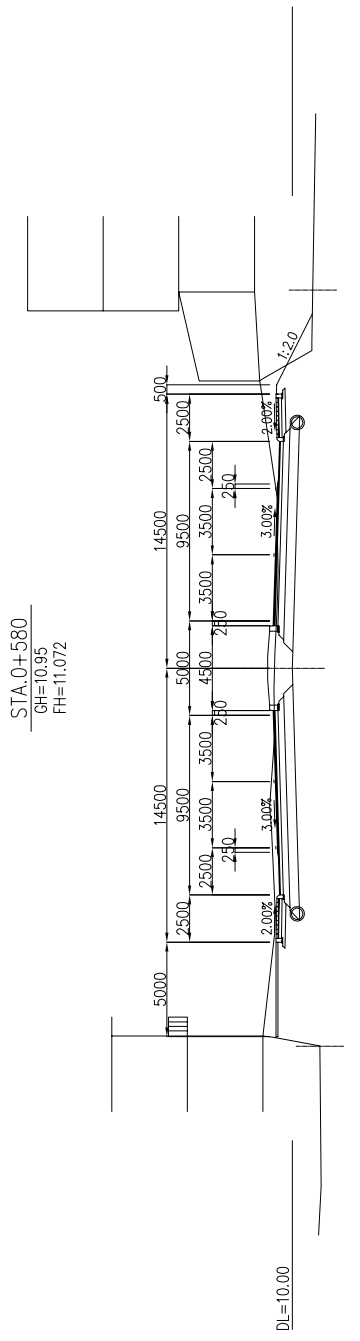
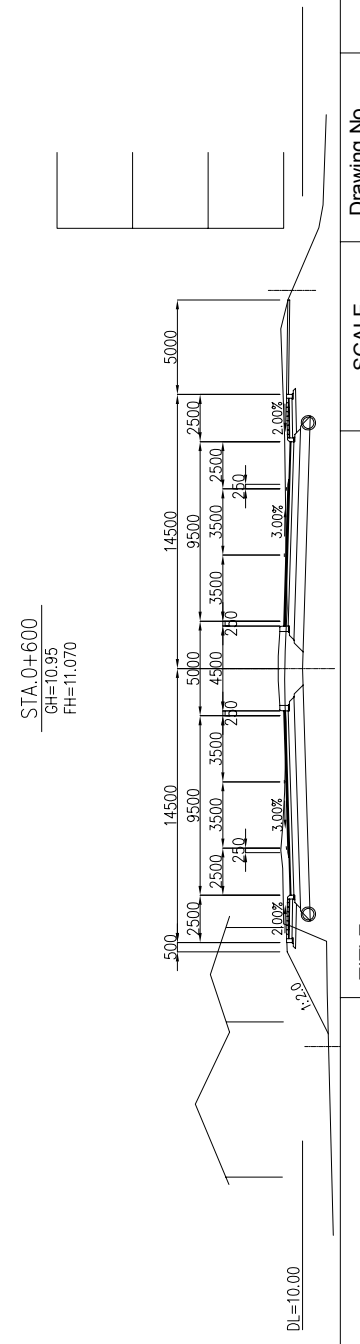
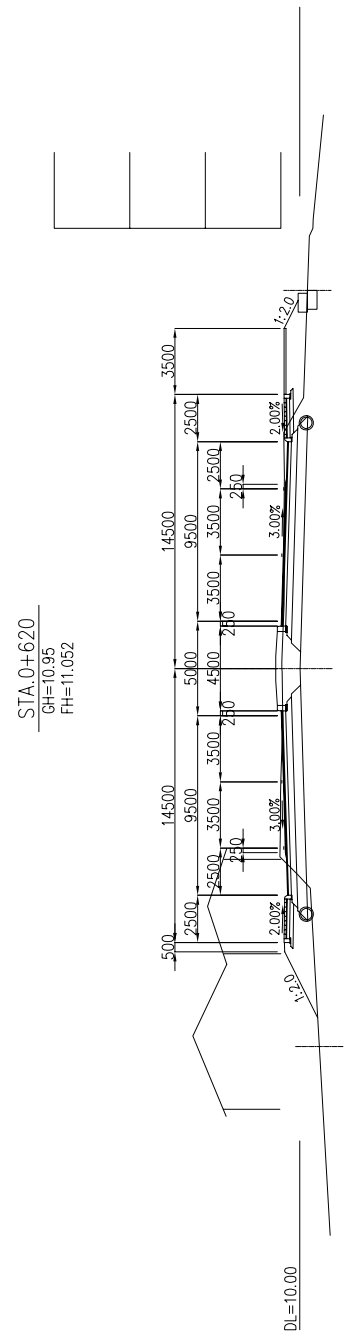
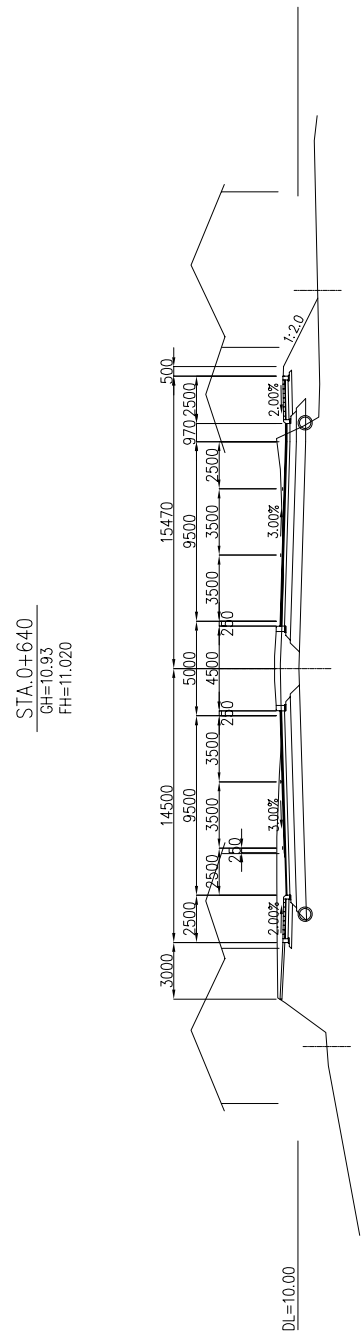
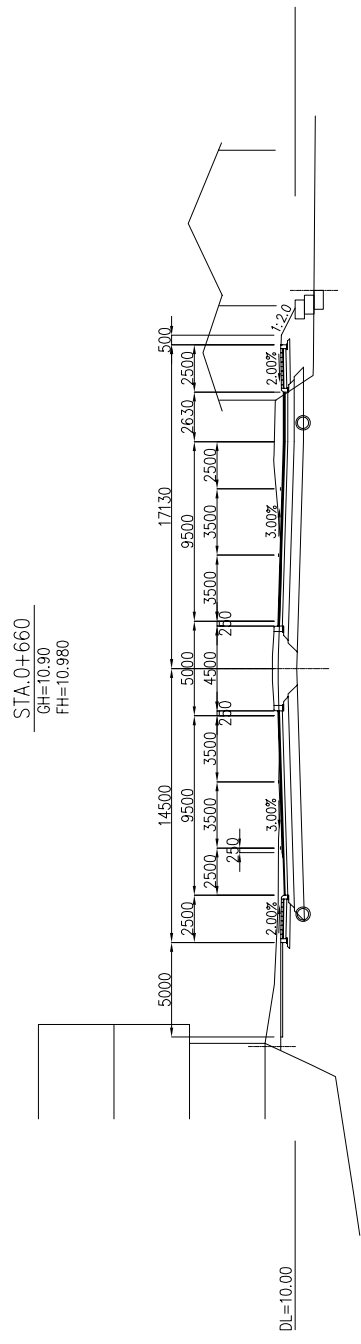
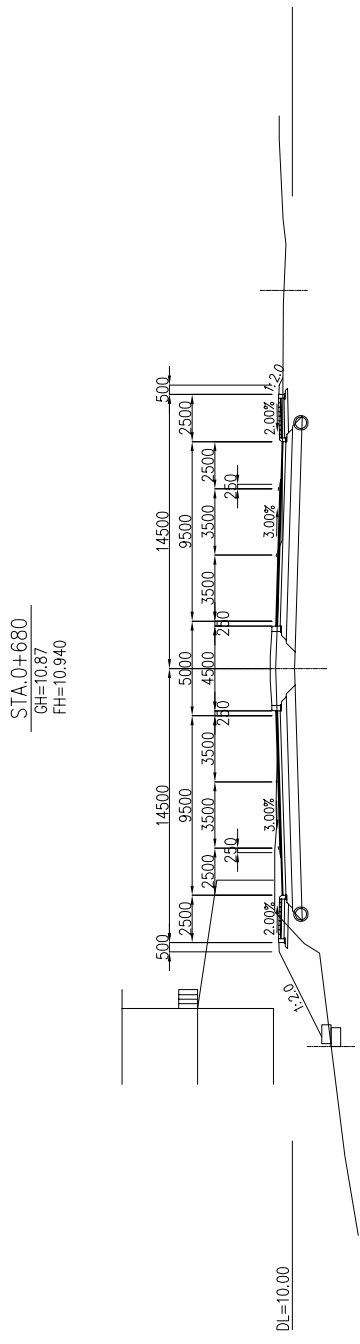
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

TITLE :
CROSS SECTION
(STA.0+300-STA.0+480)

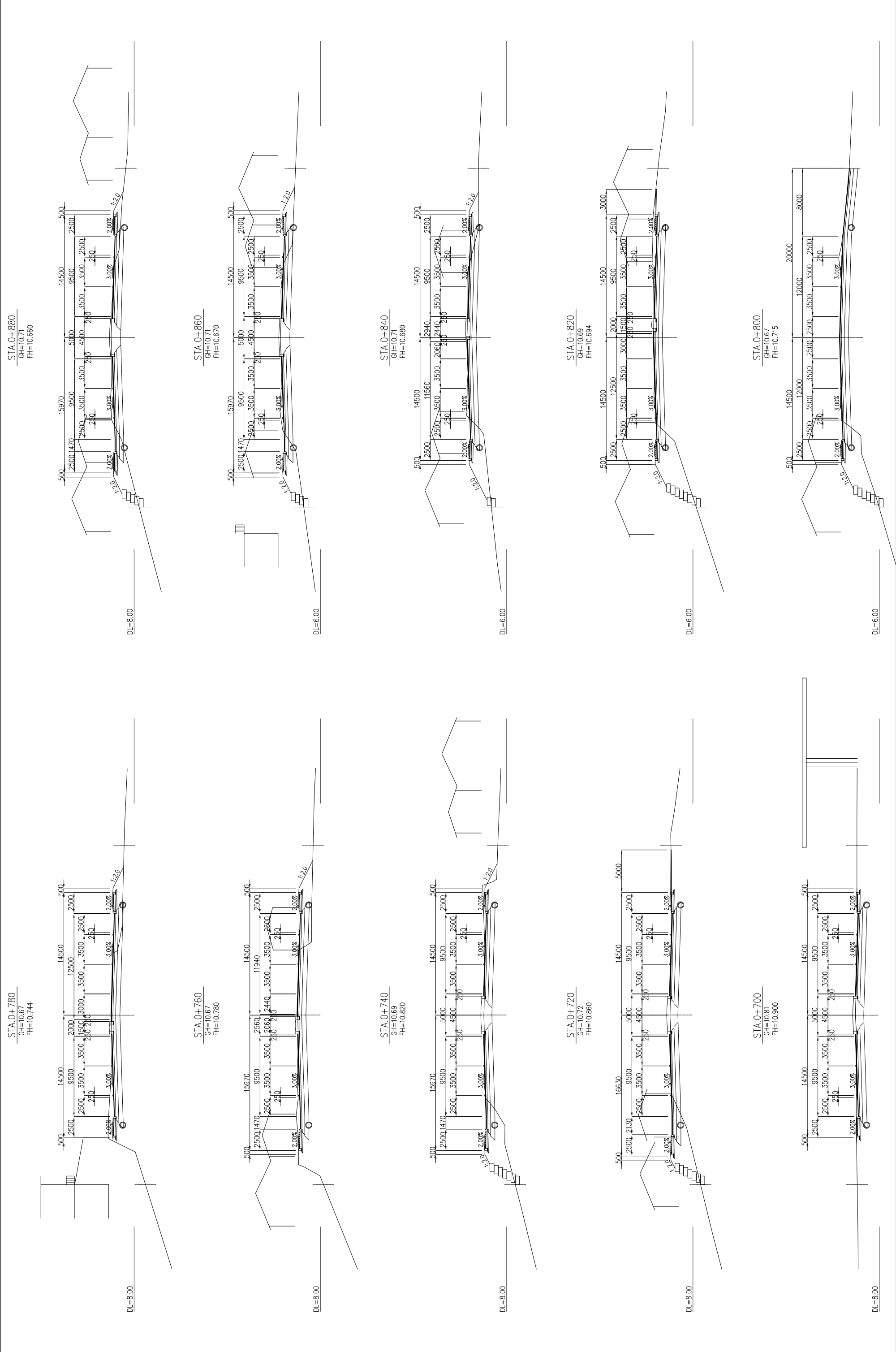
SCALE
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Drawing No.

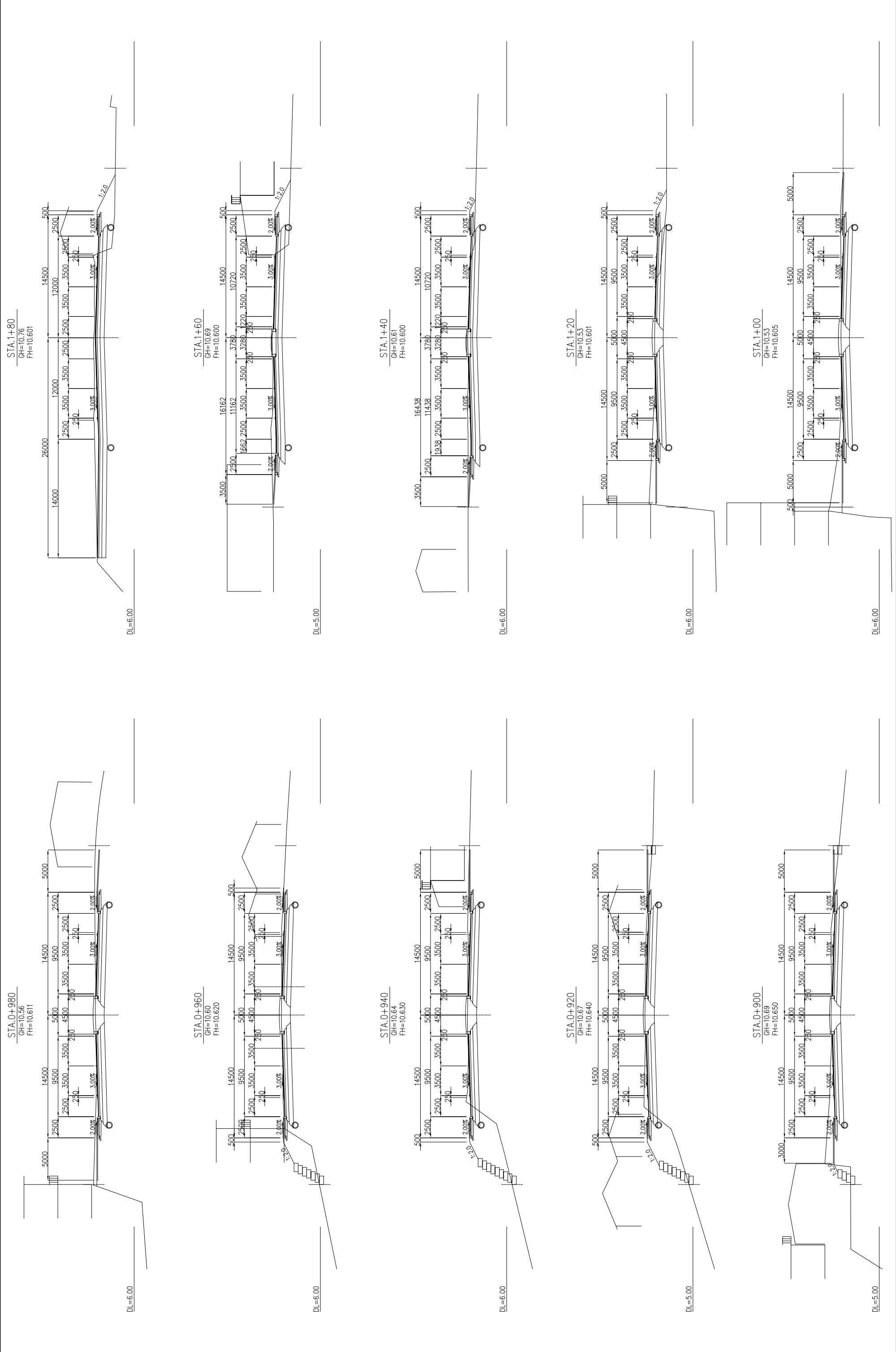
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CS- 2



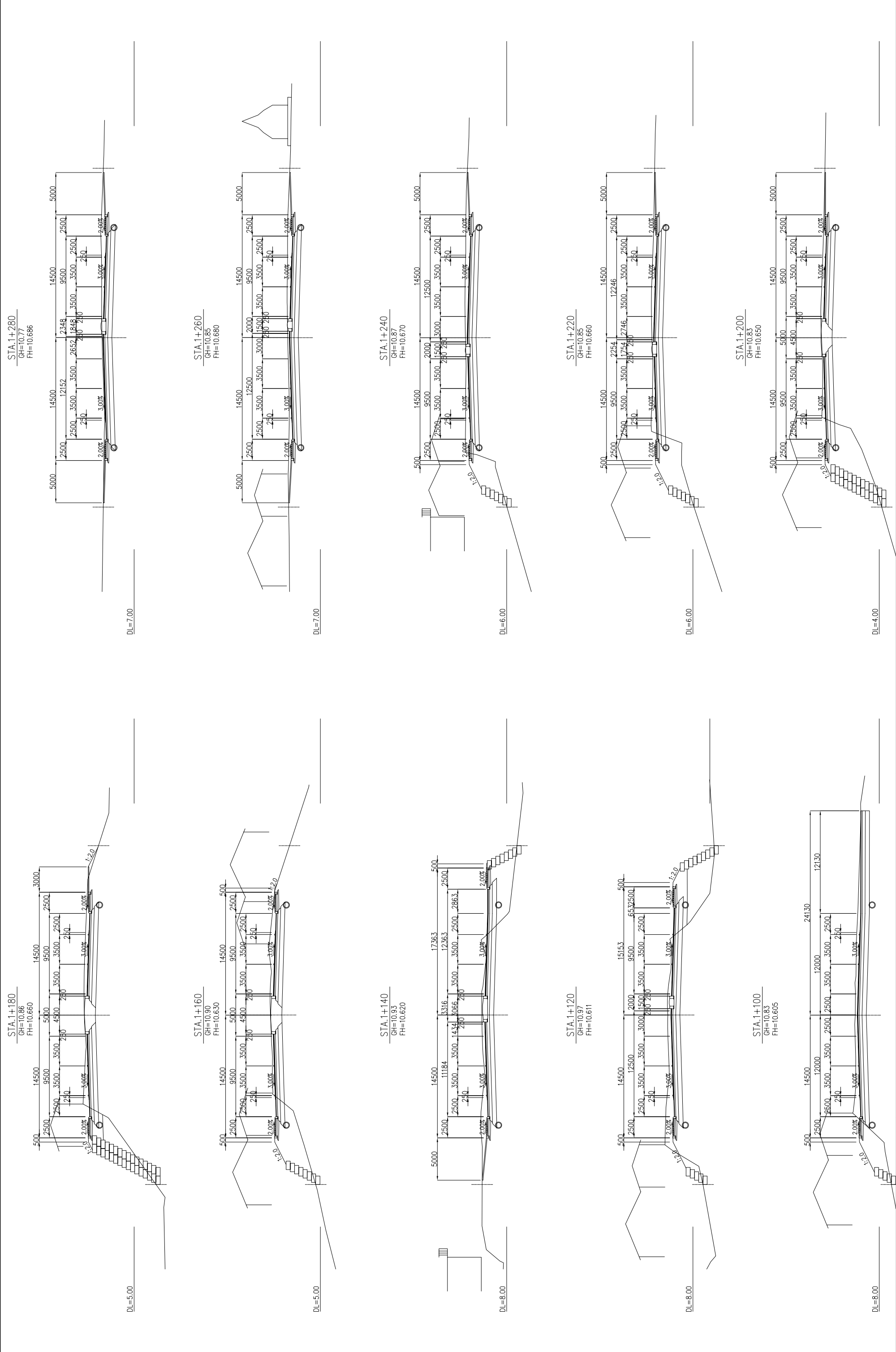
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			CROSS SECTION (STA.0+500-STA.0+680)	1/200	Sheet No. CS- 3



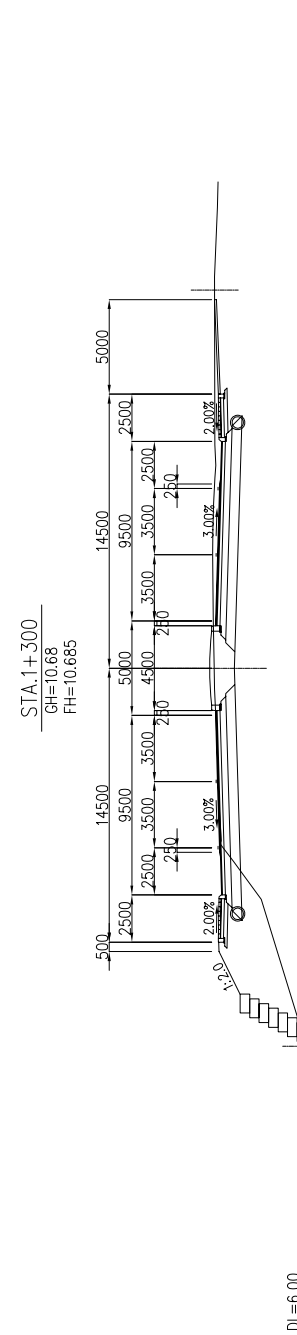
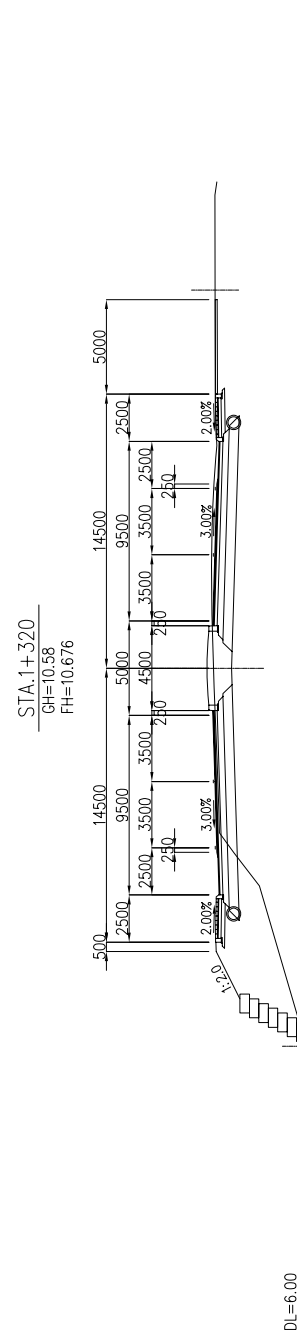
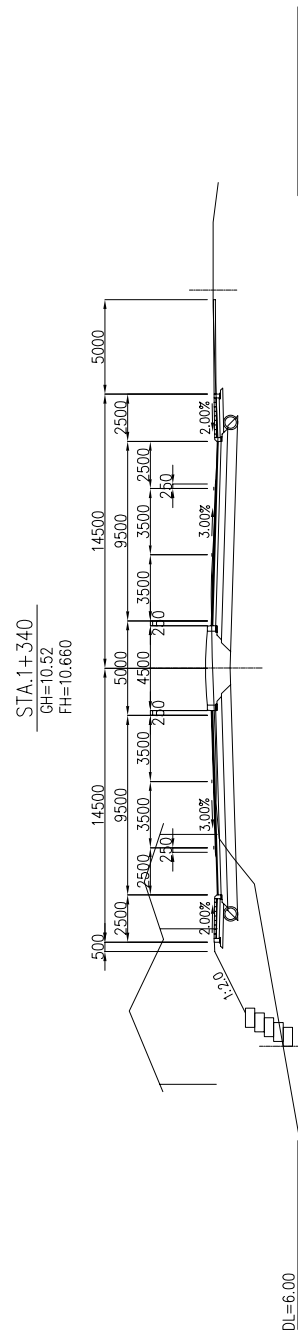
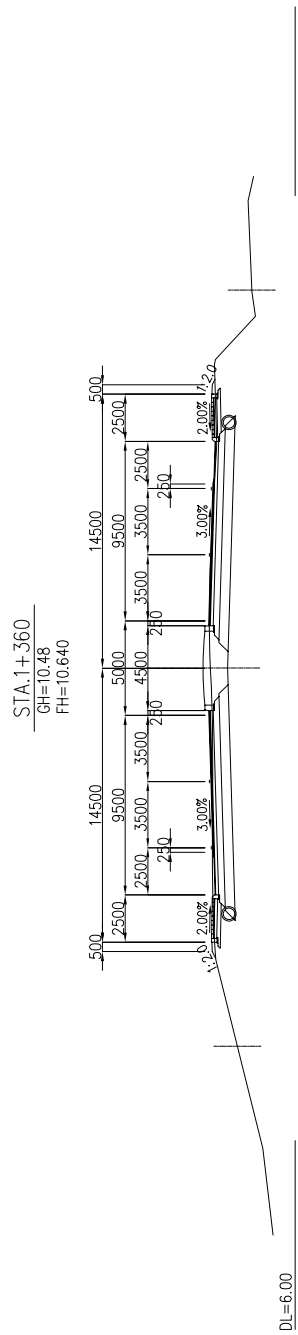
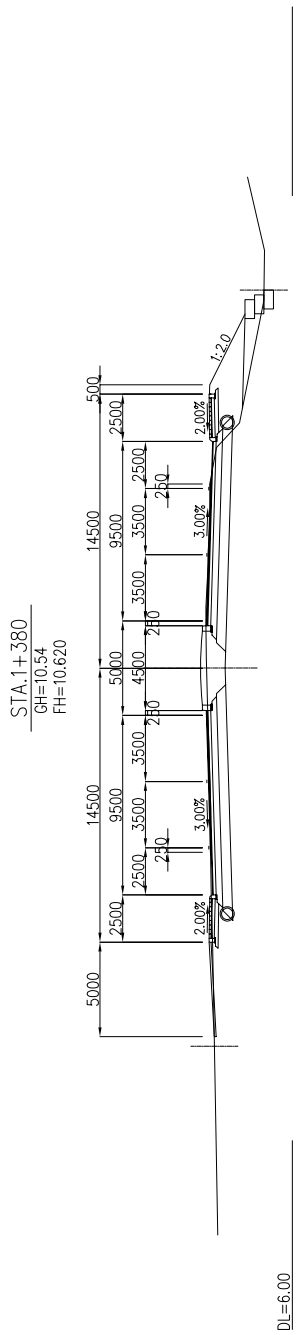
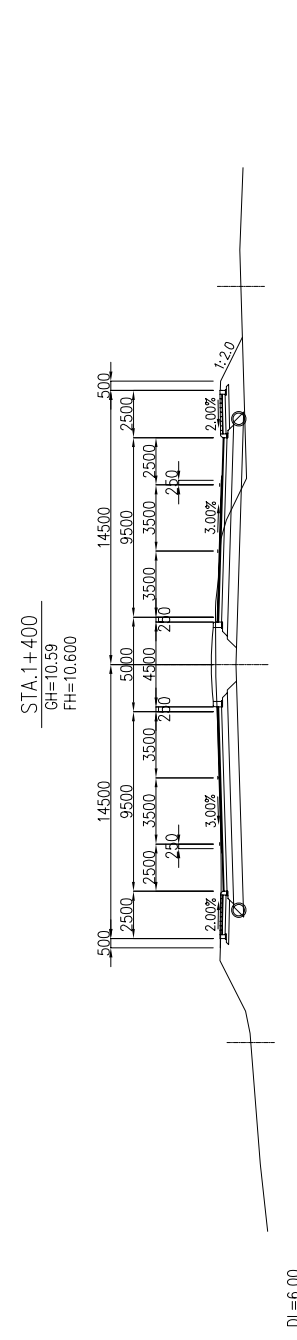
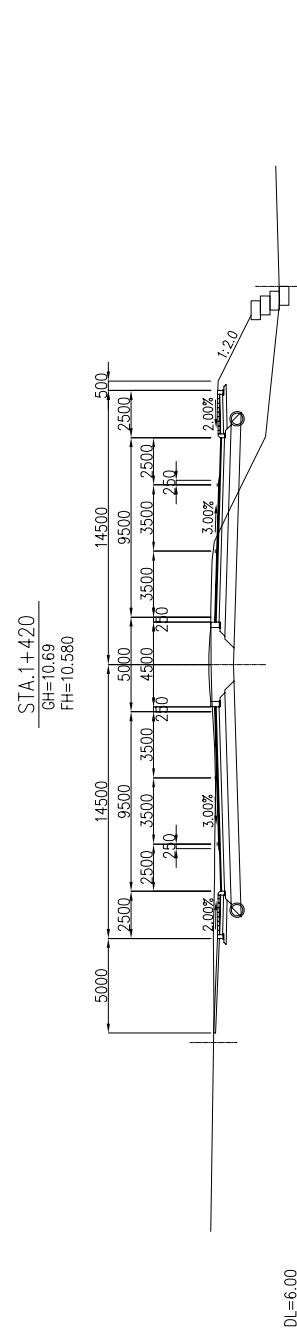
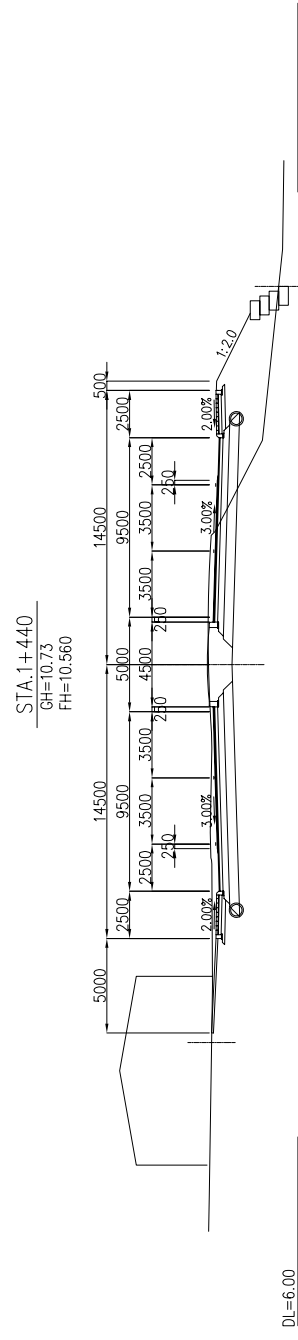
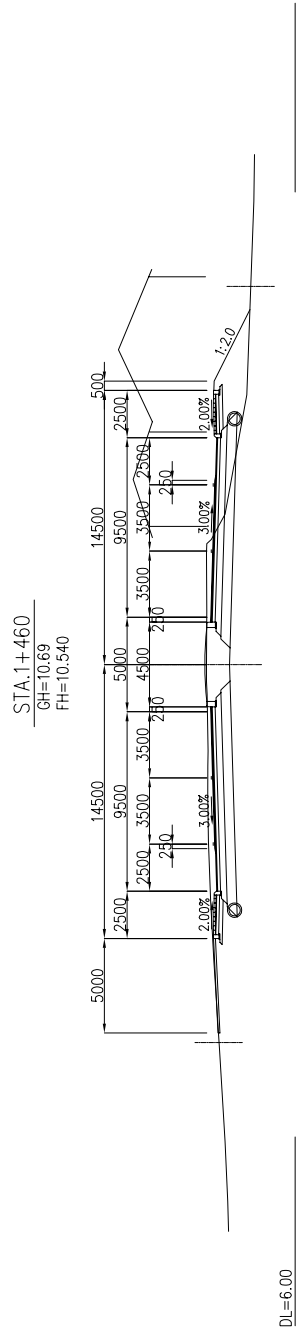
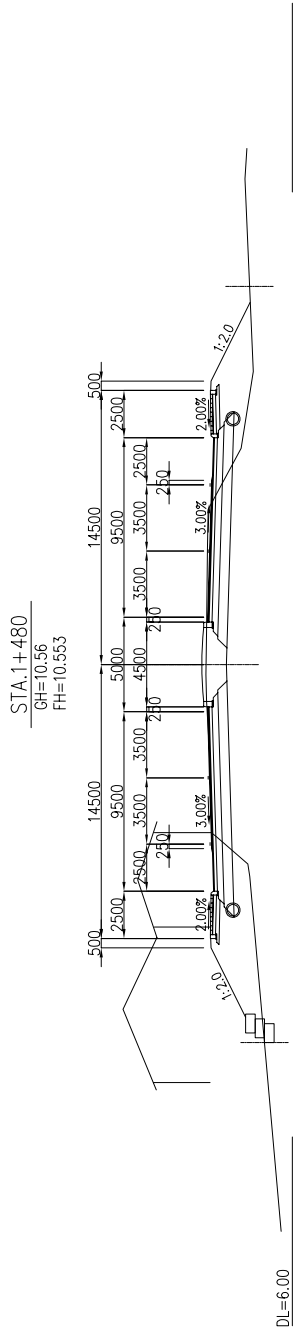
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : CROSS SECTION (STA.0+700-STA.0+880)	
			SCALE 1/200	Drawing No. Sheet No. CS- 4



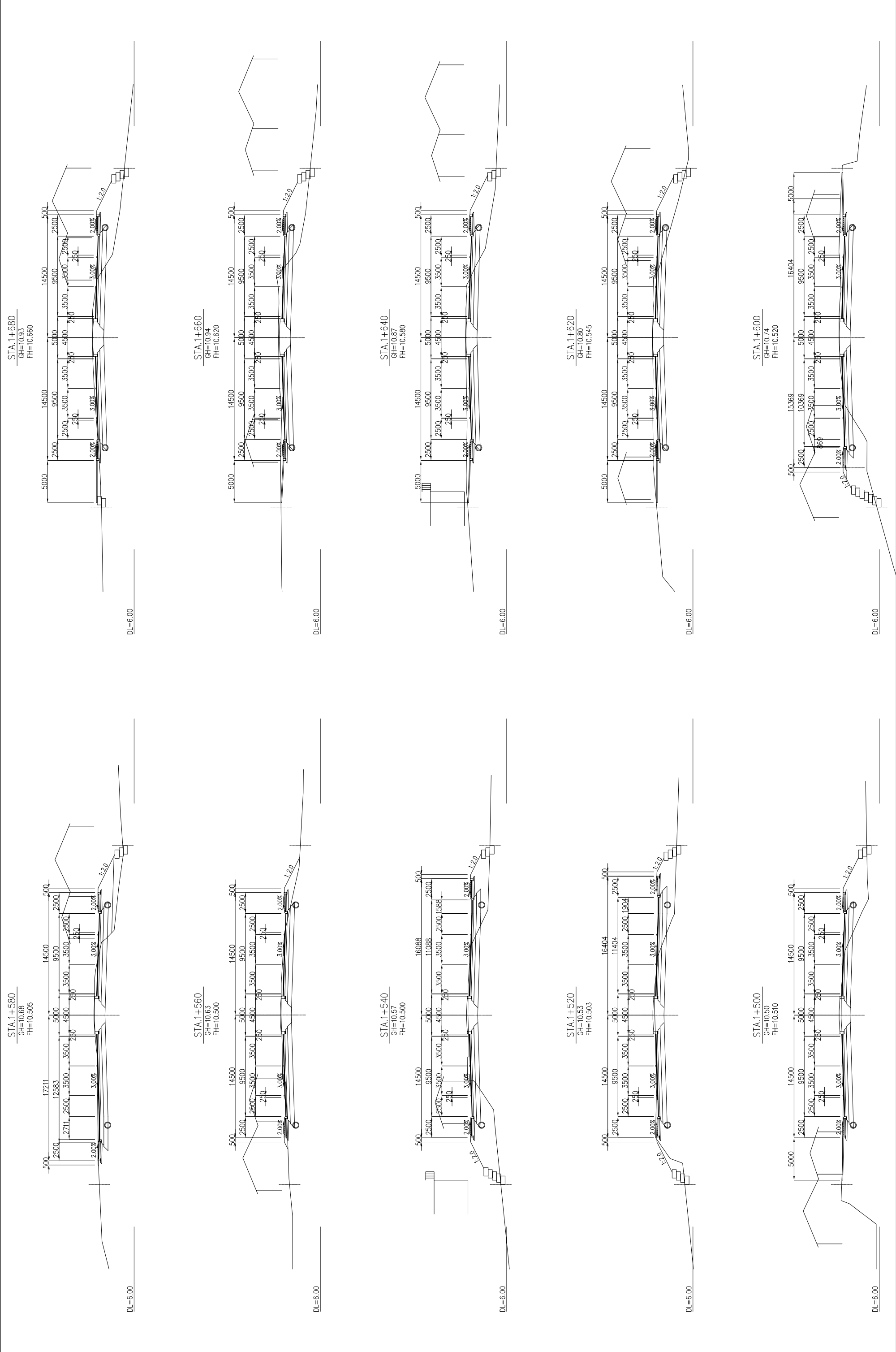
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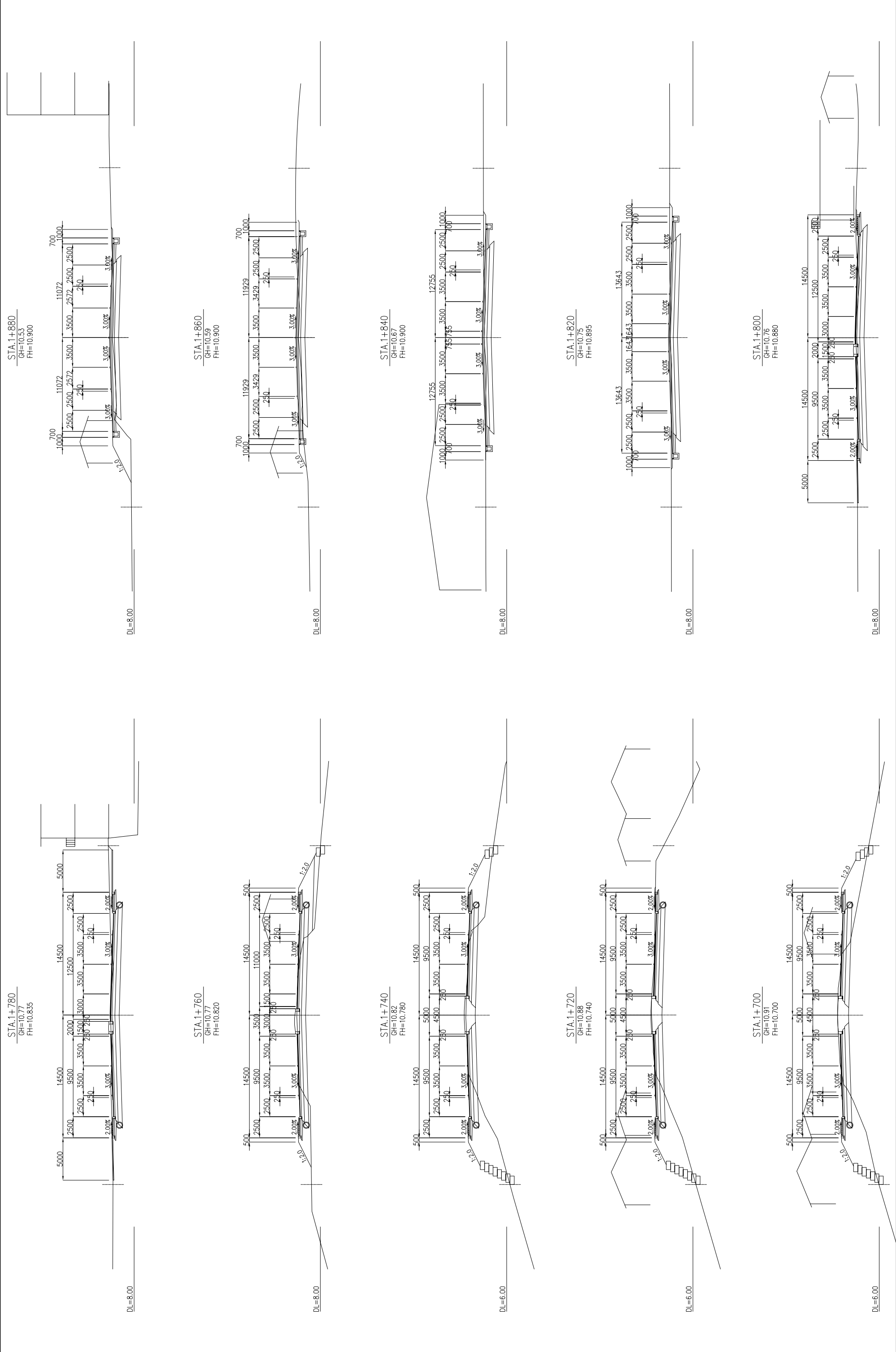
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	Sheet No. CS- 6						



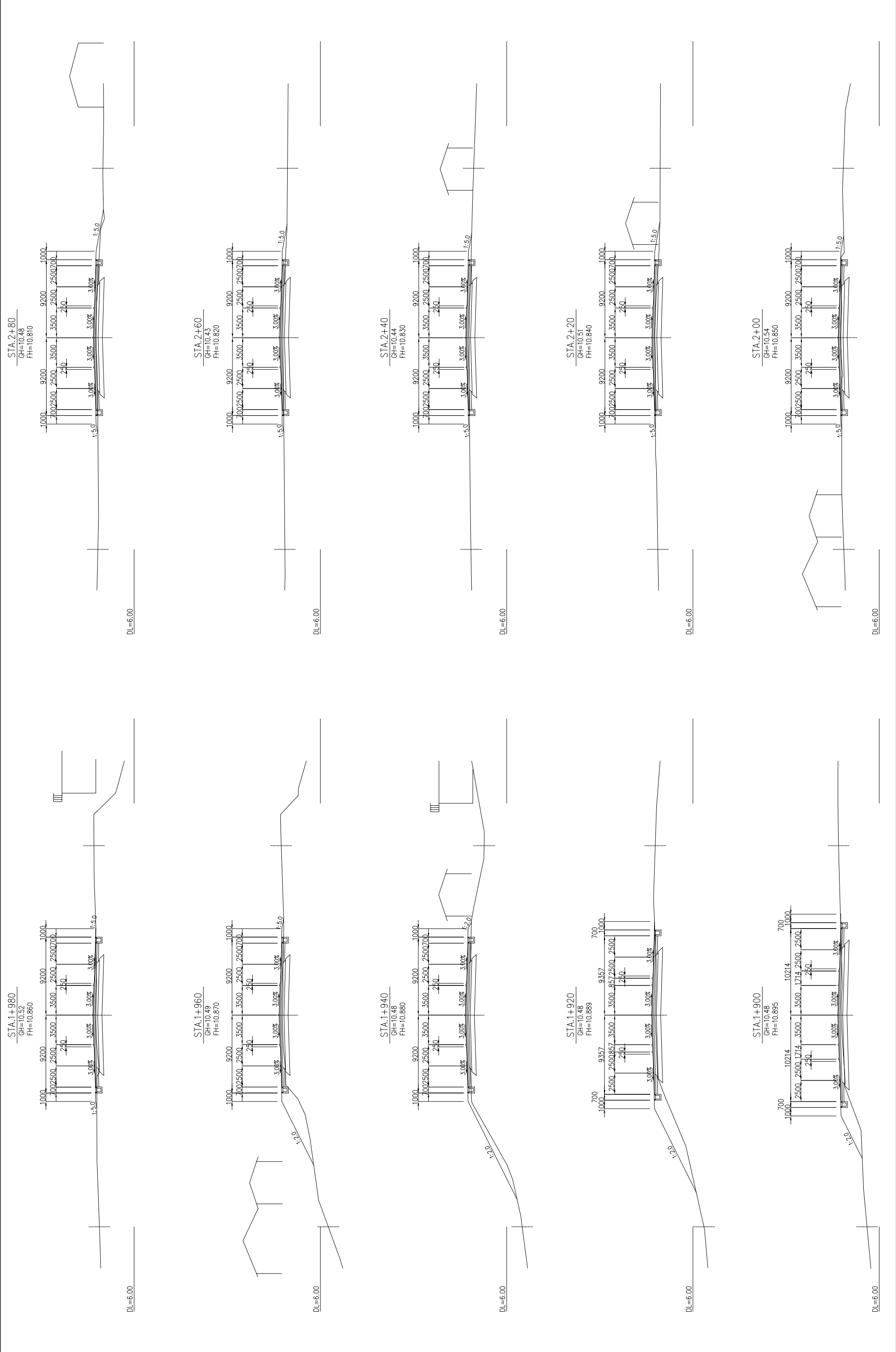
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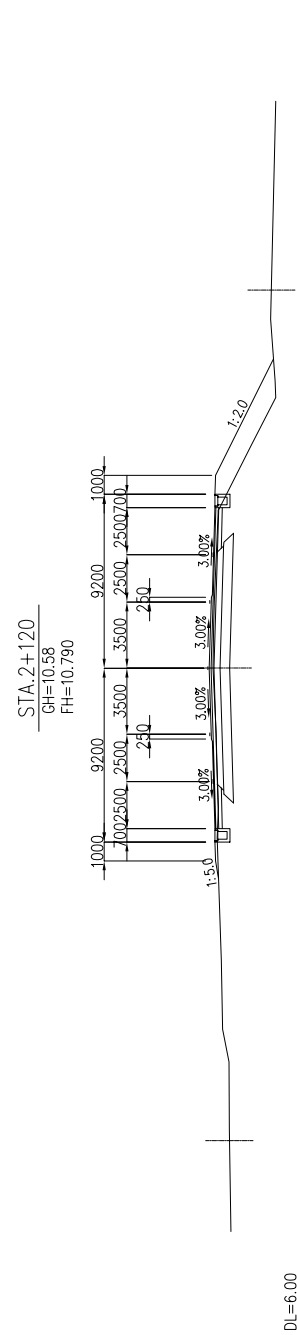
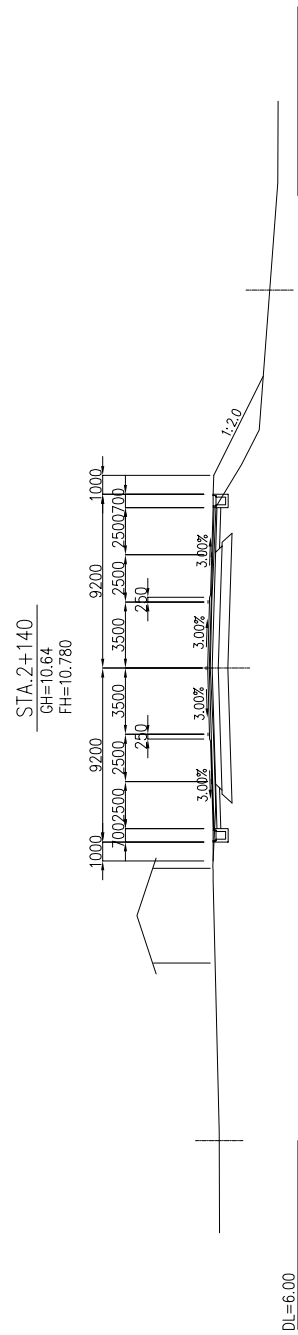
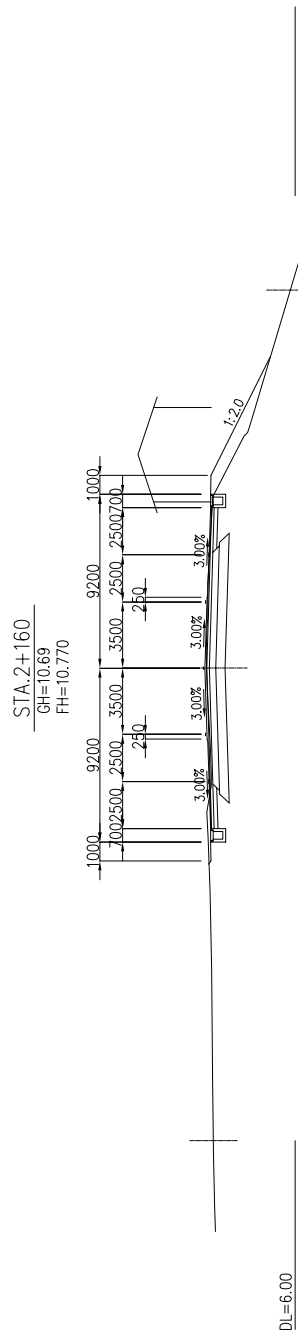
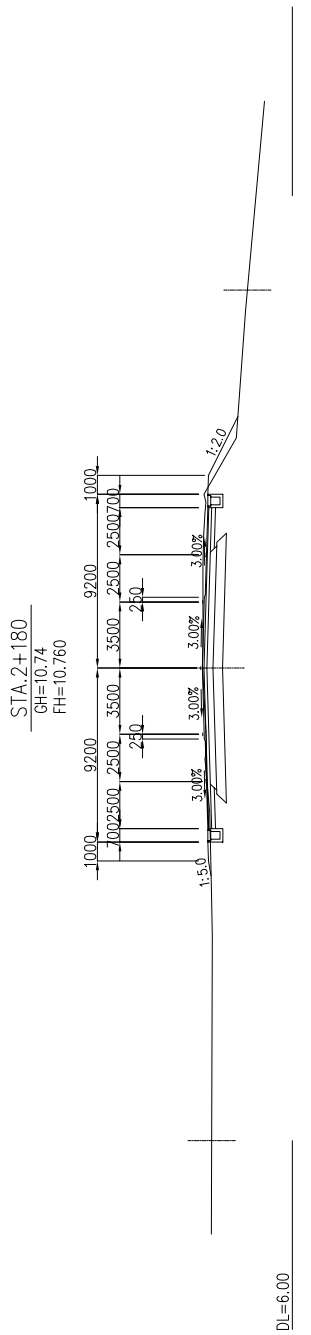
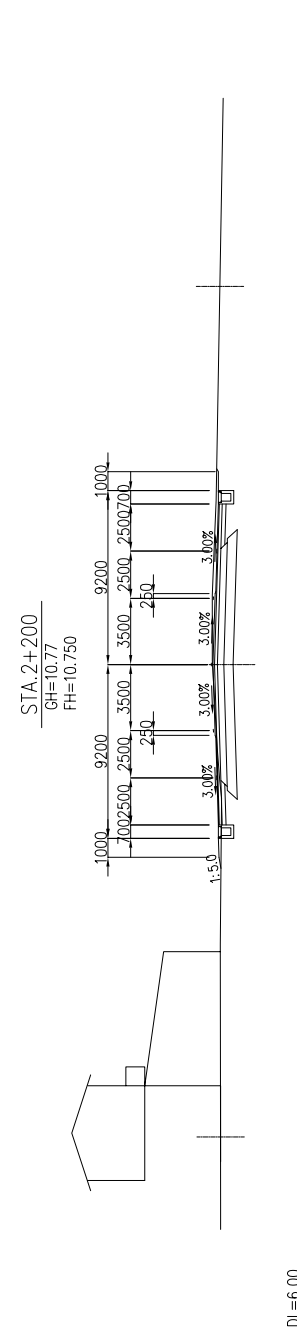
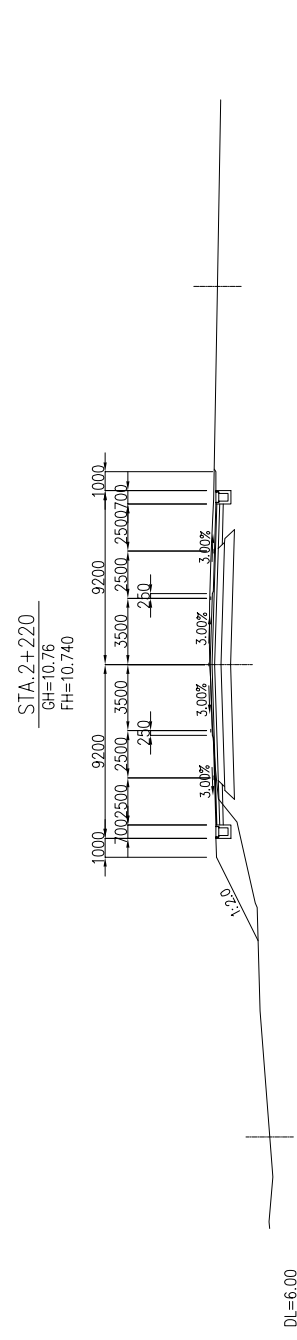
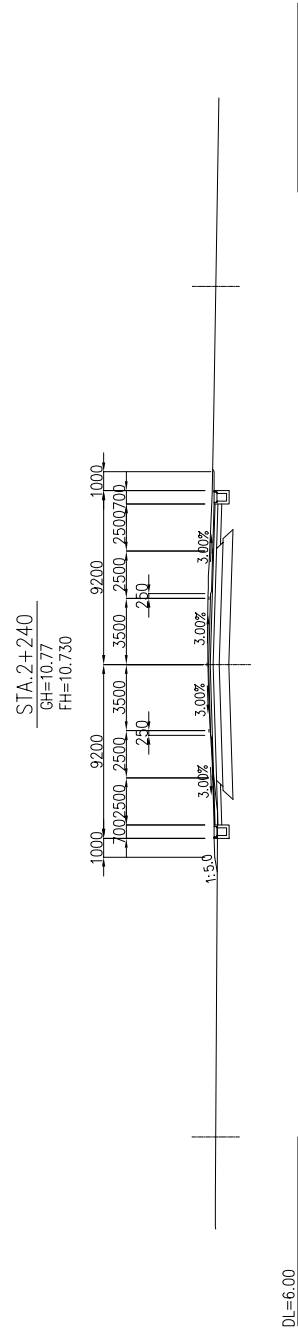
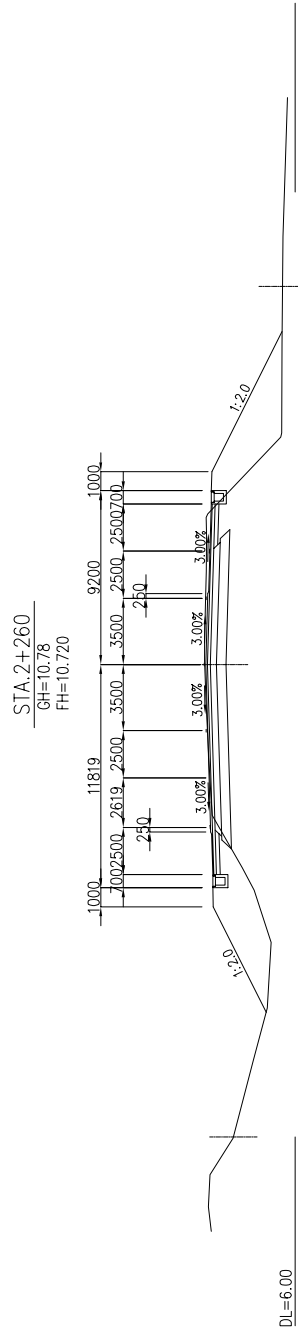
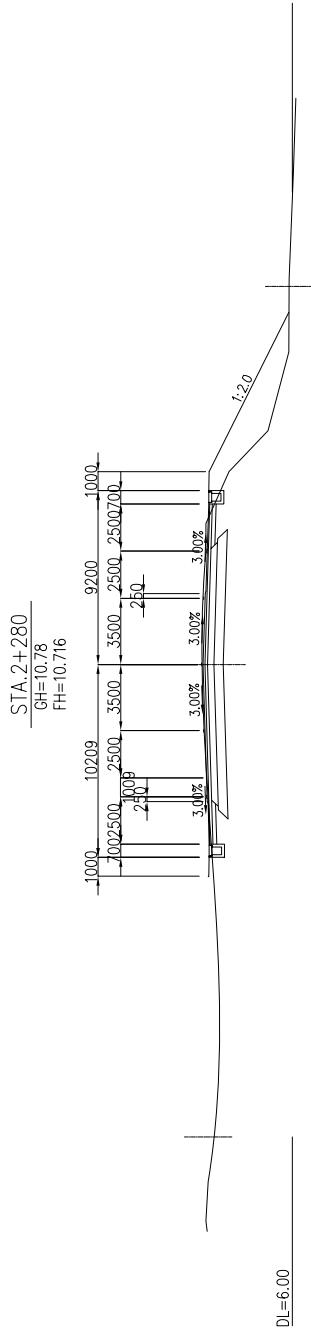
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA		JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL		TITLE : CROSS SECTION (STA.1+500-STA.1+680)	SCALE 1/200	Drawing No.
							Sheet No. CS- 8



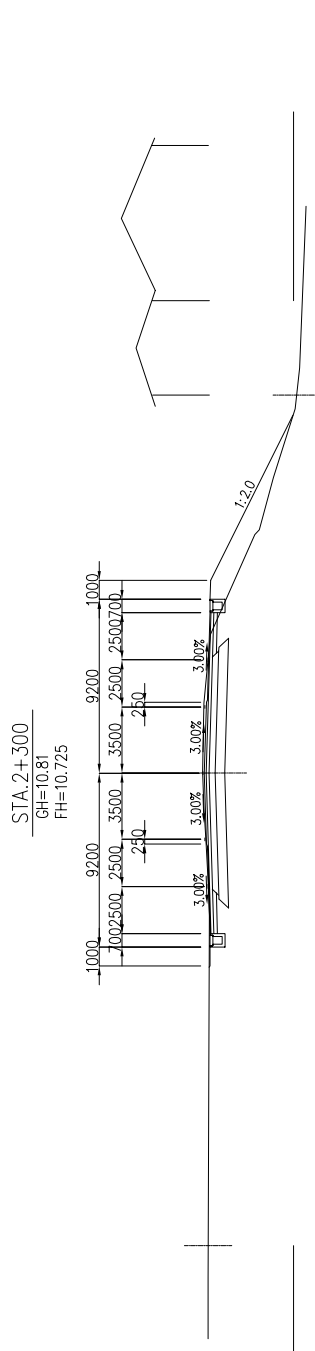
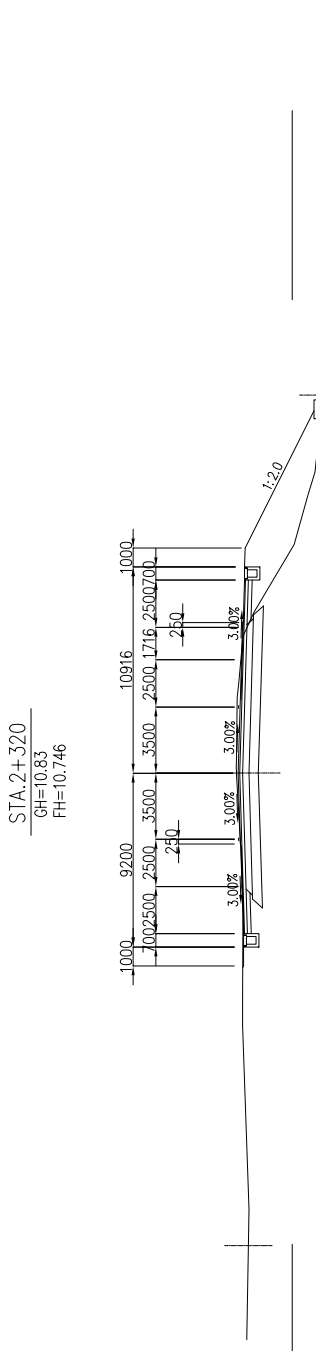
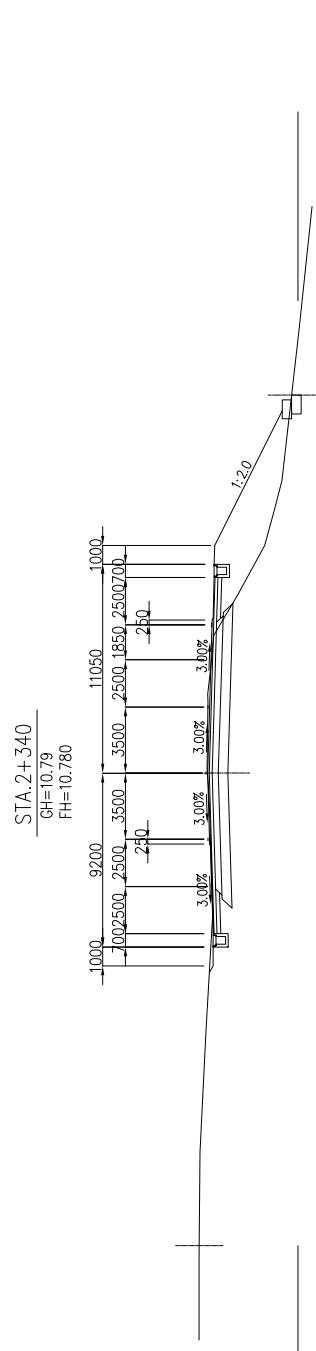
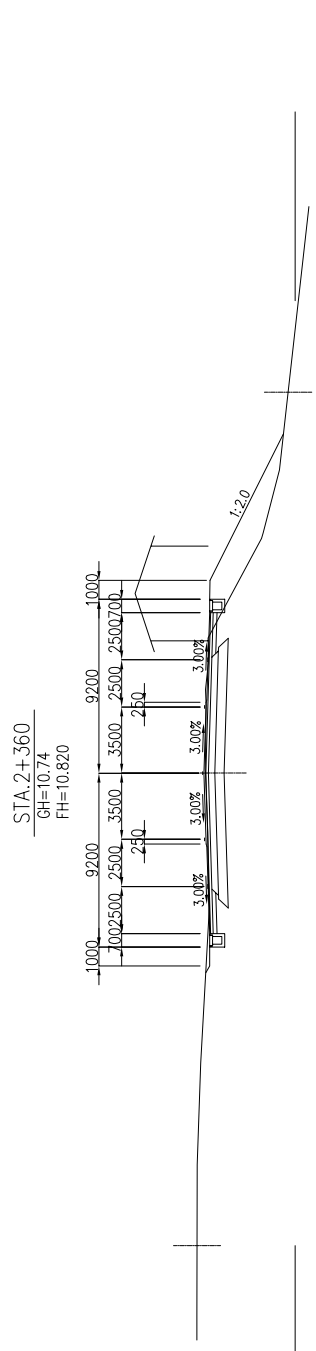
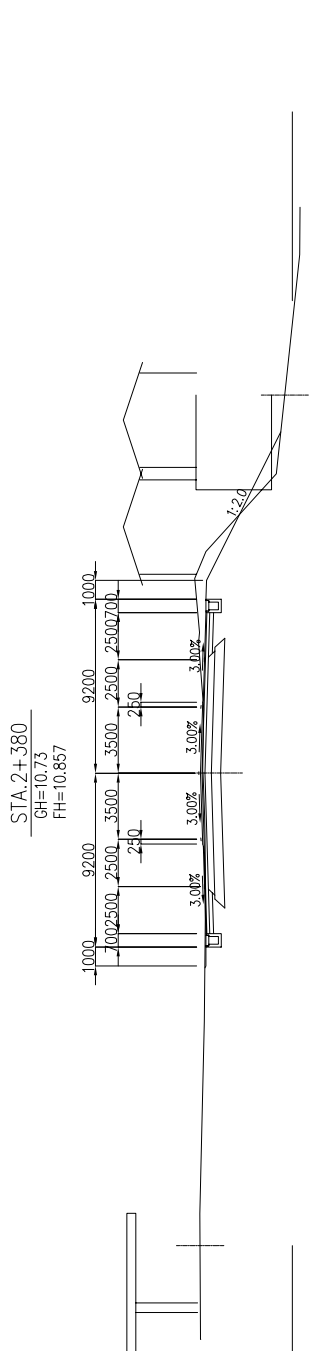
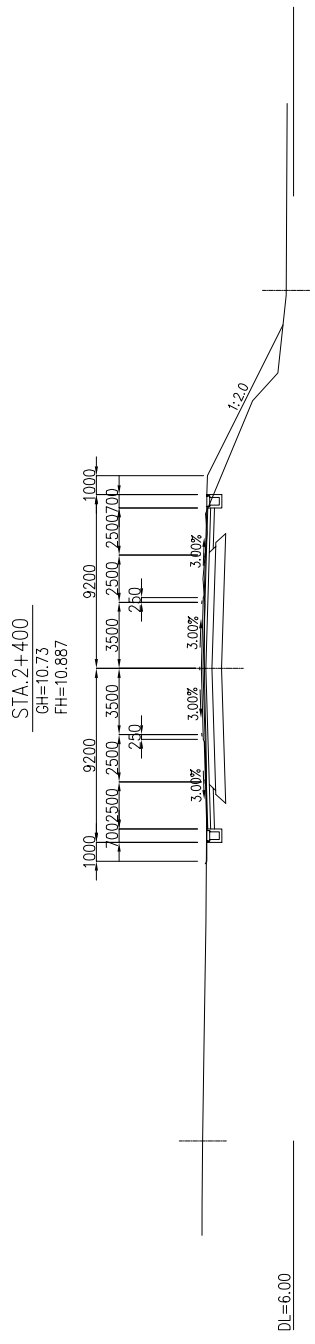
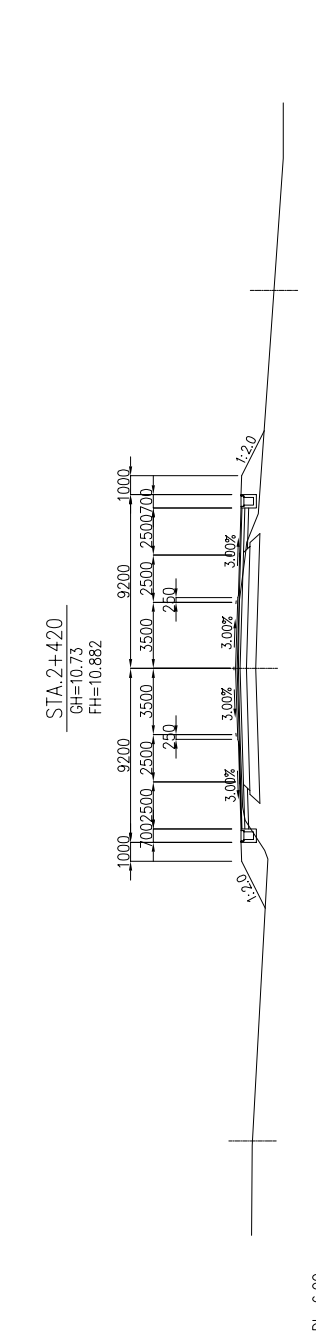
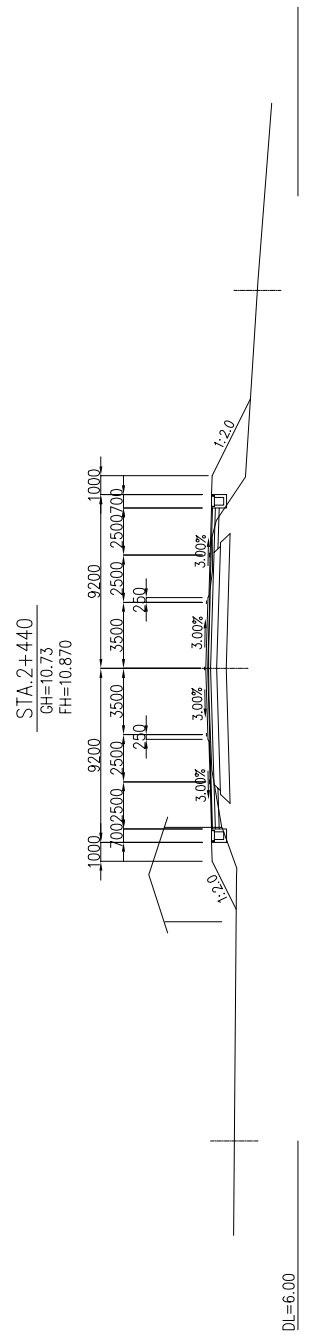
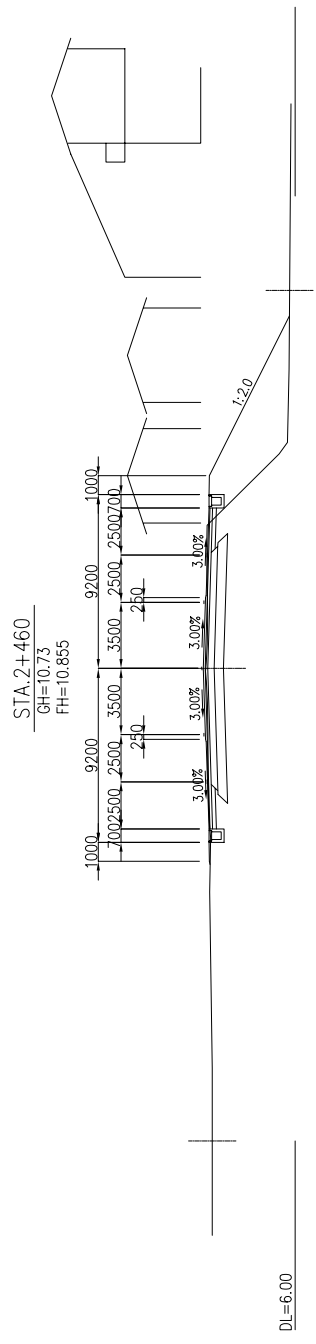
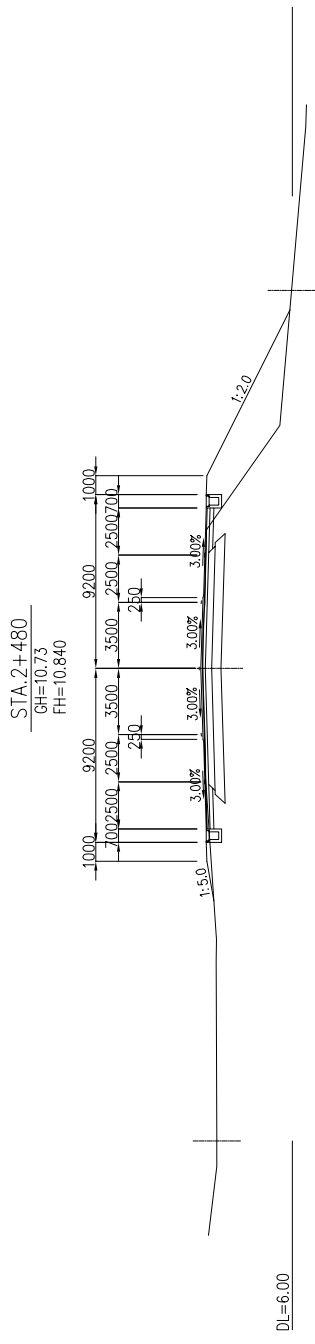
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA		JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL		TITLE : CROSS SECTION (STA.1+700-STA.1+880)	SCALE 1/200	Drawing No.
							Sheet No. CS- 9



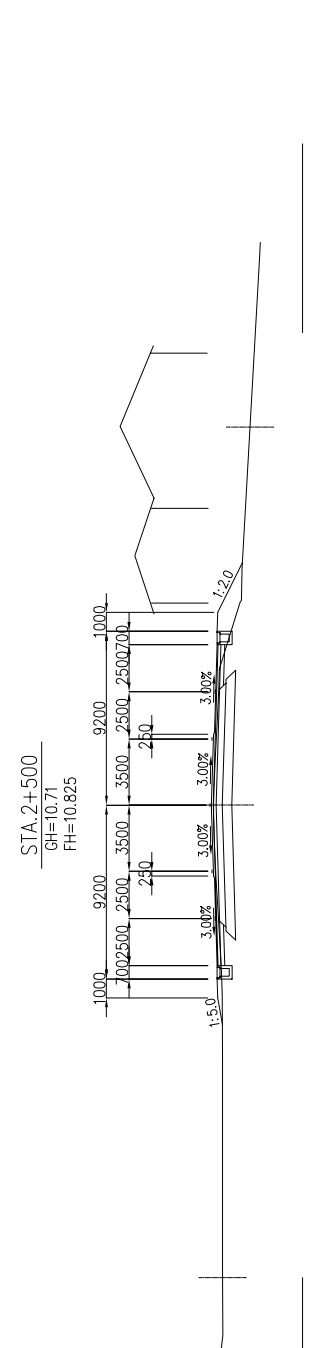
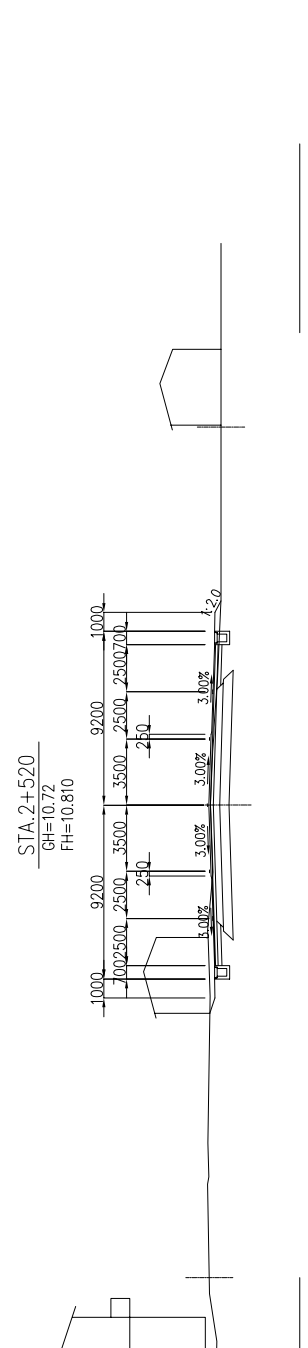
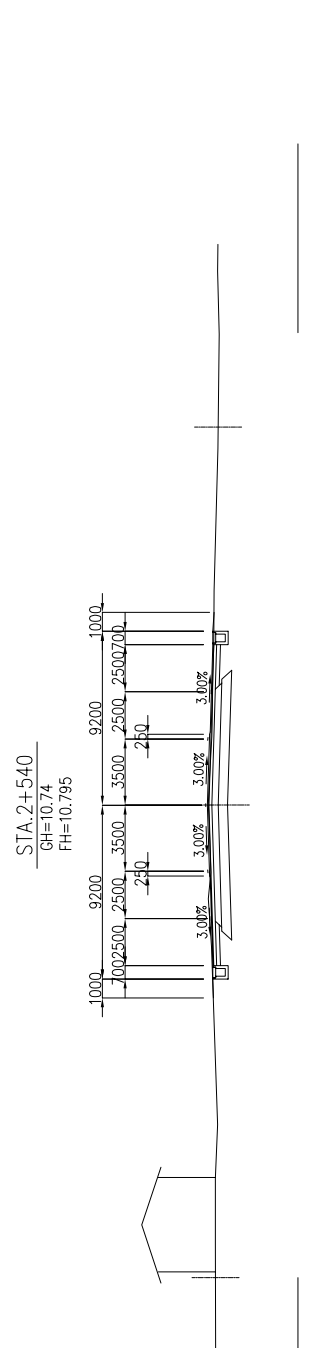
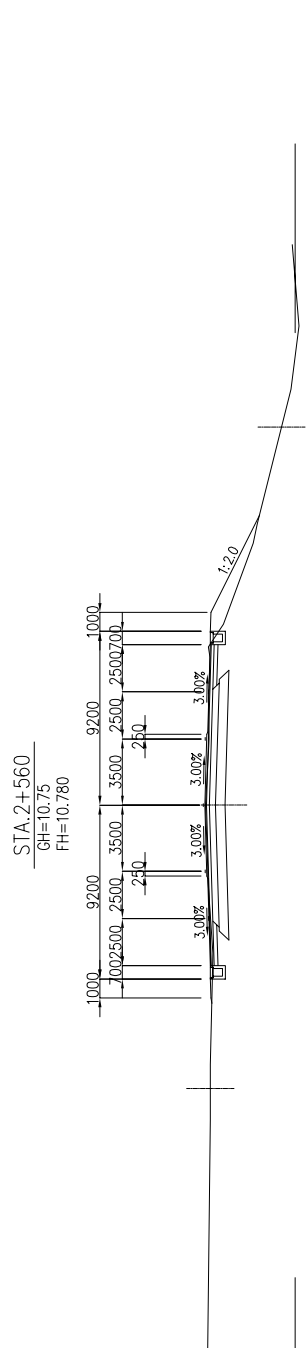
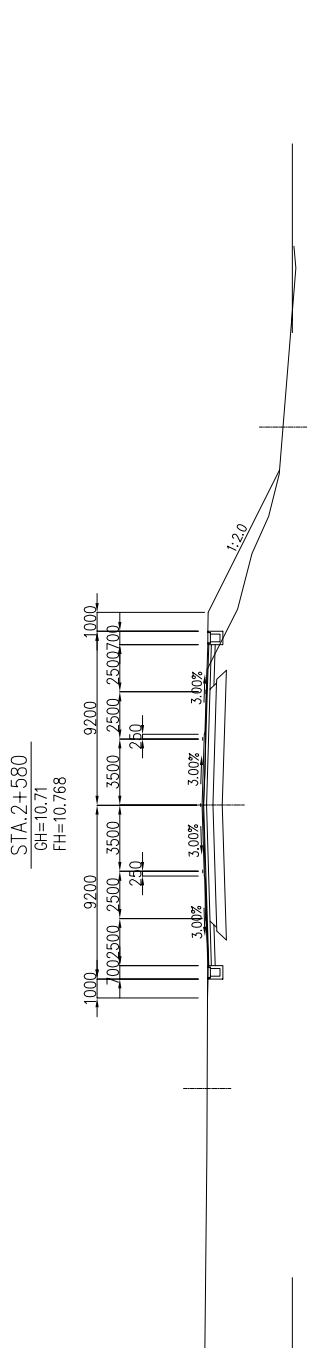
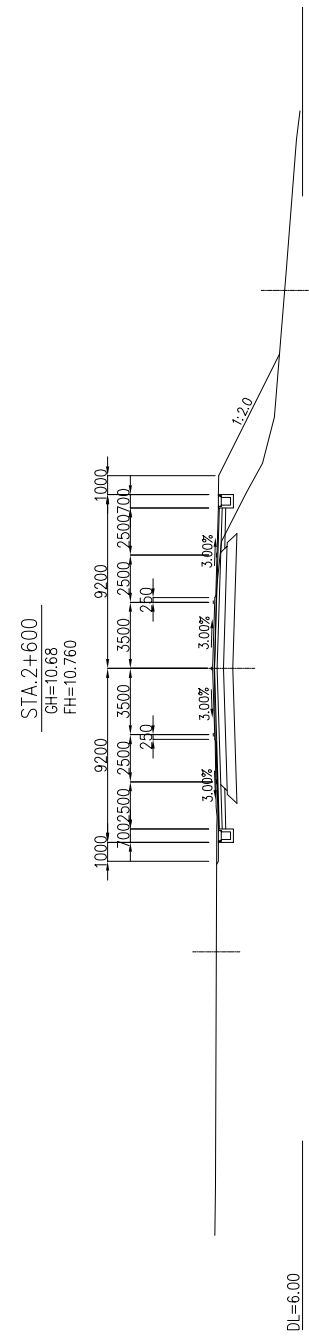
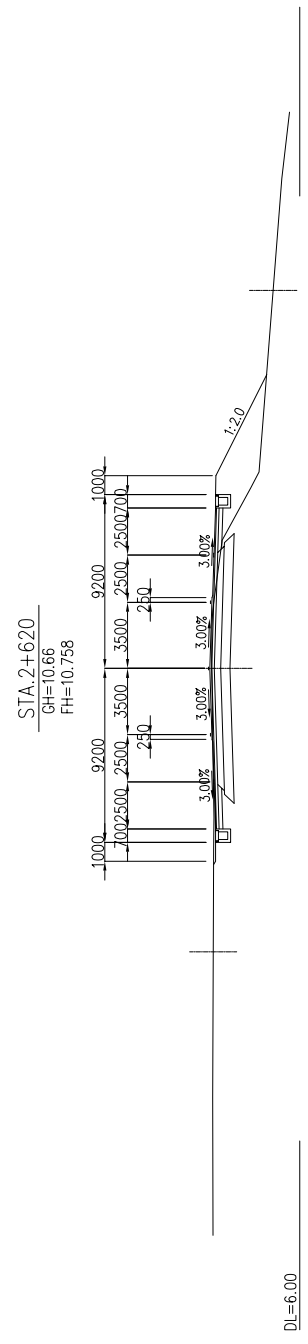
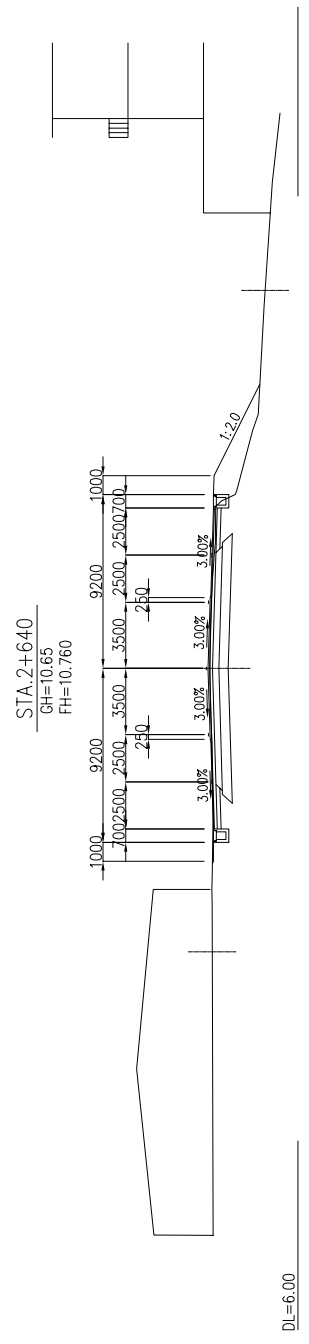
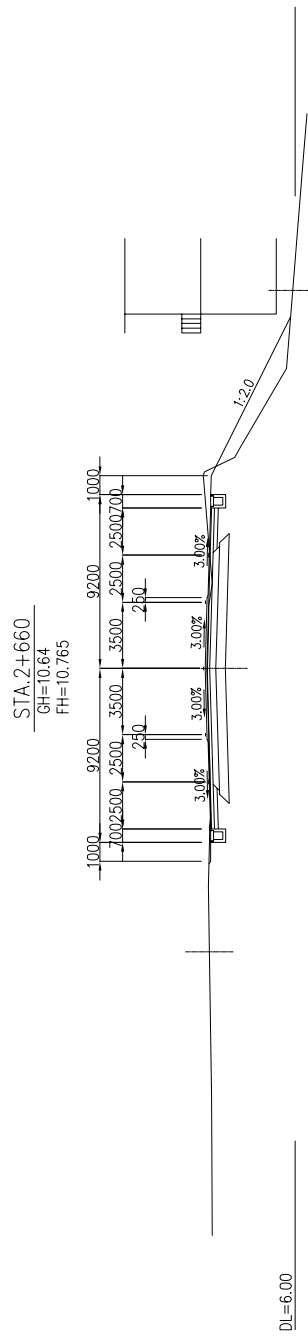
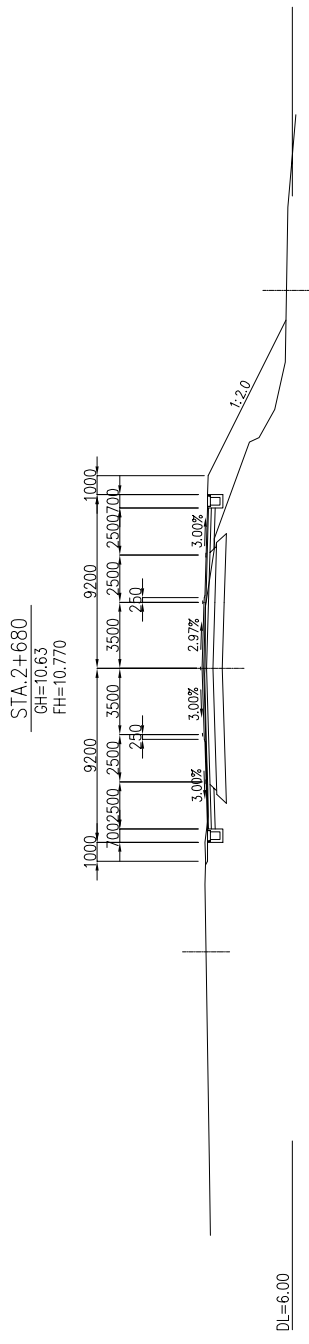
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA		JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE 1/200	Drawing No.
	CROSS SECTION (STA.1+900-STA.2+80)			Sheet No. CS- 10		



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : CROSS SECTION (STA.2+100-STA.2+280)		SCALE 1/200	Drawing No.



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : CROSS SECTION (STA.2+300-STA.2+480)		SCALE 1/200	Drawing No.



MINISTRY OF
PUBLIC WORKS AND TRANSPORT
(MPWT)

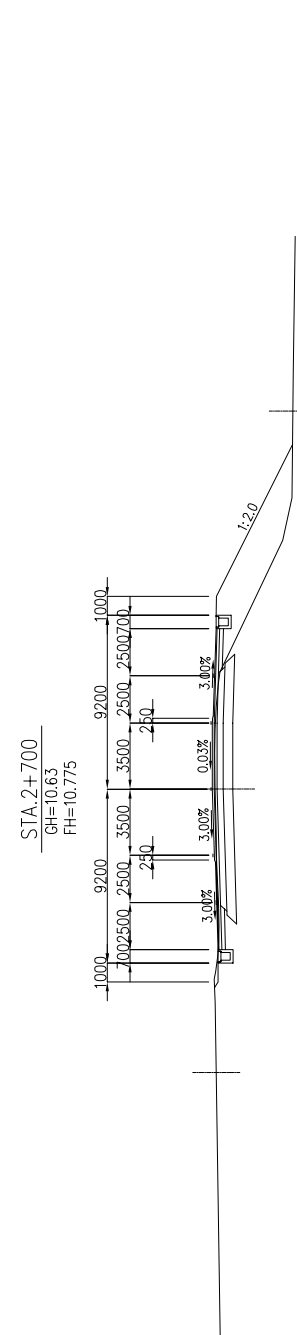
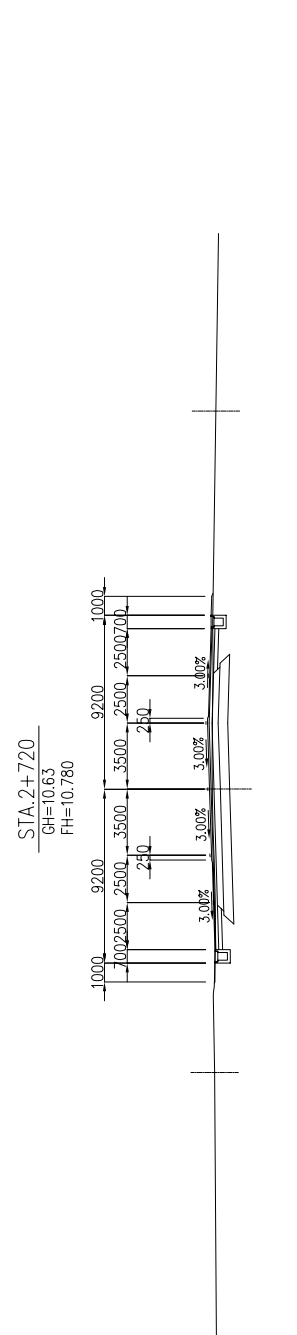
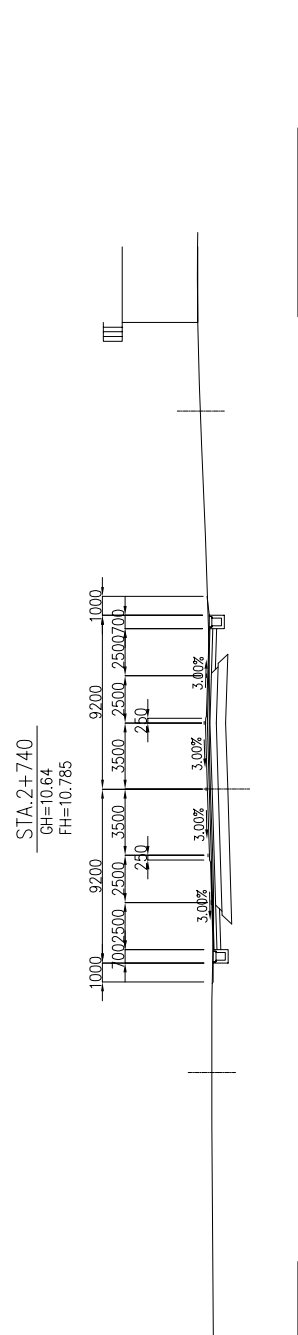
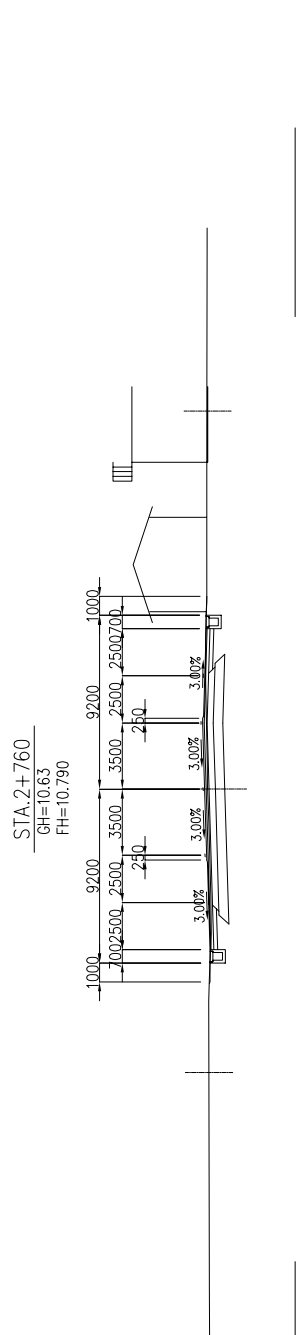
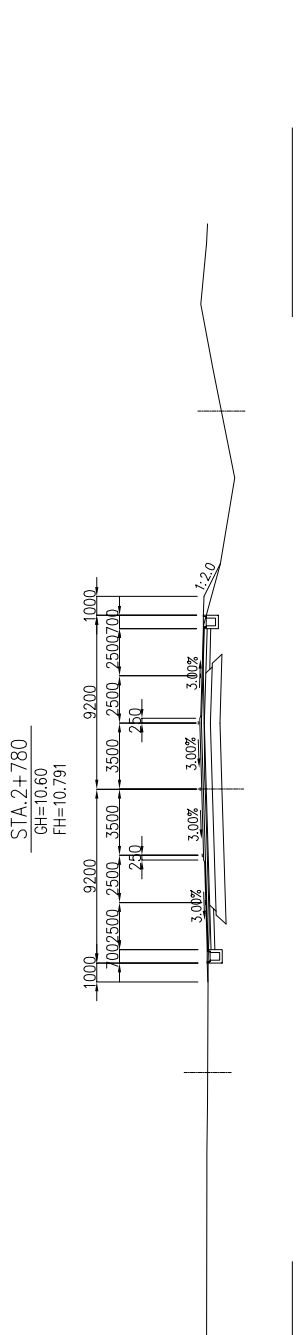
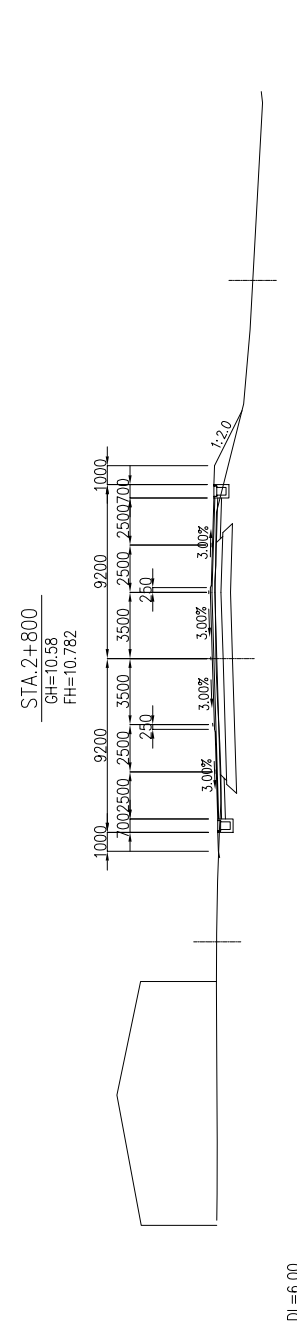
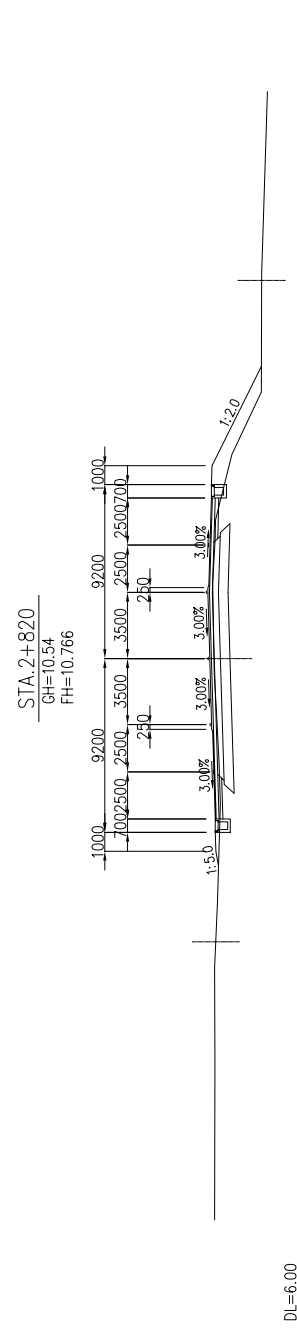
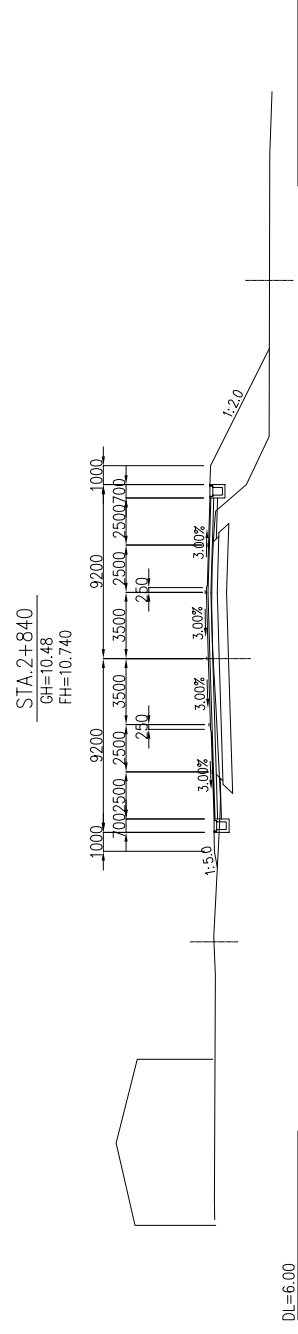
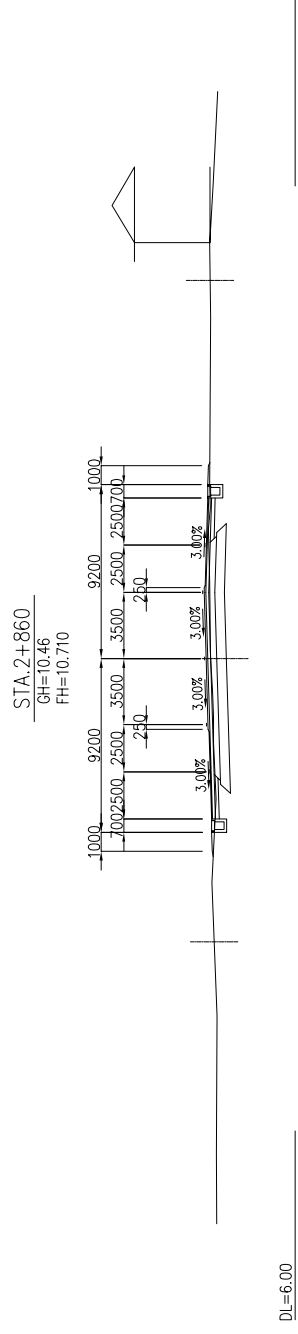
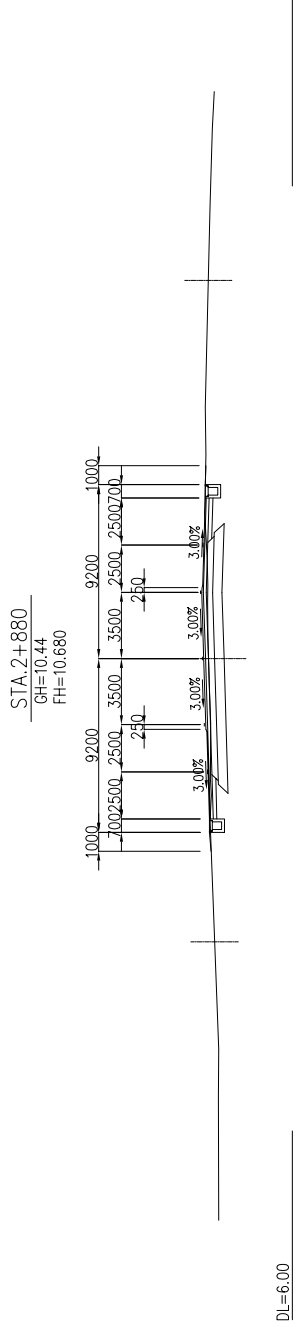
PREPARATORY STUDY ON THE PROJECT
FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1
(PHNOM PENH-NEAK LOEUNG SECTION)
IN THE KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

TITLE :
CROSS SECTION
(STA.2+500-STA.2+680)

SCALE
1/200

Drawing No.
Sheet No.
CS- 13



MINISTRY OF
PUBLIC WORKS AND TRANSPORT
(MPWT)

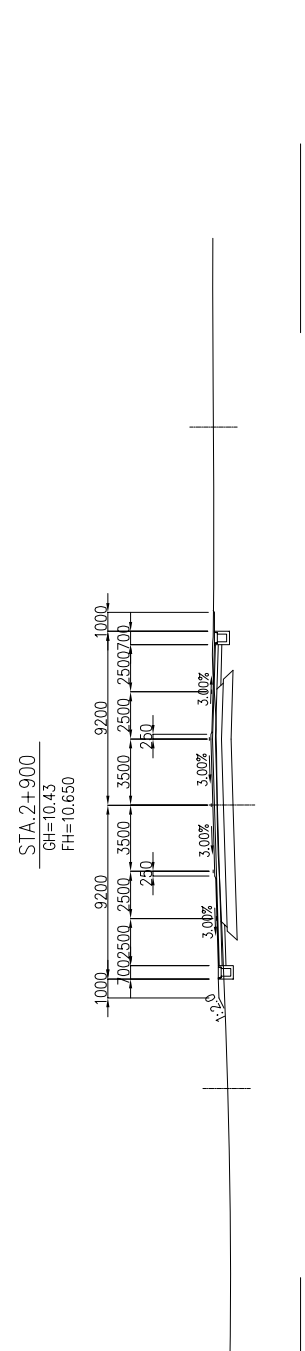
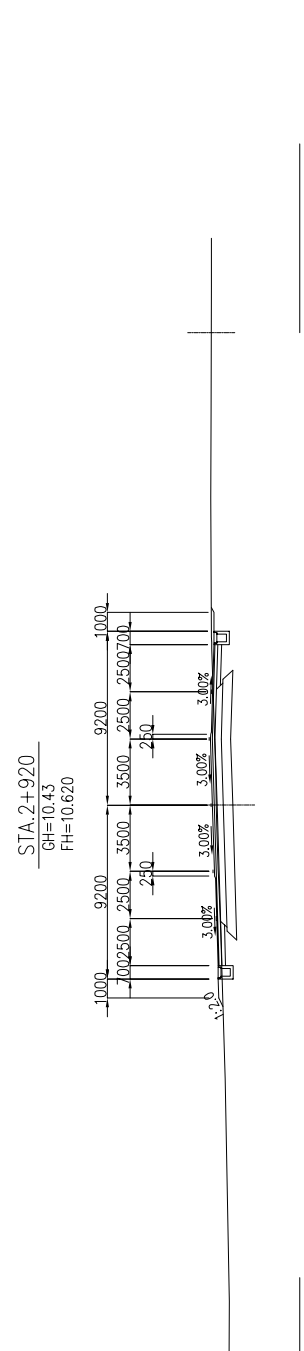
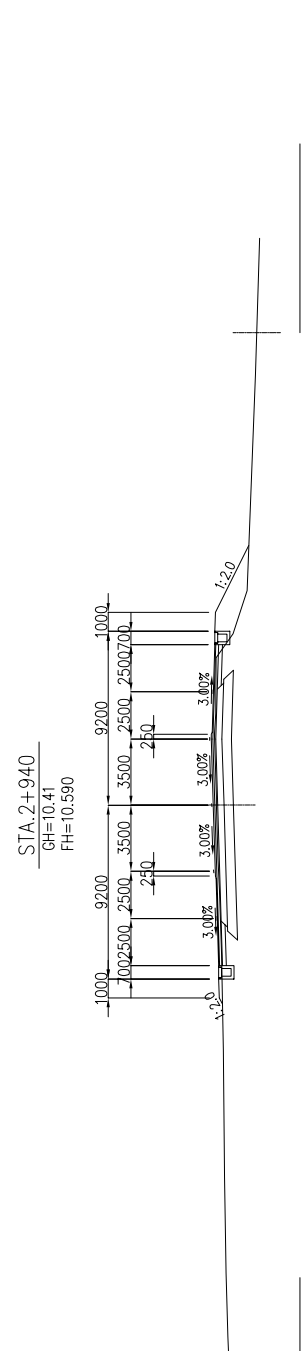
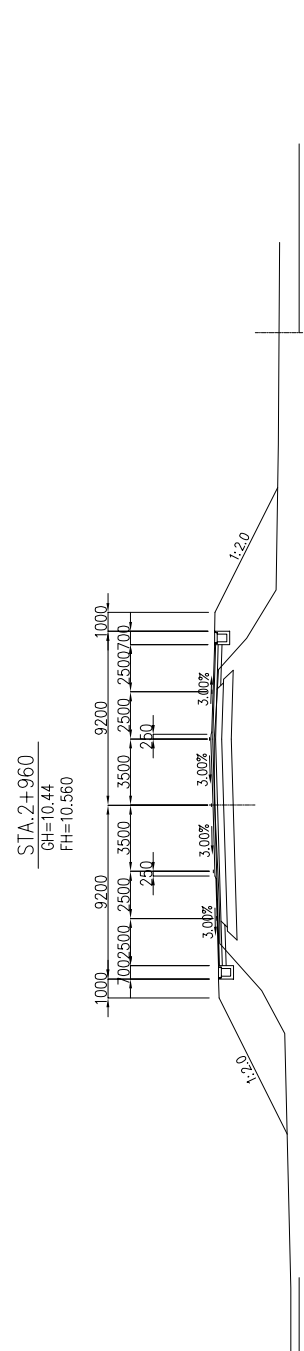
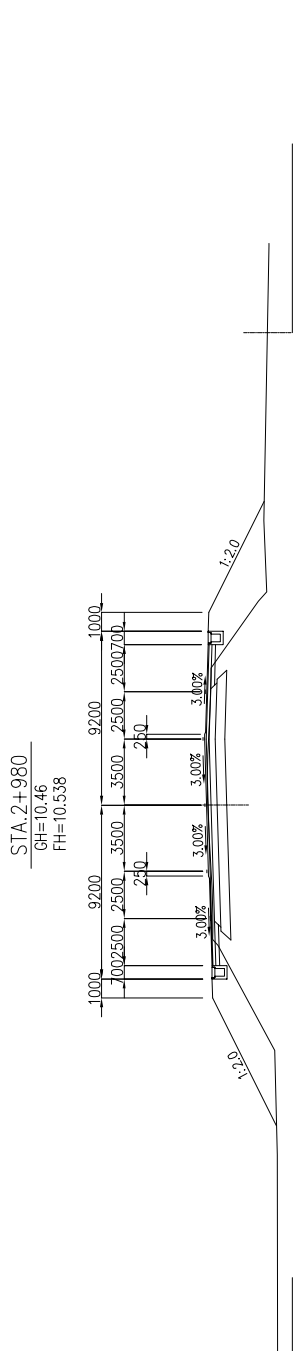
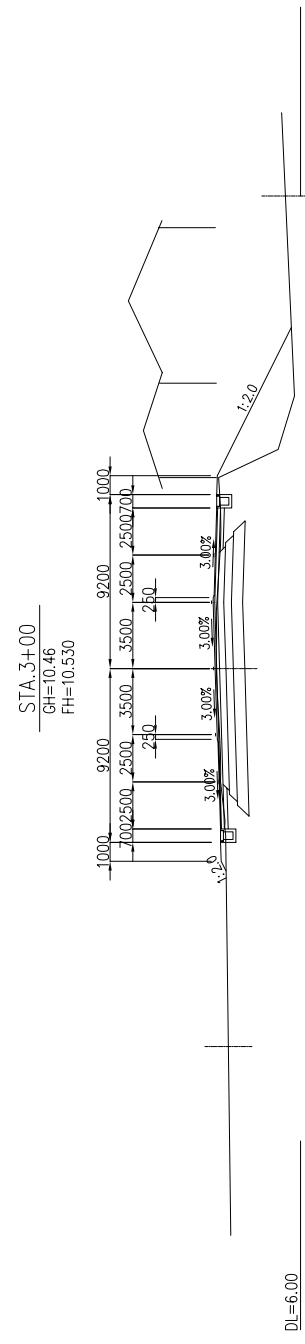
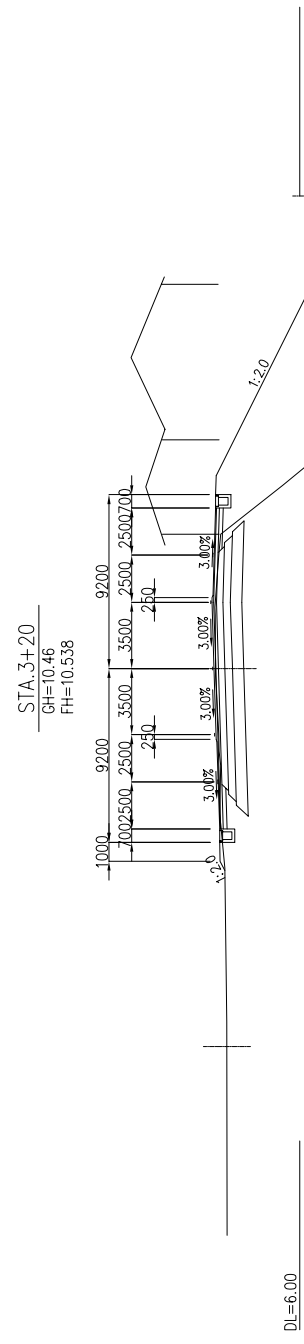
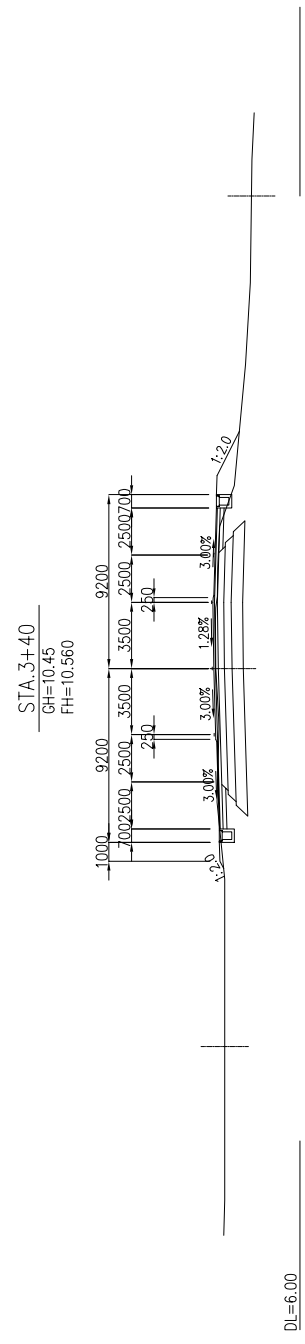
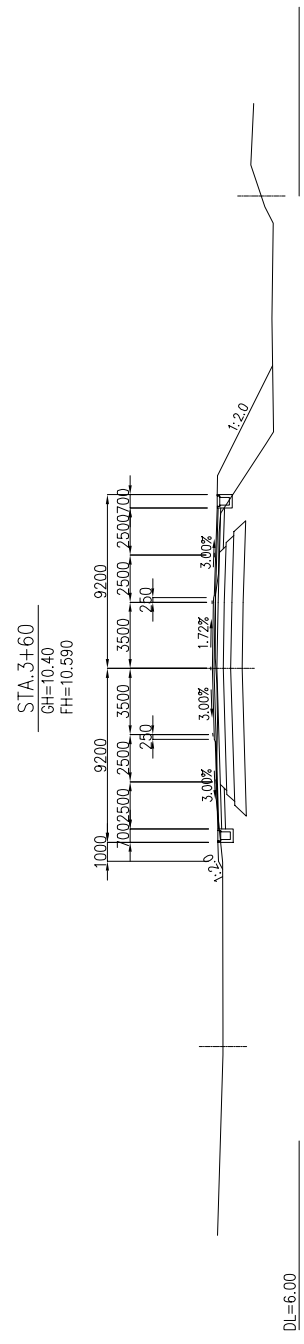
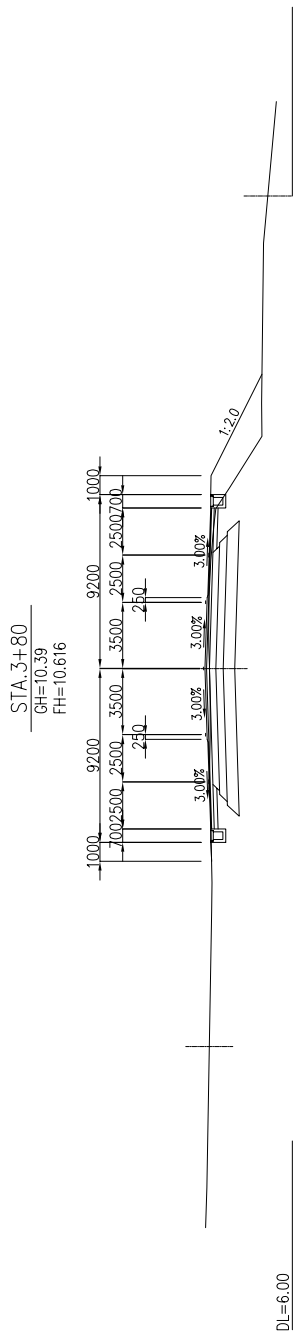
PREPARATORY STUDY ON THE PROJECT
FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1
(PHNOM PENH-NEAK LOEUNG SECTION)
IN THE KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

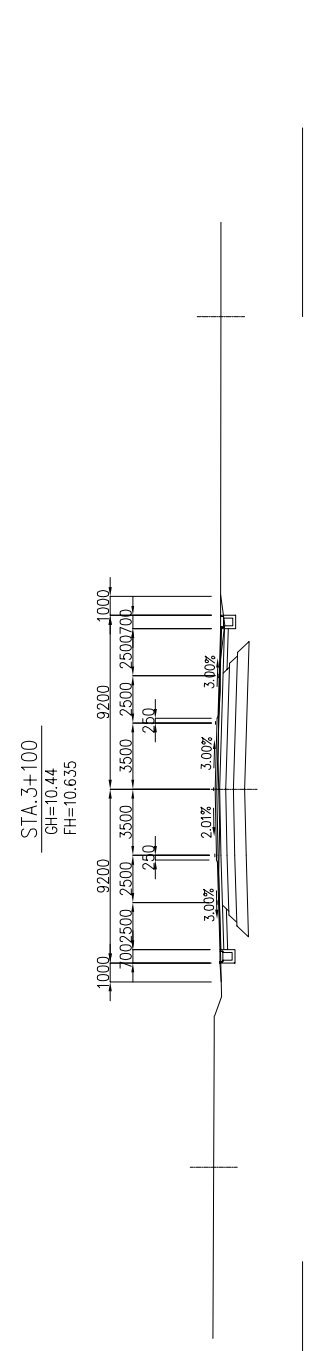
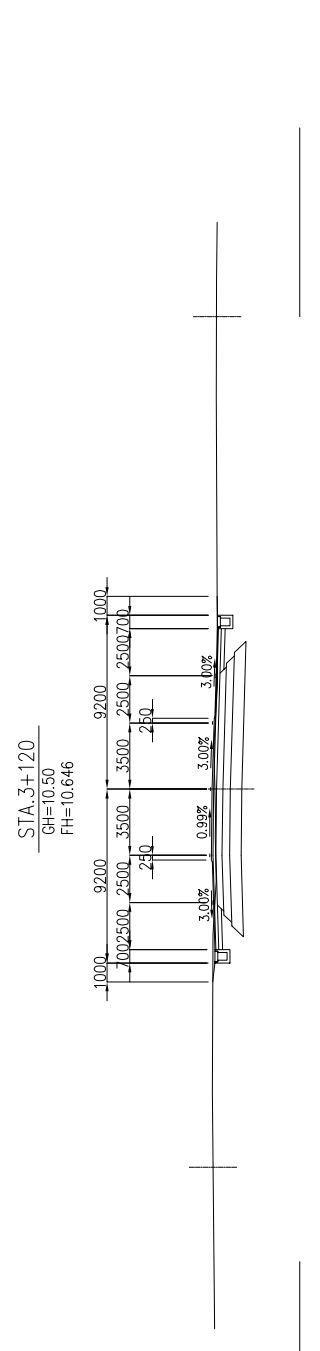
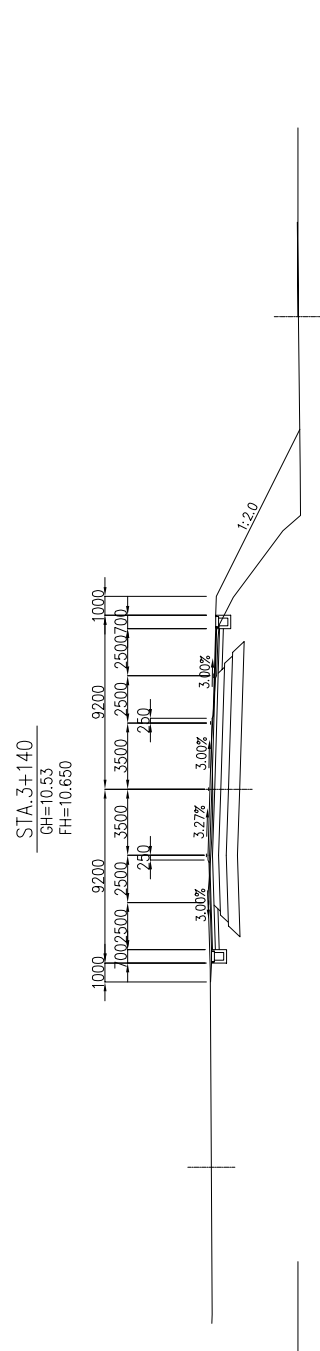
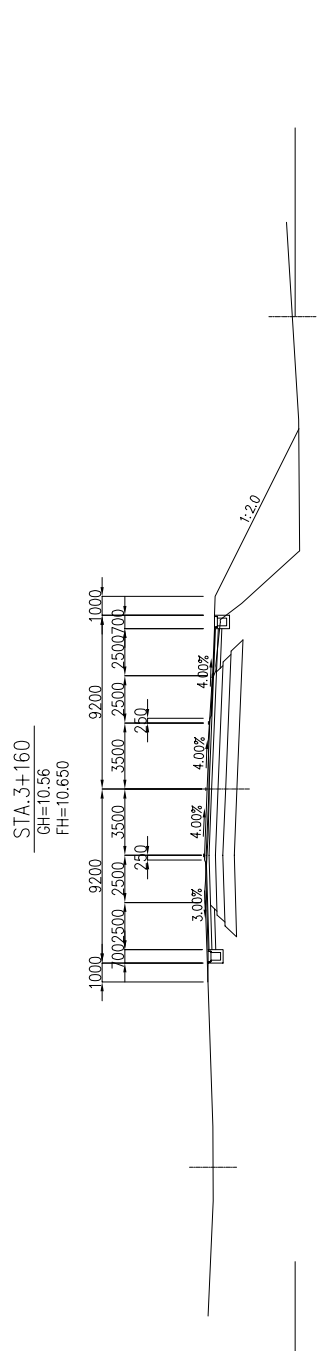
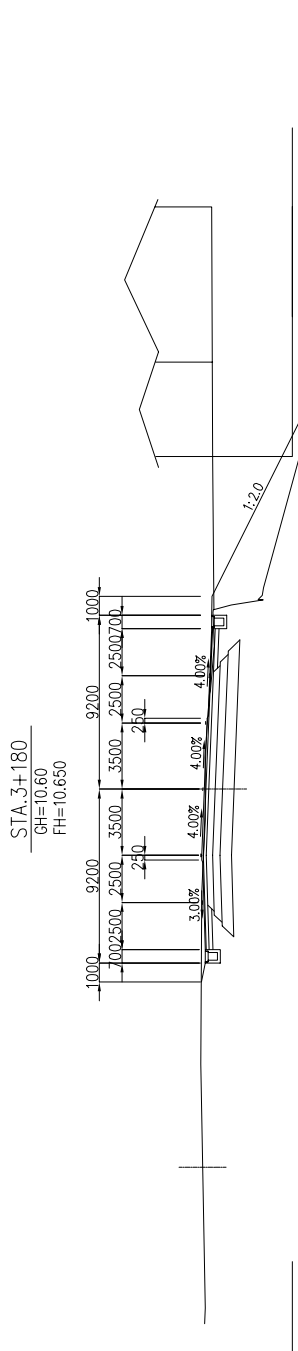
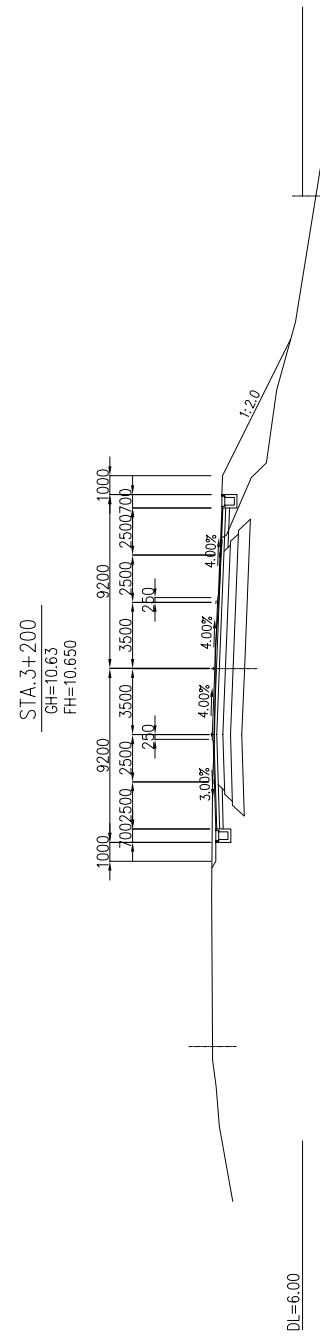
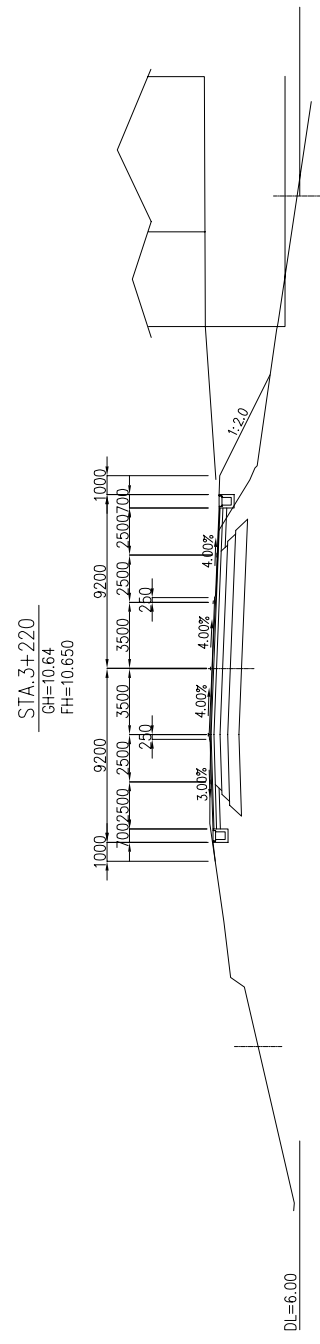
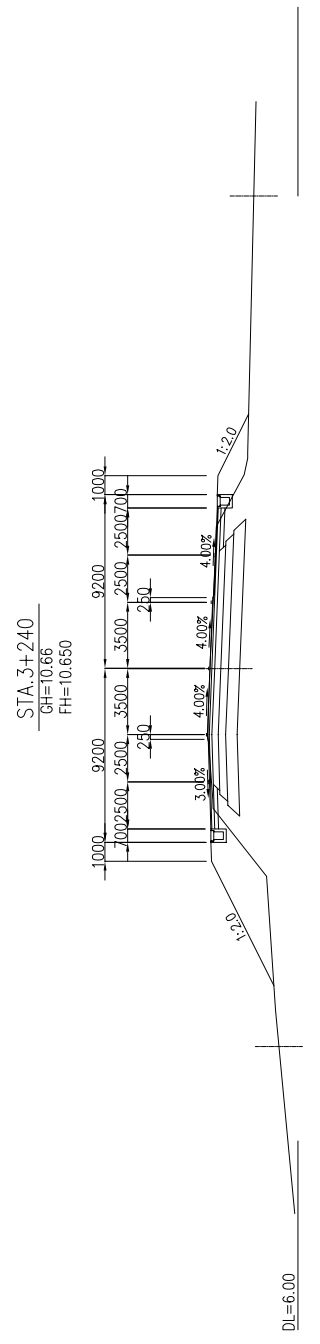
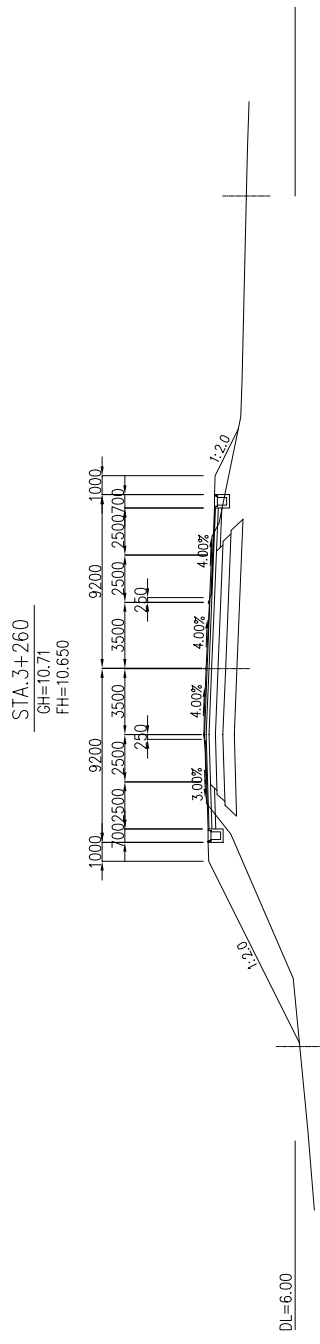
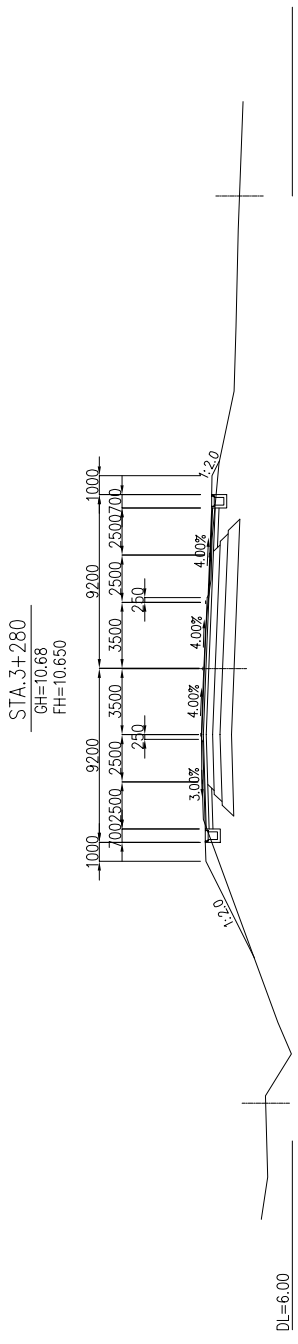
TITLE :
CROSS SECTION
(STA.2+700-STA.2+880)

SCALE
1/200

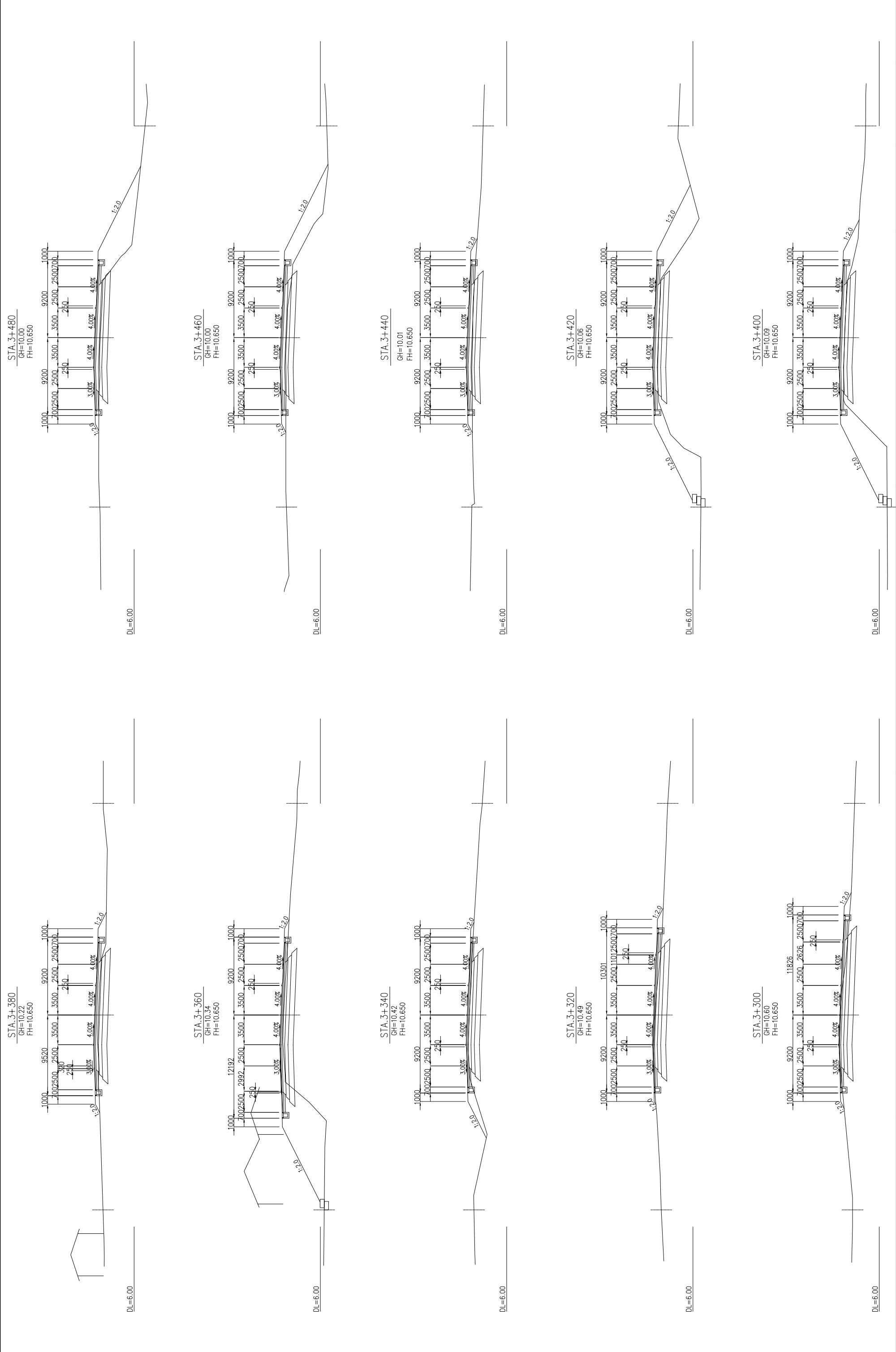
Drawing No.
Sheet No.
CS- 14



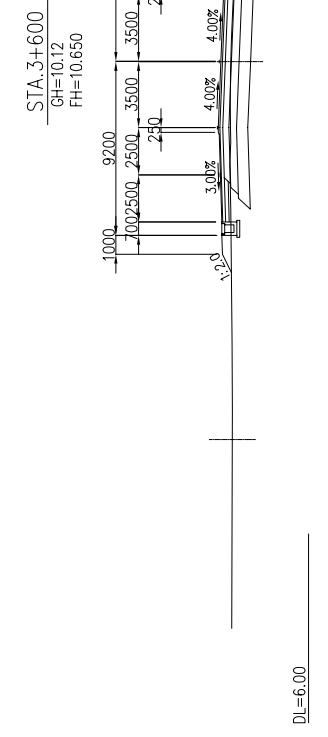
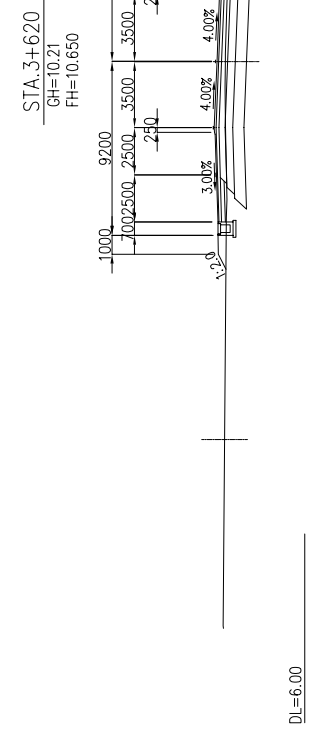
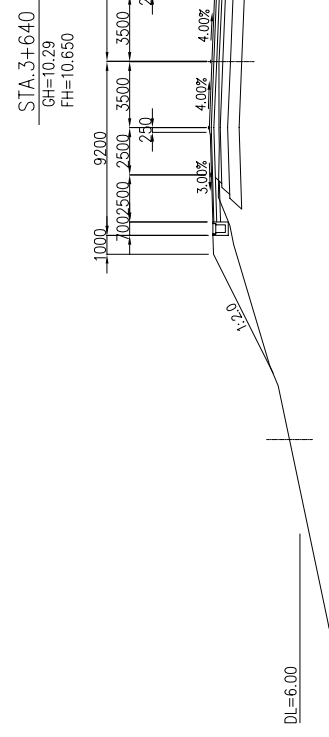
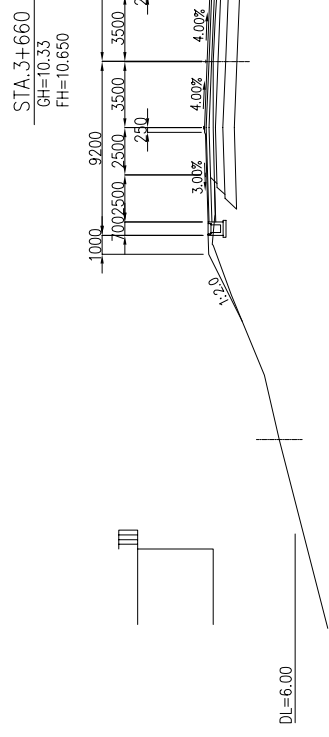
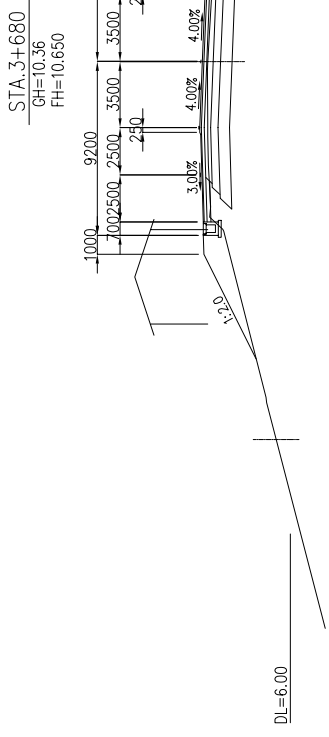
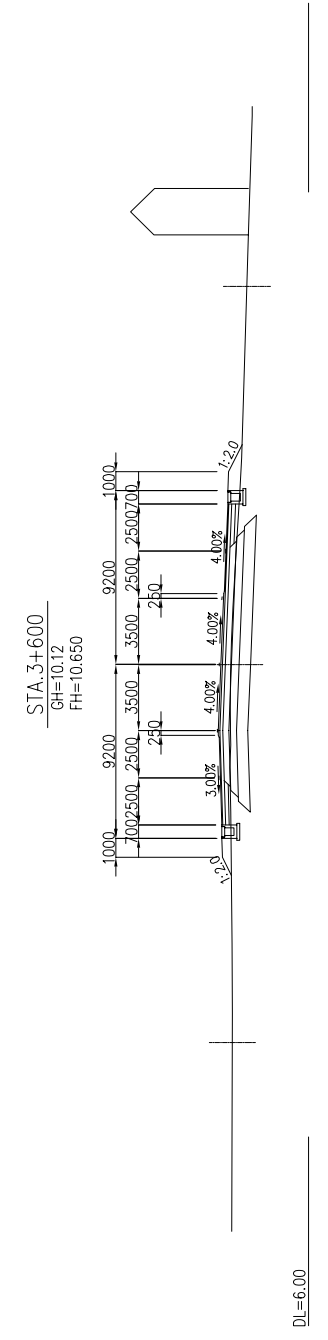
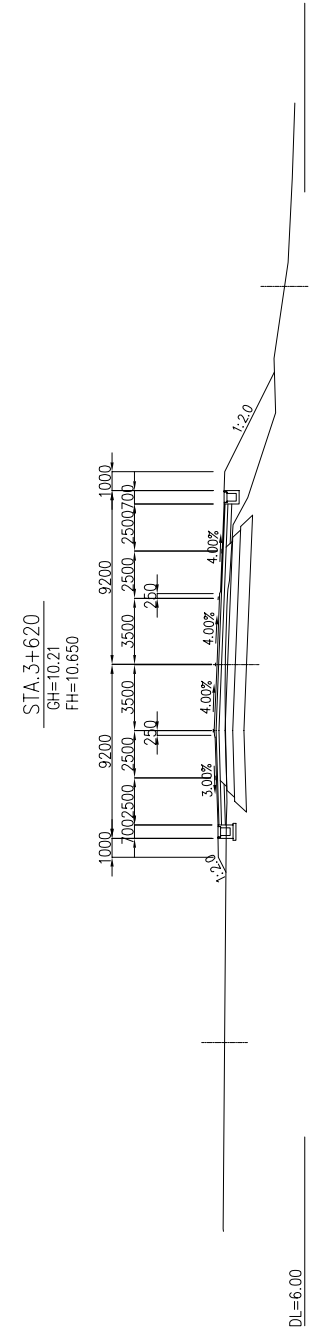
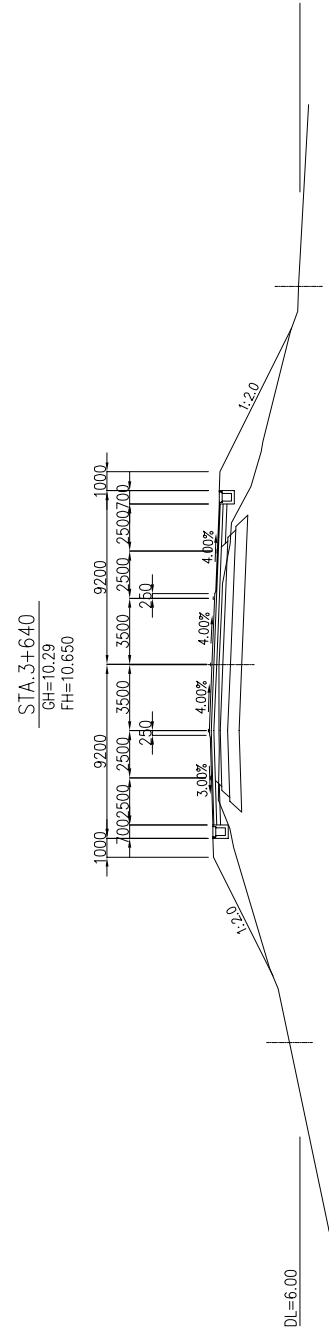
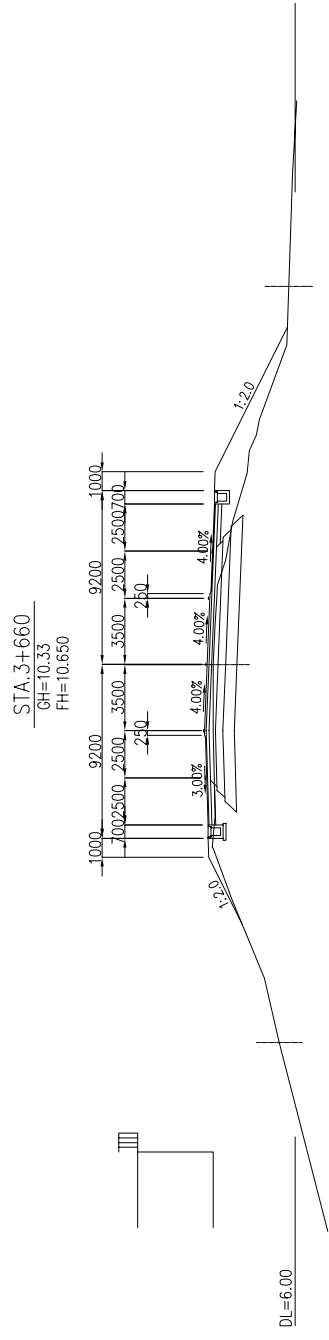
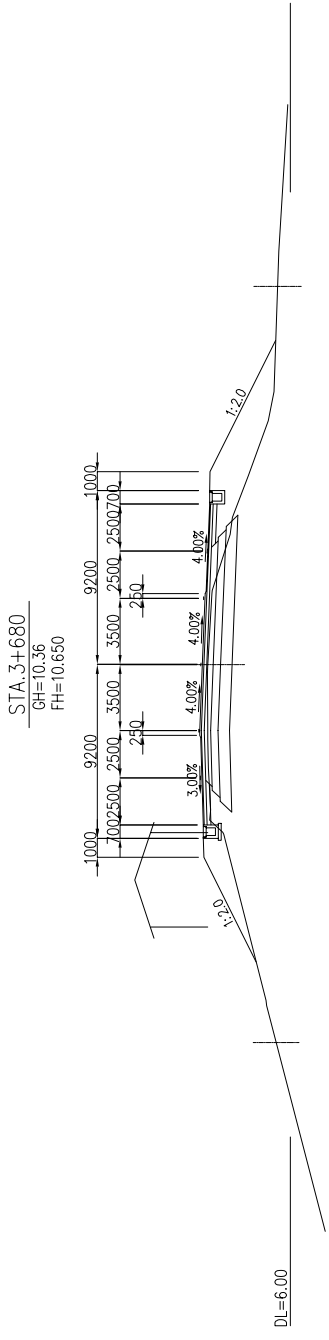
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : CROSS SECTION (STA.2+900-STA.3+80)	
			SCALE 1/200	Drawing No. Sheet No. CS- 15



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : CROSS SECTION (STA.3+100-STA.3+280)		SCALE 1/200	Drawing No.



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA		JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL		TITLE : CROSS SECTION (STA.3+300-STA.3+480)	SCALE 1/200	Drawing No.
							Sheet No. CS- 17



MINISTRY OF
PUBLIC WORKS AND TRANSPORT
(MPWT)

PREPARATORY STUDY ON THE PROJECT
FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1
(PHNOM PENH-NEAK LOEUNG SECTION)
IN THE KINGDOM OF CAMBODIA

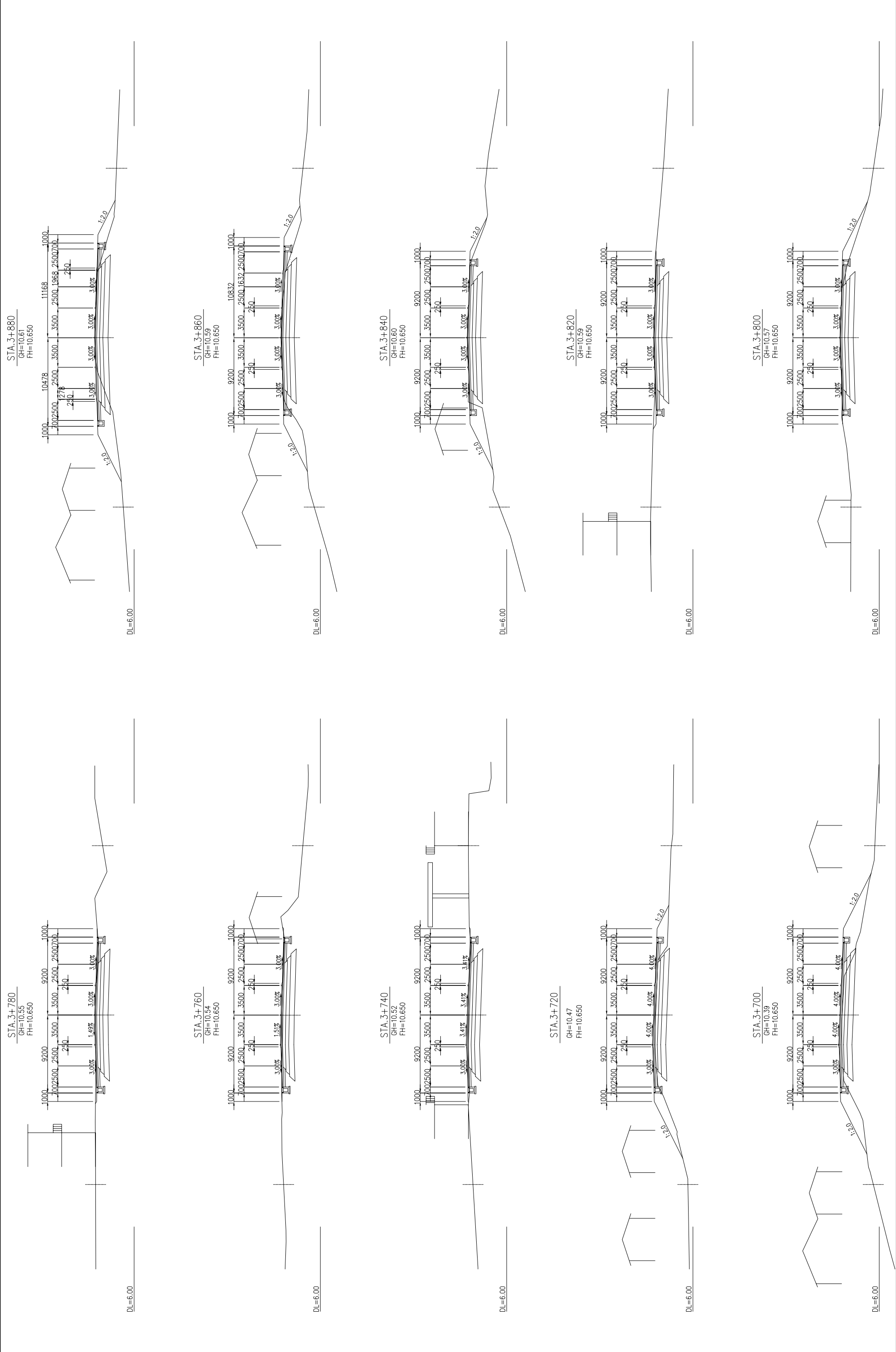
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

TITLE :
CROSS SECTION
(STA.3+500-STA.3+680)

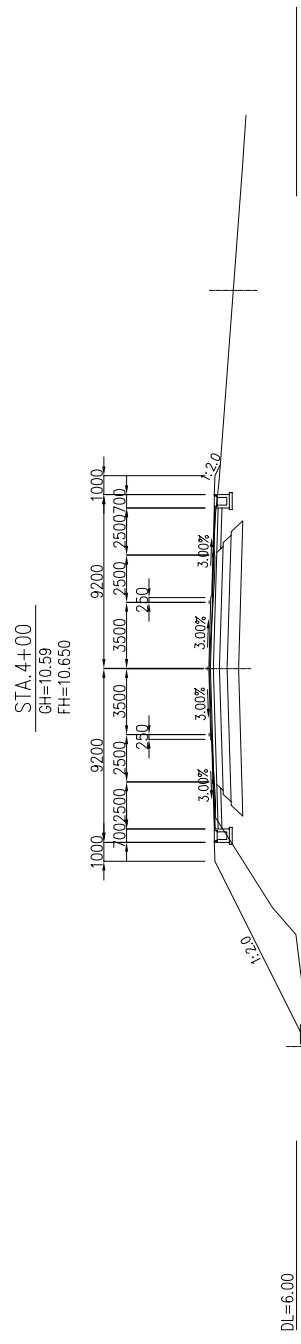
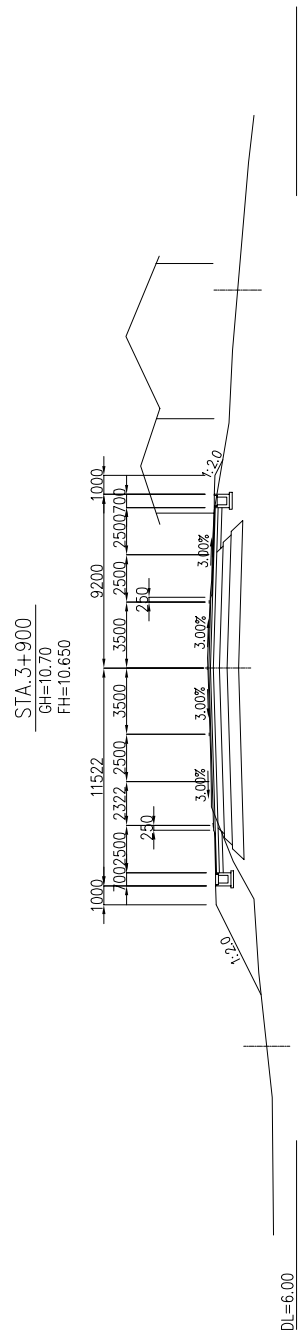
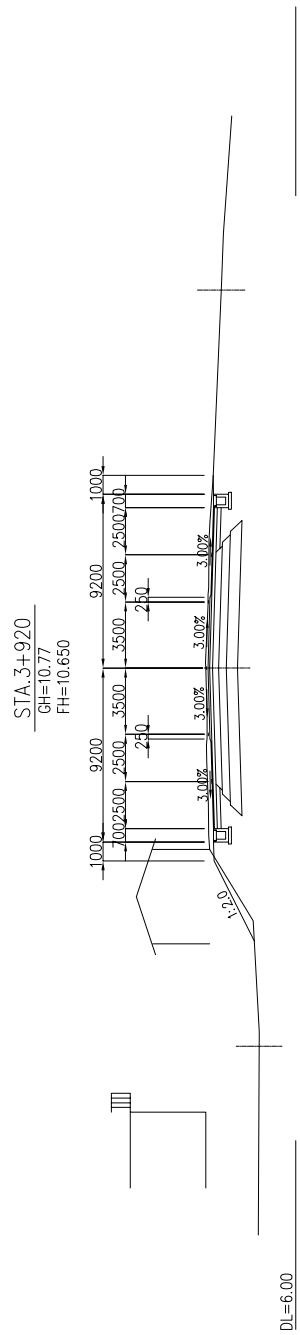
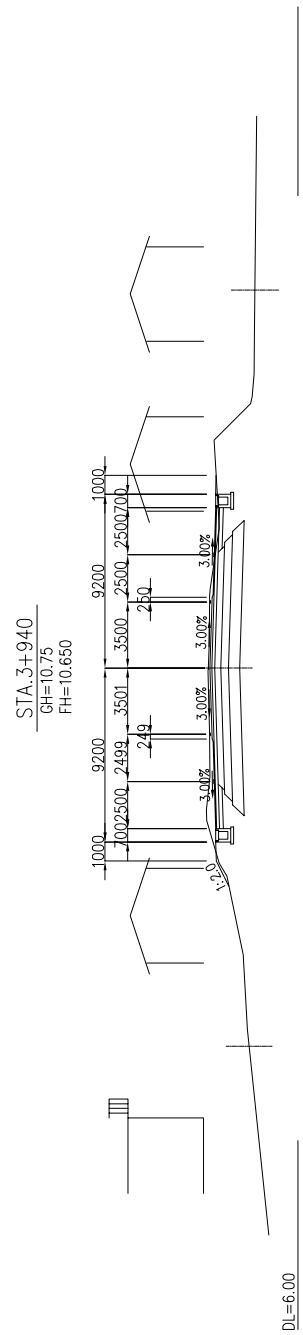
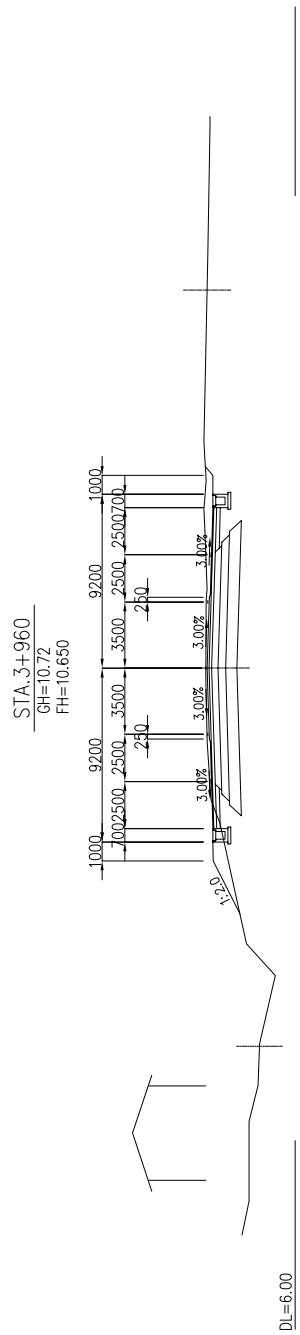
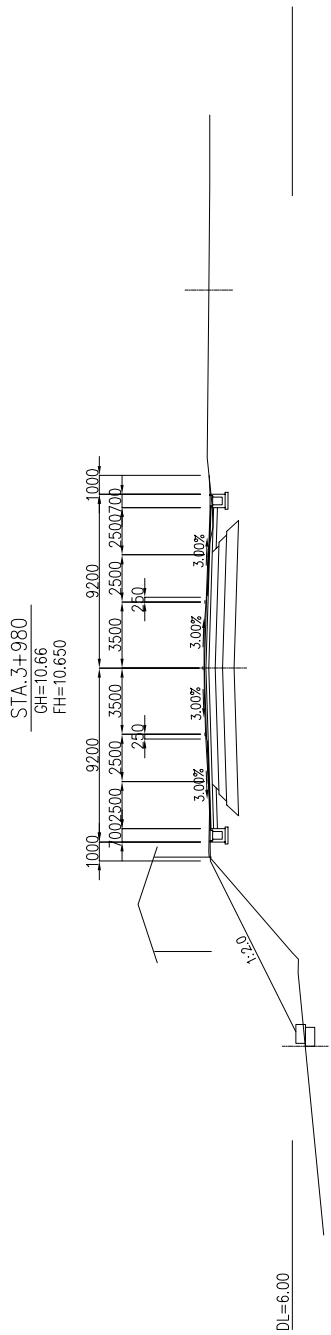
SCALE
1/200

Drawing No.

Sheet No.
CS- 18



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL		TITLE: CROSS SECTION (STA.3+700-STA.3+880)	SCALE 1/200	Drawing No.
						Sheet No. CS- 19



MINISTRY OF
PUBLIC WORKS AND TRANSPORT
(MPWT)

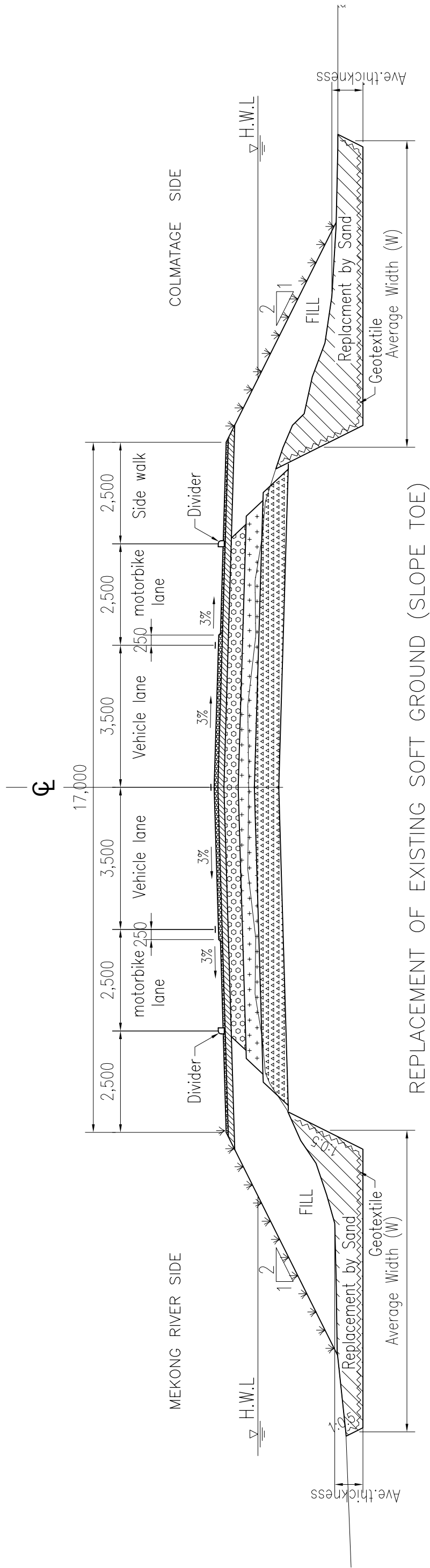
PREPARATORY STUDY ON THE PROJECT
FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1
(PHNOM PENH-NEAK LOEUNG SECTION)
IN THE KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

TITLE :
CROSS SECTION
(STA. 3+900-STA. 4+00)

SCALE
1/200

Drawing No.
Sheet No.
CS- 20

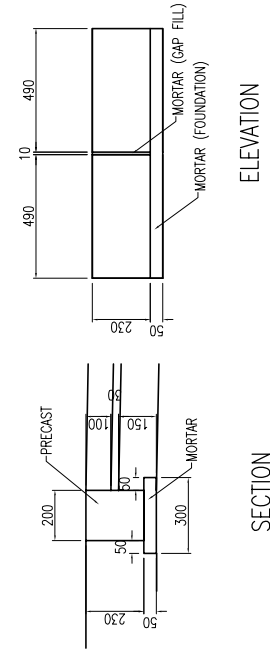


REPLACEMENT OF EXISTING SOFT GROUND (SLOPE TOE)

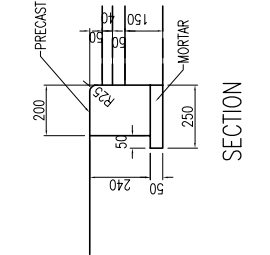
SCHEDULE OF REPLACEMENT

Station	Replacement by Sand					
	Mekong side			Colmatage side		
	Replacement Section #	Ave. Thickness (m)	Ave. Width (m)	Replacement Section	Ave. Thickness (m)	Ave. Width (m)
0.0km-1.0km	300m	1.2	5.0	160m	1.0	6.0
1.0km-2.0km	440m	1.4	4.7	460m	1.2	6.7
2.0km-3.0km	80m	1.1	5.8	330m	1.2	5.7
3.0km-4.0km	290m	1.3	5.5	490m	1.2	5.4
Total	1,110m			1,440m		

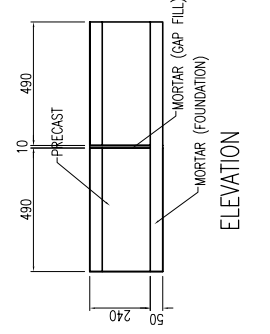
* Replacement section shall be finalized by the Engineer as of the construction stage in accordance with the actual site condition.



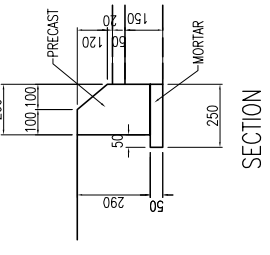
VERGE BLOCK (VB)



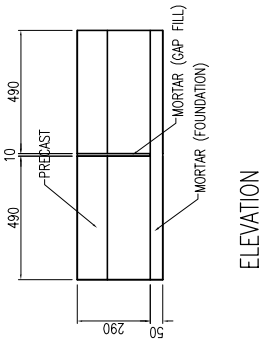
CURVED BLOCK FOR MEDIAN X SIDEWALK (CS-50)



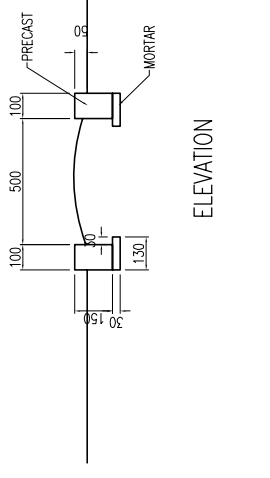
CURVED BLOCK FOR MEDIAN X SIDEWALK (CS-50)



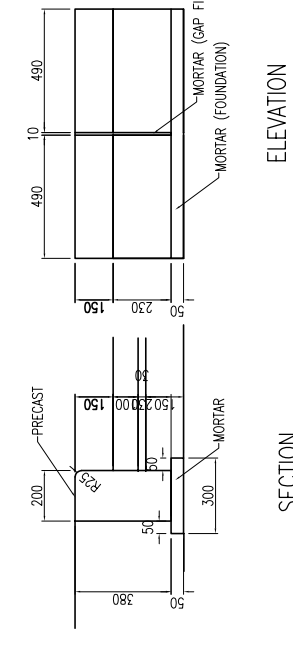
CURVED BLOCK FOR MEDIAN X SIDEWALK (CS-50)



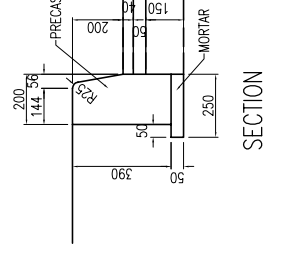
CURVED BLOCK FOR MEDIAN X SIDEWALK (CS-50)



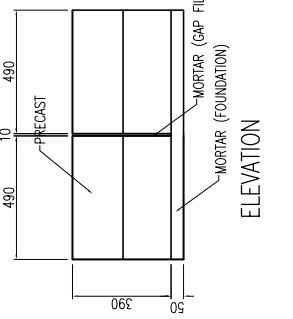
TREE CIRCLE FOR AC PARKING (TRC)



CURVED BLOCK FOR SIDEWALK X MEDIAN (CS-150)



CURVED BLOCK FOR SIDEWALK X MEDIAN (CS-150)



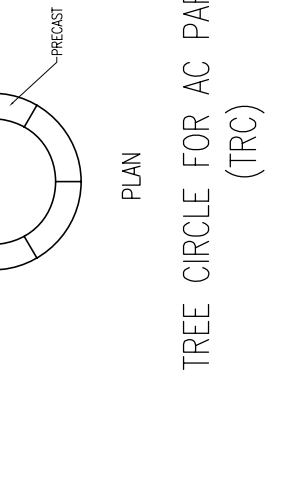
CURVED BLOCK FOR SIDEWALK X MEDIAN (CS-150)



CURVED BLOCK FOR SIDEWALK X MEDIAN (CS-150)

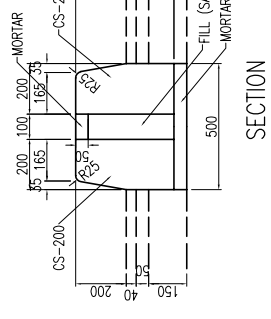


CURVED BLOCK FOR SIDEWALK X MEDIAN (CS-150)

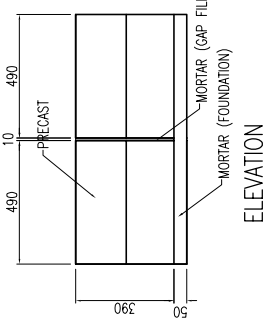


CURVED BLOCK FOR SIDEWALK X MEDIAN (CS-150)

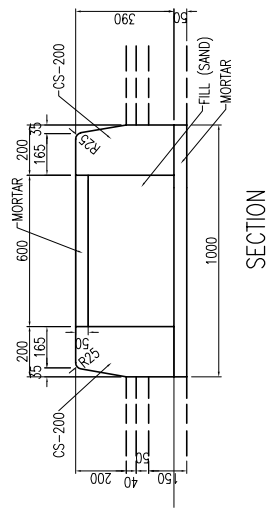
CURVED BLOCK FOR MEDIAN (CS-200)



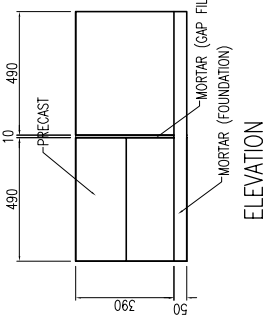
MEDIAN BARRIER (MB-200X500)



MEDIAN BARRIER (MB-200X500)



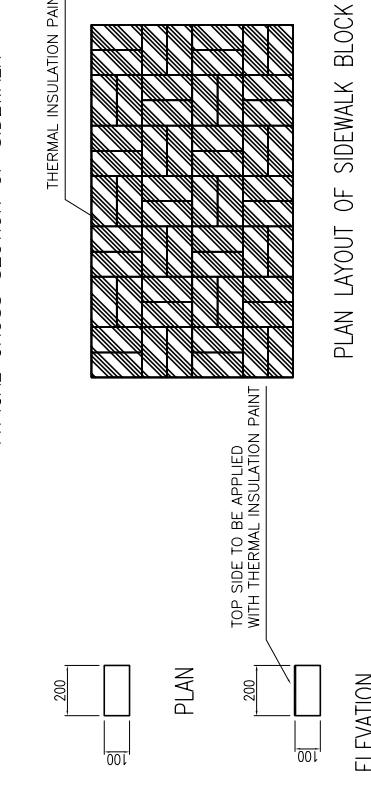
MEDIAN BARRIER (MB-200X1000)



MEDIAN BARRIER (MB-200X1000)



CURVED BLOCK FOR SIDEWALK X MEDIAN (CS-150)

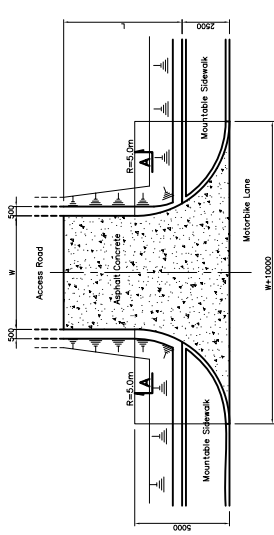


TYPICAL CROSS SECTION OF SIDEWALK

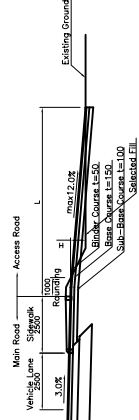
SIDEWALK BLOCK WITH THERMAL INSULATION PAINT (SWB)

Note: Trees shall be planted at every 10m interval to be indicated on the Drawings(TYPICAL CROSS SECTION G-2) by transplanting from the roadside or nurseries.

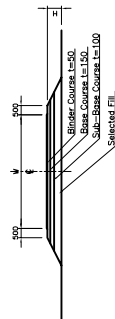
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL		TITLE :	ROAD STRUCTURES OF CURB STONE, MEDIAN BARRIER, SIDEWALK BLOCK, ETC.	SCALE	1:30	Drawing No.	
								Sheet No.	RS - 1



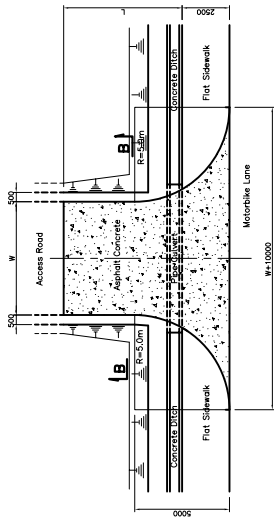
PLAN



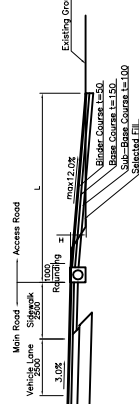
PROFILE



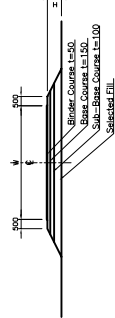
A-A SECTION
AC-TYPE-A
(4-Lane Section)



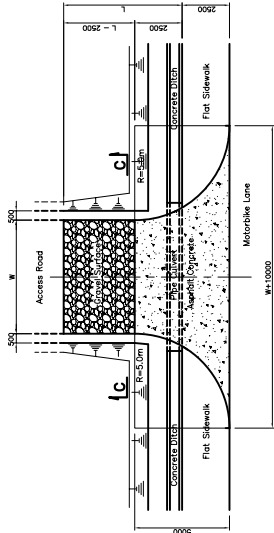
PLAN



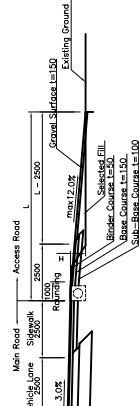
PROFILE



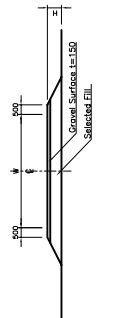
B-B SECTION
AC-TYPE-B



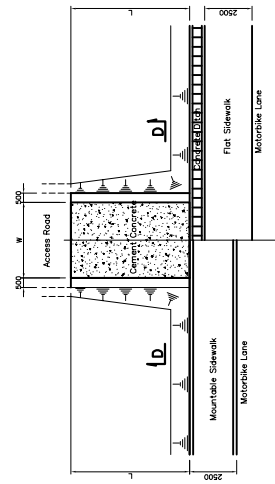
PLAN



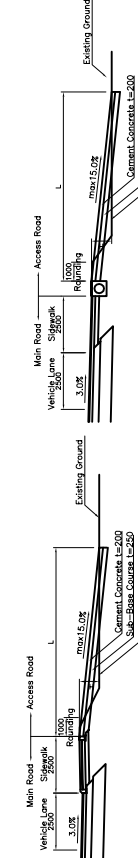
PROFILE



C-C SECTION
(Gravel Section)
AC-TYPE-C
(2-Lane Section)

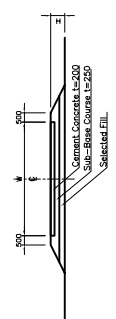


PLAN

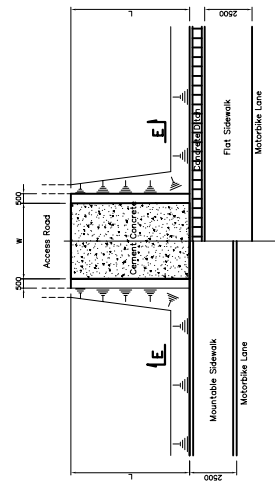


PROFILE

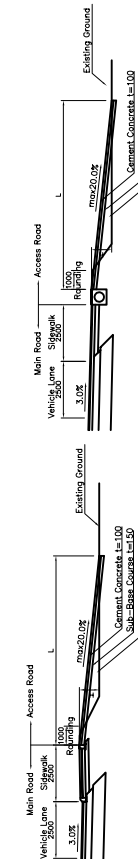
(2-Lane Section)



D-D SECTION
AC-TYPE-D

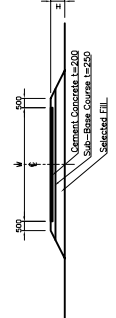


PLAN

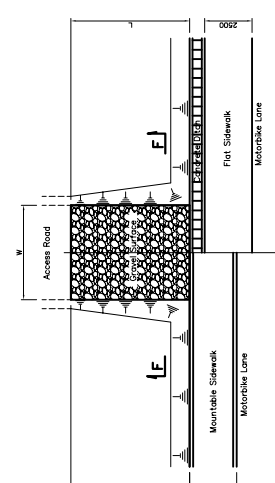


PROFILE

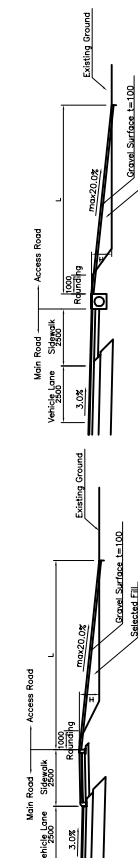
(2-Lane Section)



E-E SECTION
AC-TYPE-E

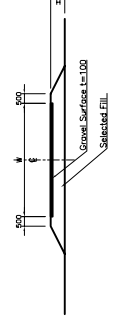


PLAN

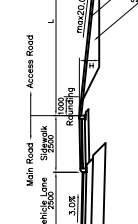


PROFILE

(2-Lane Section)



F-F SECTION
AC-TYPE-F



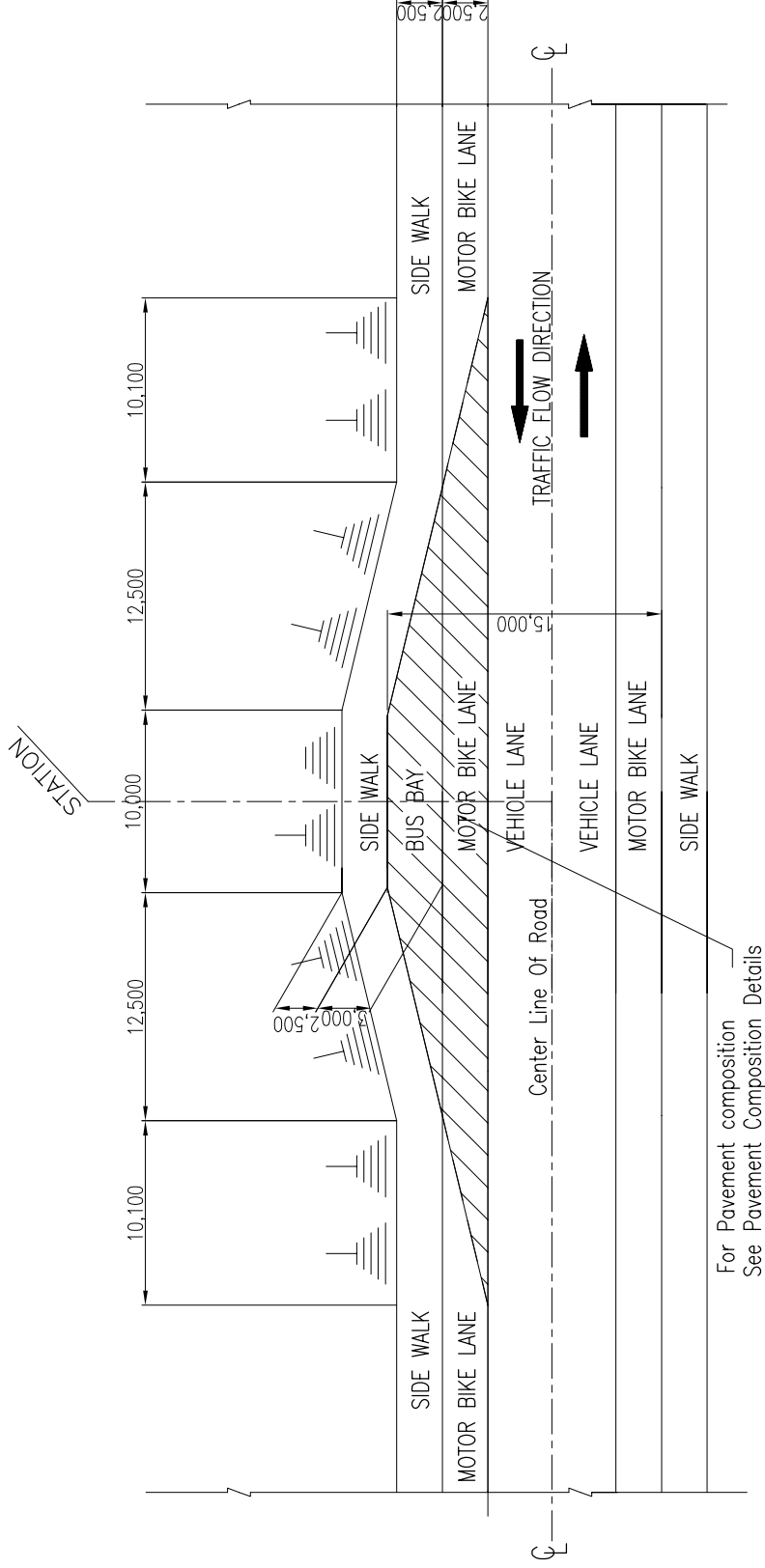
PROFILE

(4-Lane Section)

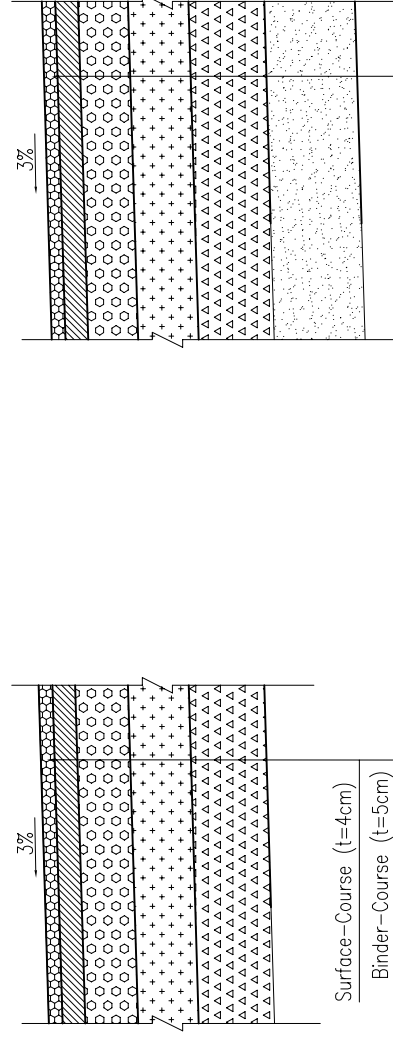
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY SURVEY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			ACCESS ROADS	1:100	Sheet No. RS - 2

SCHEDULE OF BUS STOPS

No.	STATION (km)	WIDENING SIDE	PAVEMENT TYPE
1	0+654	Right side	Type 1
2	0+729	Left side	Type 1
3	1+049	Left side	Type 1
4	1+135	Right side	Type 1
5	1+529	Right side	Type 1
6	1+586	Left side	Type 1
7	2+266	Left side	Type 1
8	2+330	Right side	Type 1
9	3+307	Right side	Type 2
10	3+364	Left side	Type 2
11	3+870	Right side	Type 2
12	3+892	Left side	Type 2
TOTAL		12	



PLAN SCALE 1:400



Surface-Course (t=4cm)
 Binder-Course (t=5cm)
 Base-Course (t=15cm)
 Sub-Base Course (t=33cm)
 Sub-Grade
 (Existing+Cement Stabilization t=50cm)

Surface-Course (t=4cm)
 Binder-Course (t=5cm)
 Base-Course (t=15cm)
 Sub-Base Course (t=33cm)
 Sub-Grade
 (Cement Stabilization t=40cm)
 Sub-Grade
 (Replacement t=60cm)

TYPE-1 (0+250 - 3+000)

TYPE-2 (3+000 - 4+000)

PAVEMENT COMPOSITION DETAILS SCALE 1:50

MINISTRY OF
PUBLIC WORKS AND TRANSPORT
(MPWT)

PREPARATORY STUDY ON THE PROJECT
FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1
(PHNOM PENH-NEAK LOEUNG SECTION)
IN THE KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

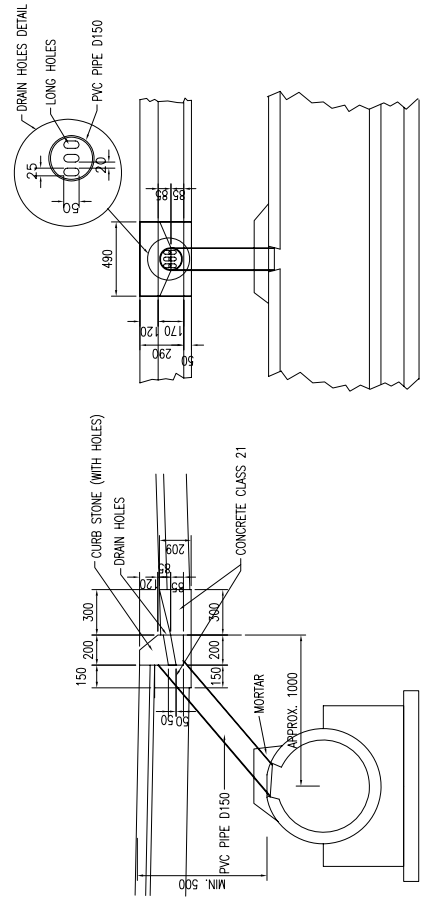
TITLE :
BUS BAY DETAIL

SCALE
AS SHOWN

Drawing No.

Sheet No.

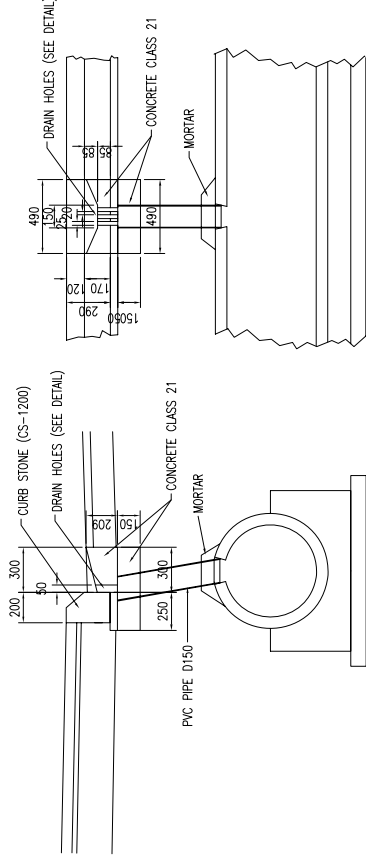
RS - 3



ELEVATION

INLET TYPE-A
(ILT-A)

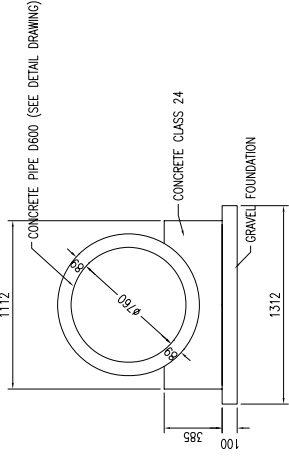
SECTION



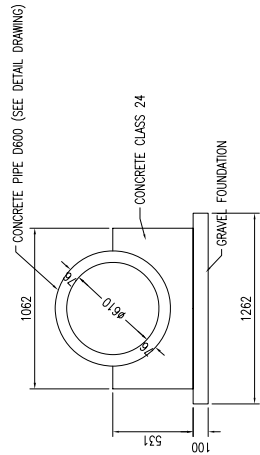
ELEVATION

INLET TYPE-B
(ILT-B)

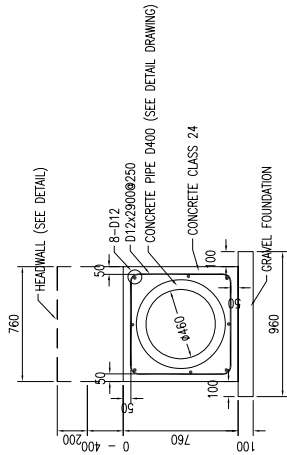
SECTION



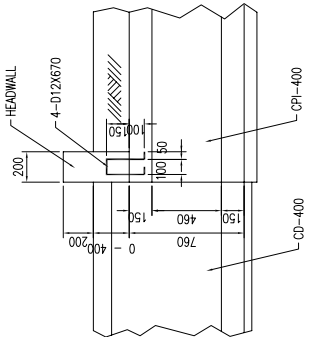
CONCRETE PIPE D750
(PI-750)



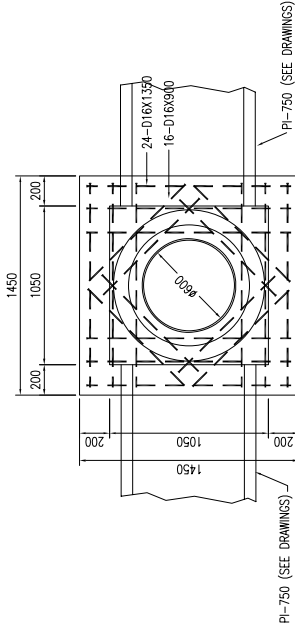
CONCRETE PIPE D600
(PI-600)



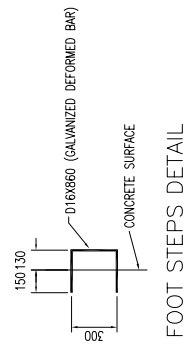
CONCRETE PIPE D400
(CPI-400)



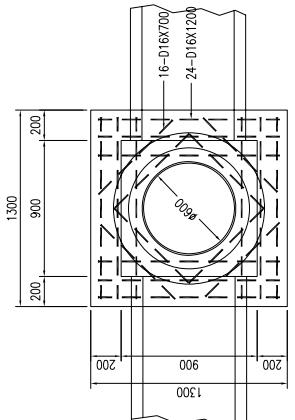
HEADWALL DETAIL



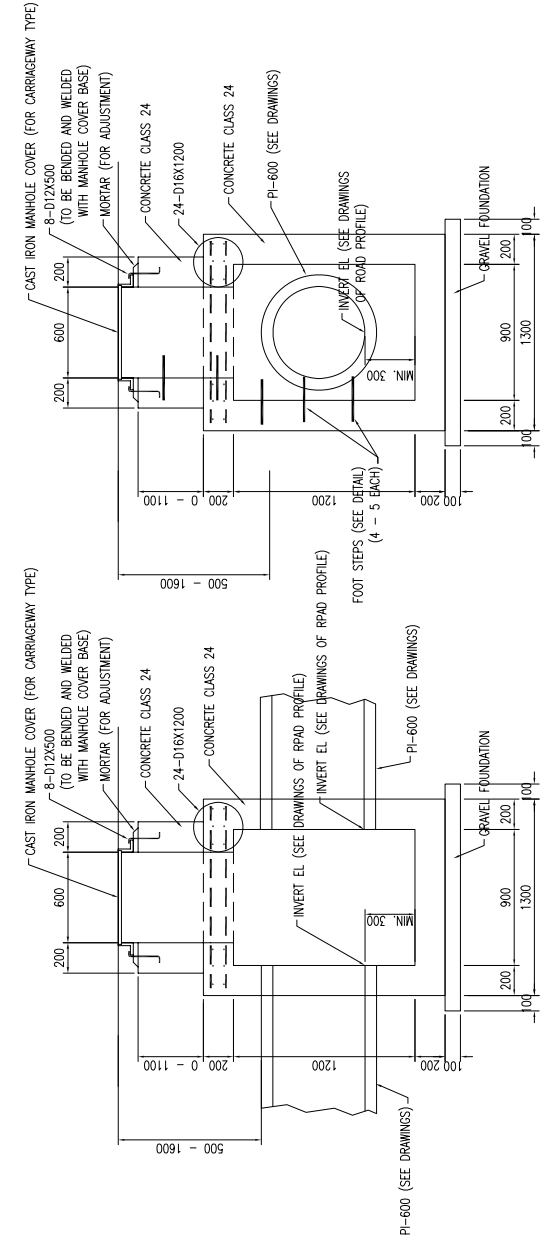
PI-750 (SEE DRAWINGS)



FOOT STEPS DETAIL

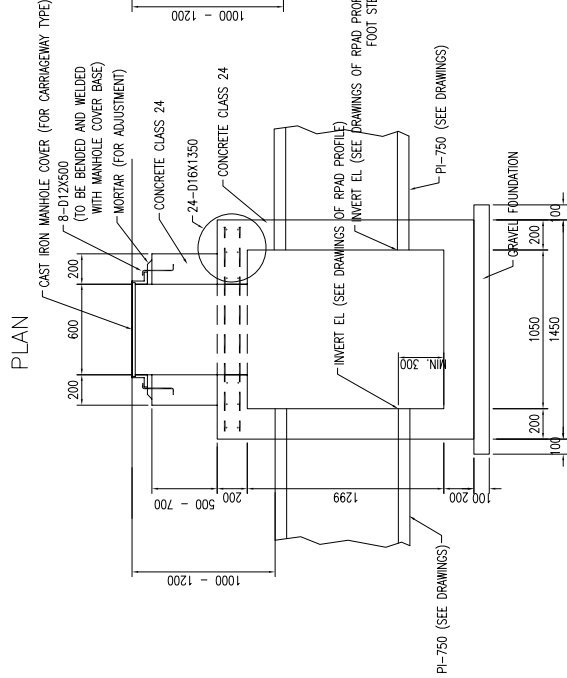


PLAN



ELEVATION

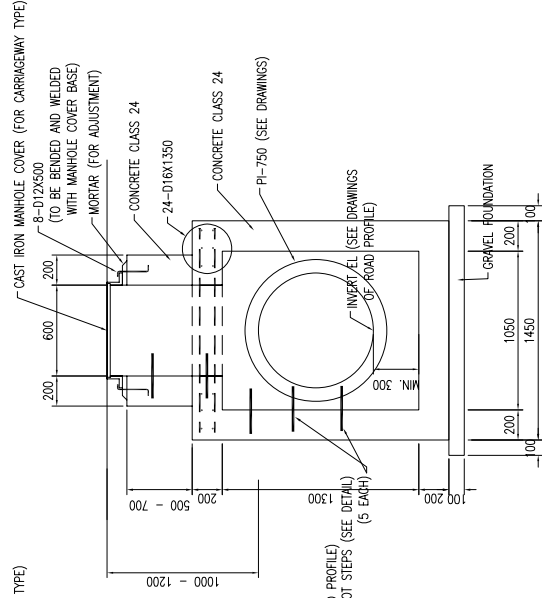
CATCH BASIN FOR PI-600
(CB-600)



PLAN

ELEVATION

CATCH BASIN FOR PI-750
(CB-750)



SECTION

MINISTRY OF
PUBLIC WORKS AND TRANSPORT
(MPWT)

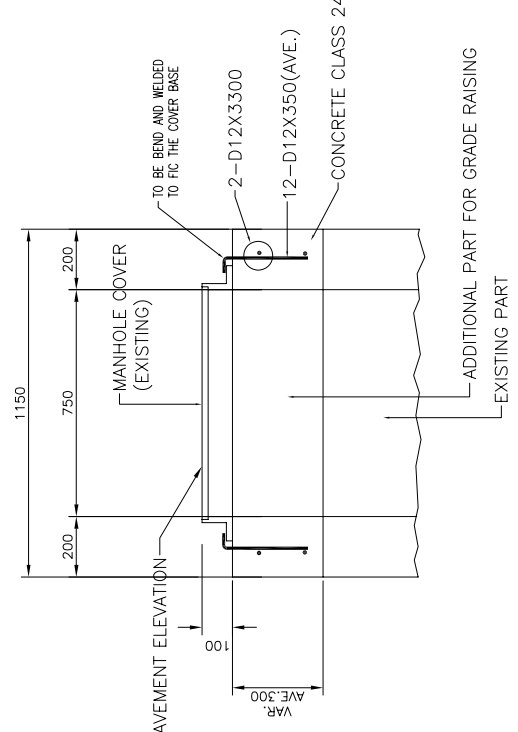
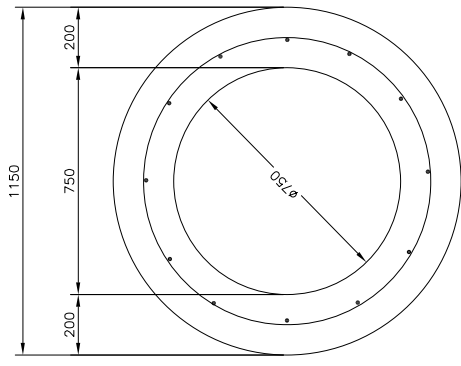
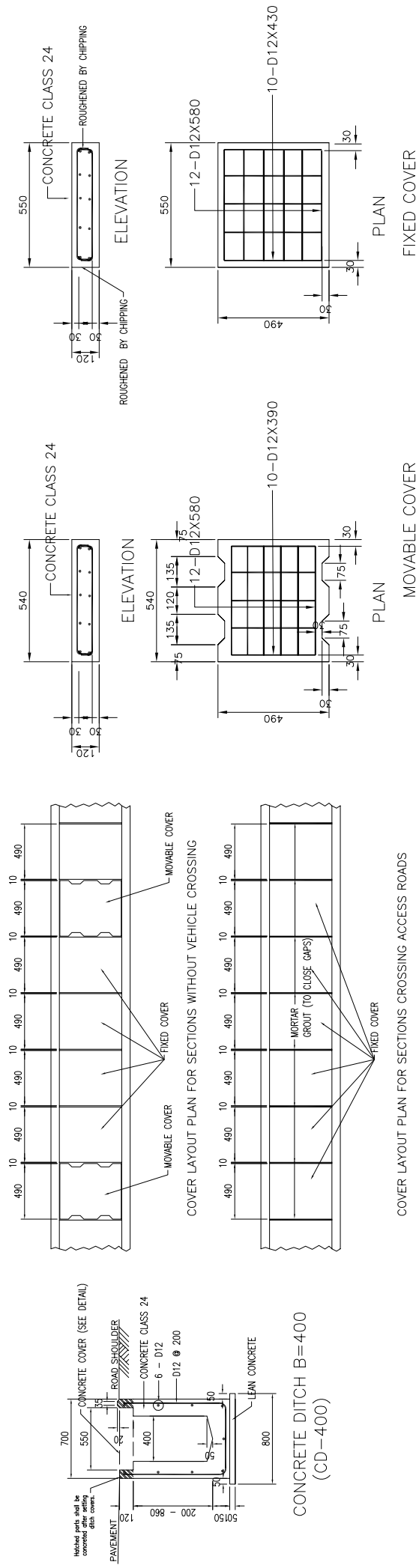
PREPARATORY STUDY ON THE PROJECT
FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1
(PHNOM PENH-NEAK LOEUNG SECTION)
IN THE KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

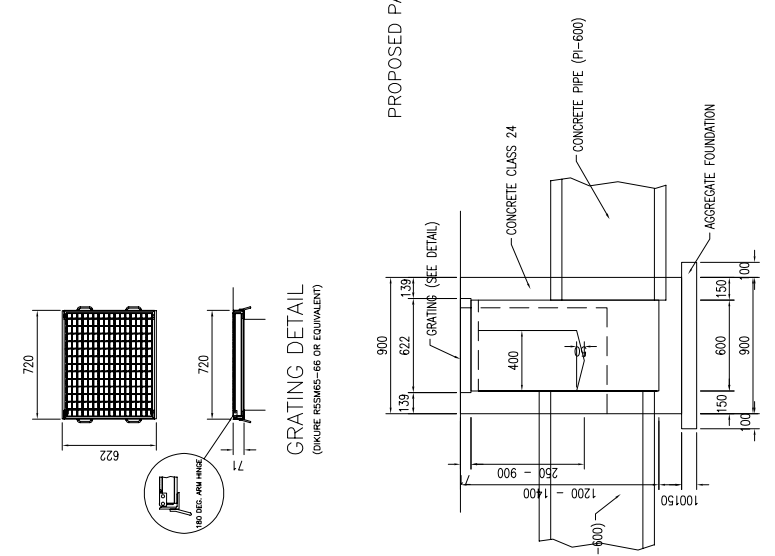
TITLE :
DRAINAGE STRUCTURES (1/4)

SCALE
1:50

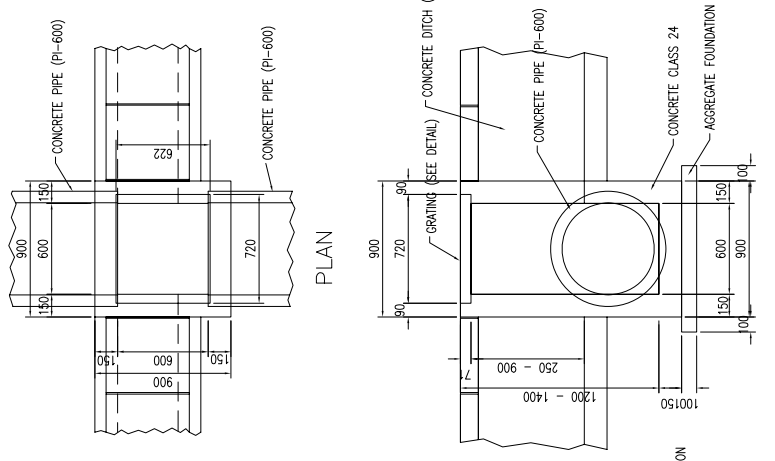
Drawing No.
Sheet No.
DR - 1



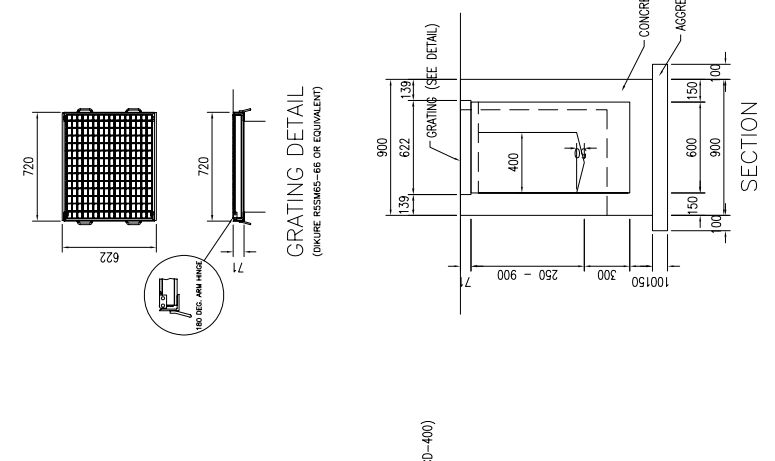
MANHOLE RAISE
(MH-RAISE)



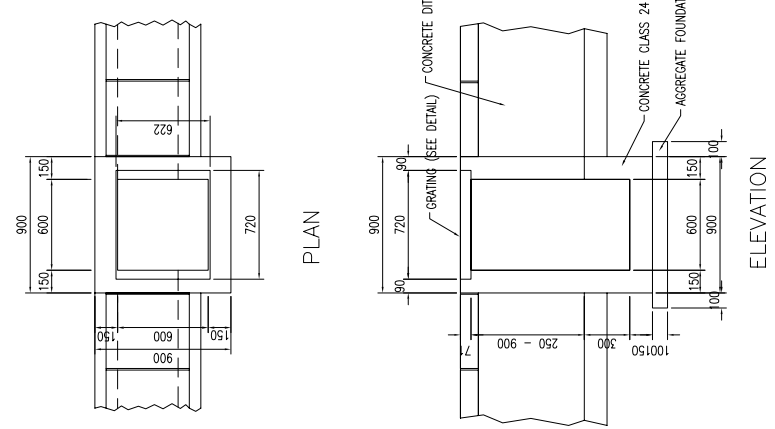
CATCH BASIN FOR DITCH-OUTLET
(CB-SP)



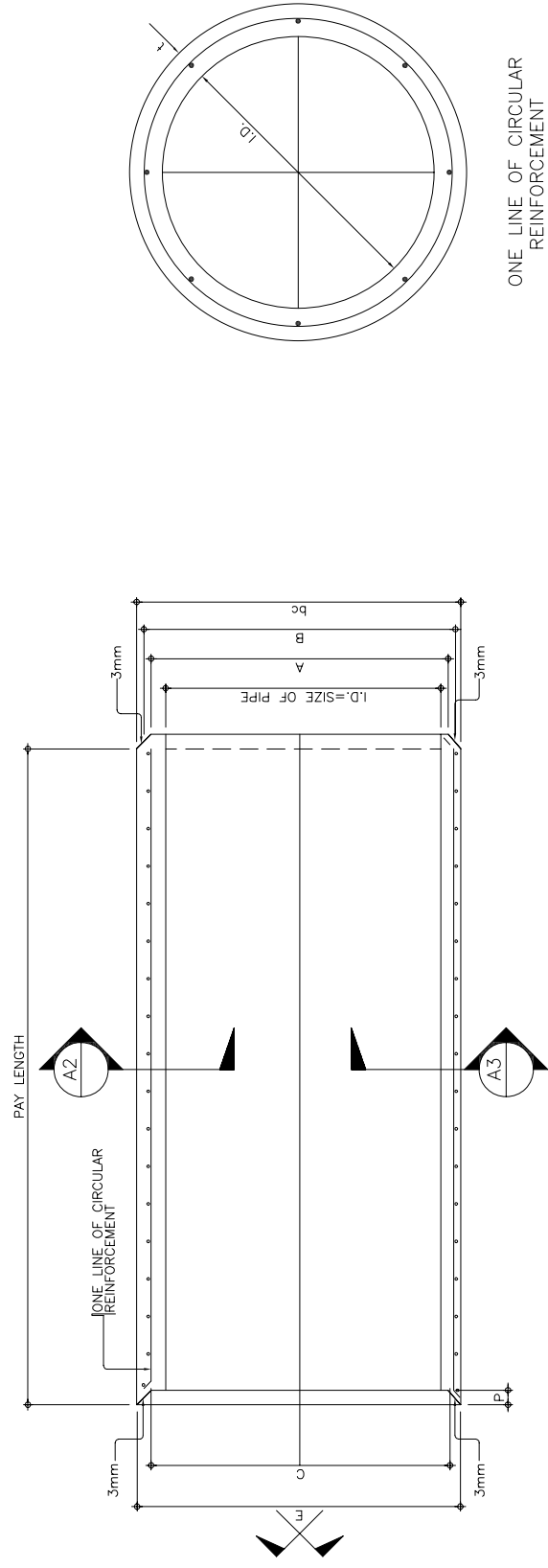
CATCH BASIN FOR DITCH-400
(CB-S)



CATCH BASIN FOR DITCH-400
(CB-400)



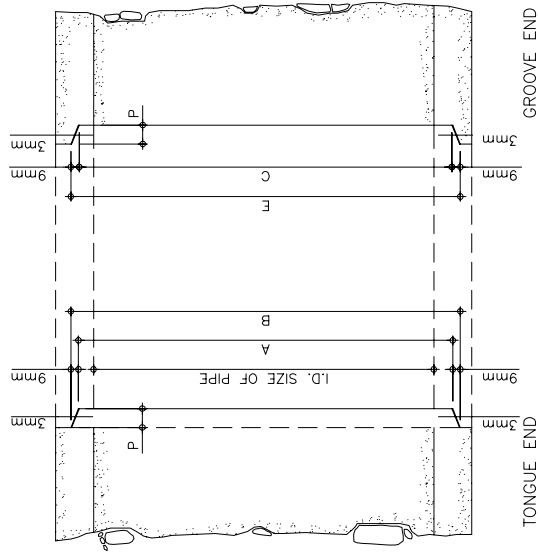
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			DRAINAGE STRUCTURES (2/4)	1:50	Sheet No. DR - 2



ONE LINE OF CIRCULAR REINFORCEMENT

STANDARD DESIGN OF REINFORCED CONCRETE PIPE

PIPE NOMINAL SIZE (mm)	PIPE I.D. (mm)	WALL THICKNESS (mm)	TONGUE (mm)			GROOVE (mm)			DEPTH (mm)	MINIMUM REINFORCEMENT cm ² /m OF PIPE	CONCRETE STRENGTH
			A	B	C	E	P	CIRCULAR REINFORCEMENT			
400	460	64	508	527	514	534	44	1 LINE	2.54	240 kg/cm ²	
610	610	76	673	692	680	699	44	1 LINE	3.60	240 kg/cm ²	
760	760	89	858	857	845	864	51	1 LINE	4.66	240 kg/cm ²	



REINFORCED CONCRETE PIPE DETAIL

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)

PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA

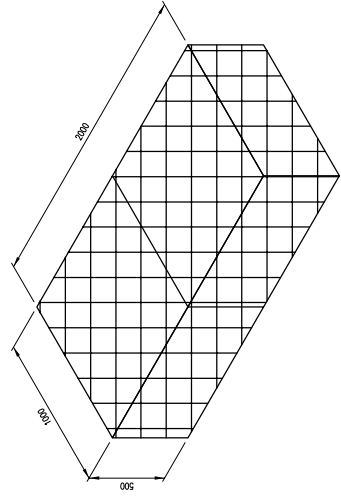
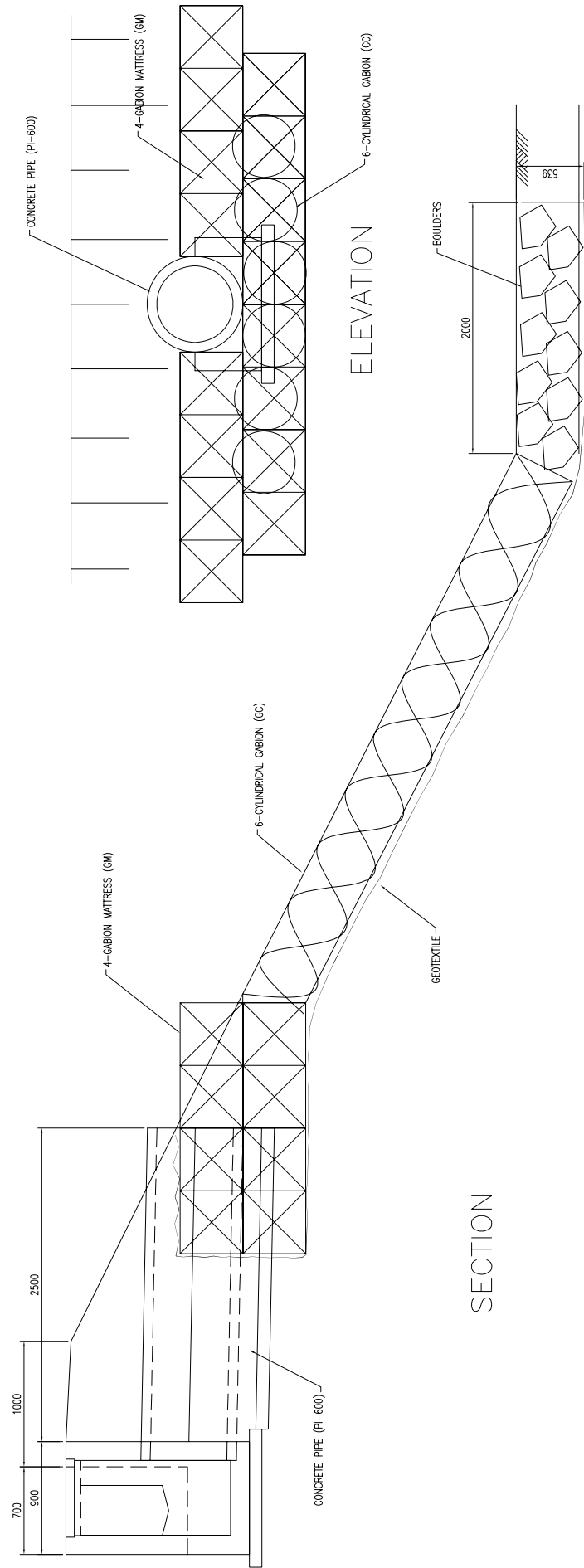
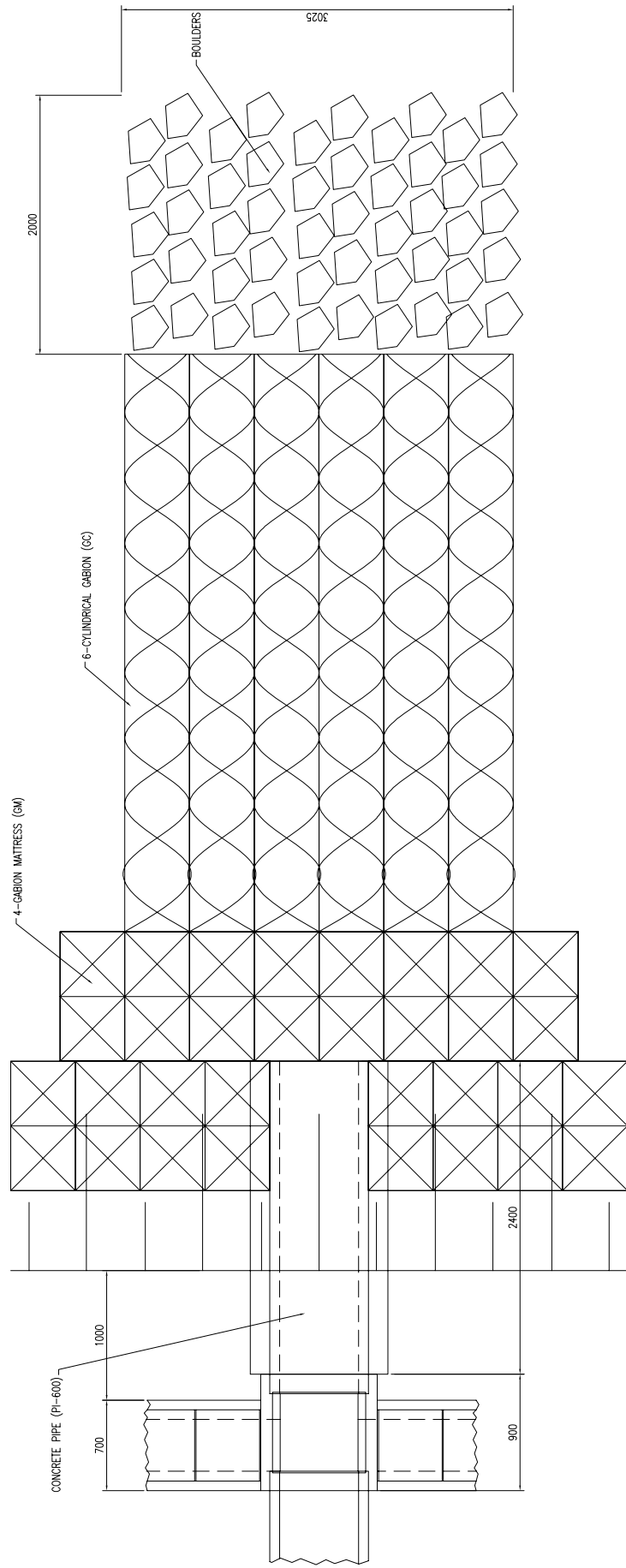
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

TITLE :
DRAINAGE STRUCTURES (3/4)
RC PIPE

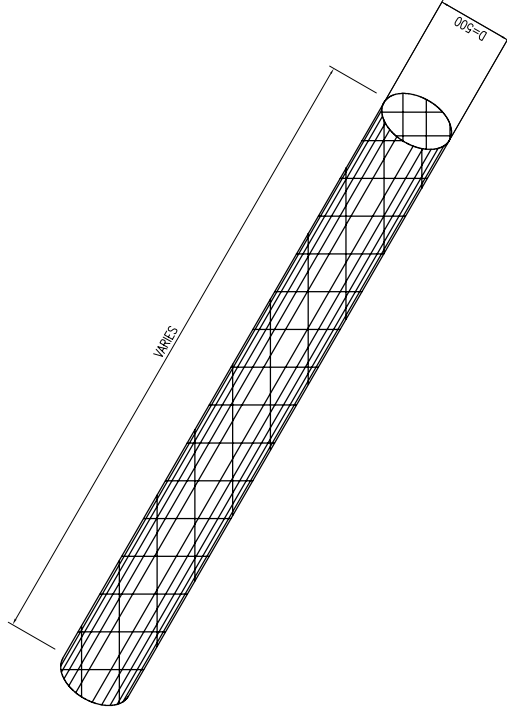
SCALE
AS SHOWN

Drawing No.

Sheet No.
DR - 3



GABION MATTRESS (GM)



CYLINDRICAL GABION (GC)

Note: Gabion mesh and Boulders shall comply with the Technical Specifications of this Contract. Gabion Mattress and Cylindrical Gabion shall be placed on Geotextile Fabric.

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)

PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA

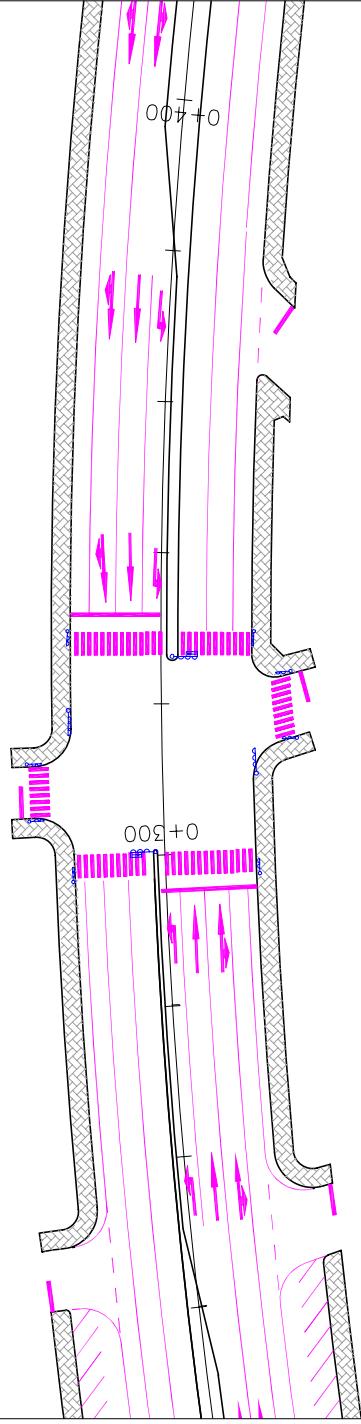
JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL

TITLE : DRAINAGE STRUCTURES (4/4) DRAIN OUTLET

SCALE 1:50

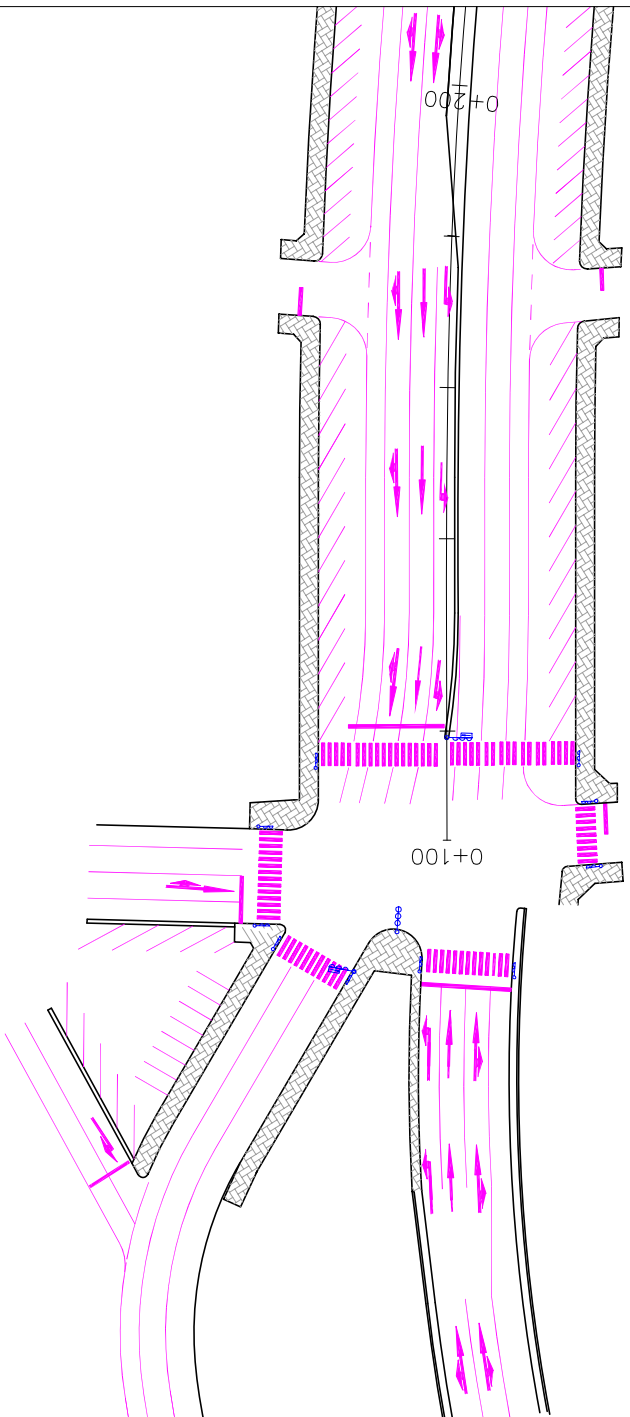
Drawing No. Sheet No. DR - 4

Sta. 0+300



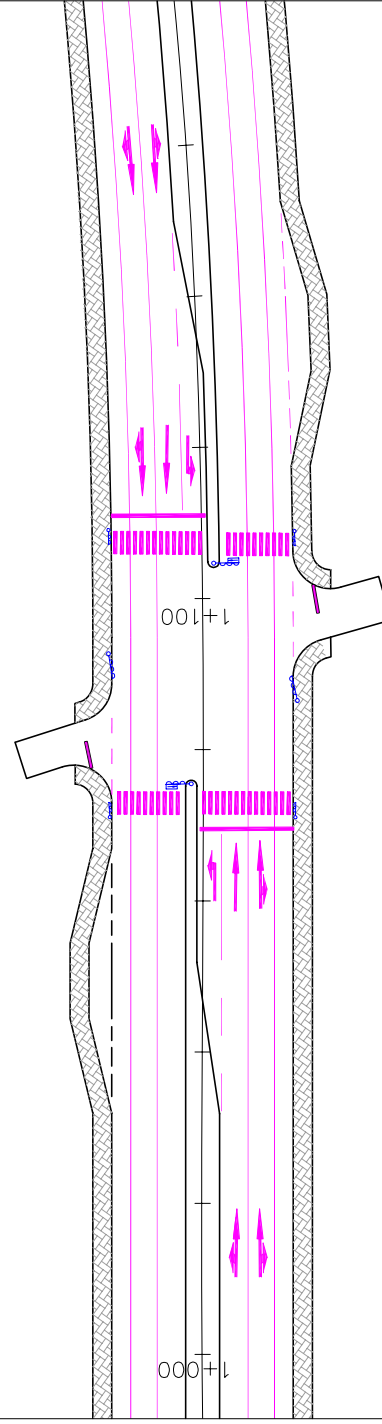
TRAFFIC LIGHT				
Sta. 0+300	Single Direction(ea)		Both Direction(ea)	
	Normal	with Arrow	Normal	with Arrow
	2	2	0	0
			Pedestrian (ea)	
			8	

Sta. 0+100



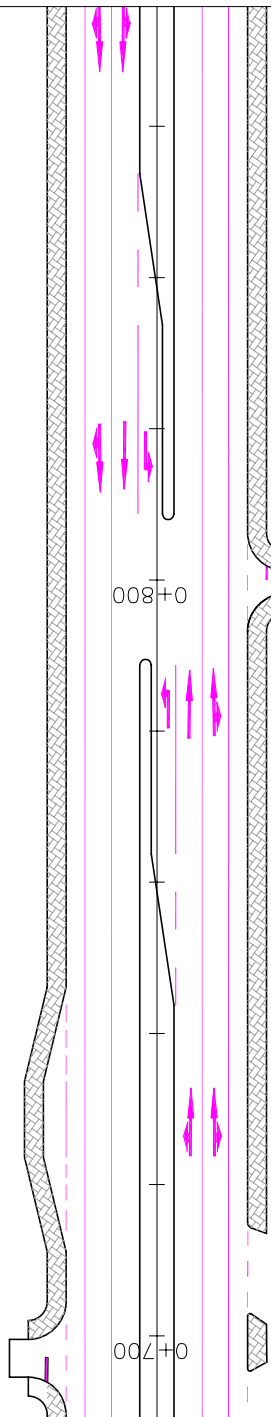
TRAFFIC LIGHT				
Sta. 0+100	Single Direction(ea)		Both Direction(ea)	
	Normal	with Arrow	Normal	with Arrow
	0	2	1	1
			Pedestrian (ea)	
			10	

Sta. 1+090



TRAFFIC LIGHT				
Sta. 1+090	Single Direction(ea)		Both Direction(ea)	
	Normal	with Arrow	Normal	with Arrow
	2	2	0	0
			Pedestrian (ea)	
			4	

Sta. 0+800



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)

PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA

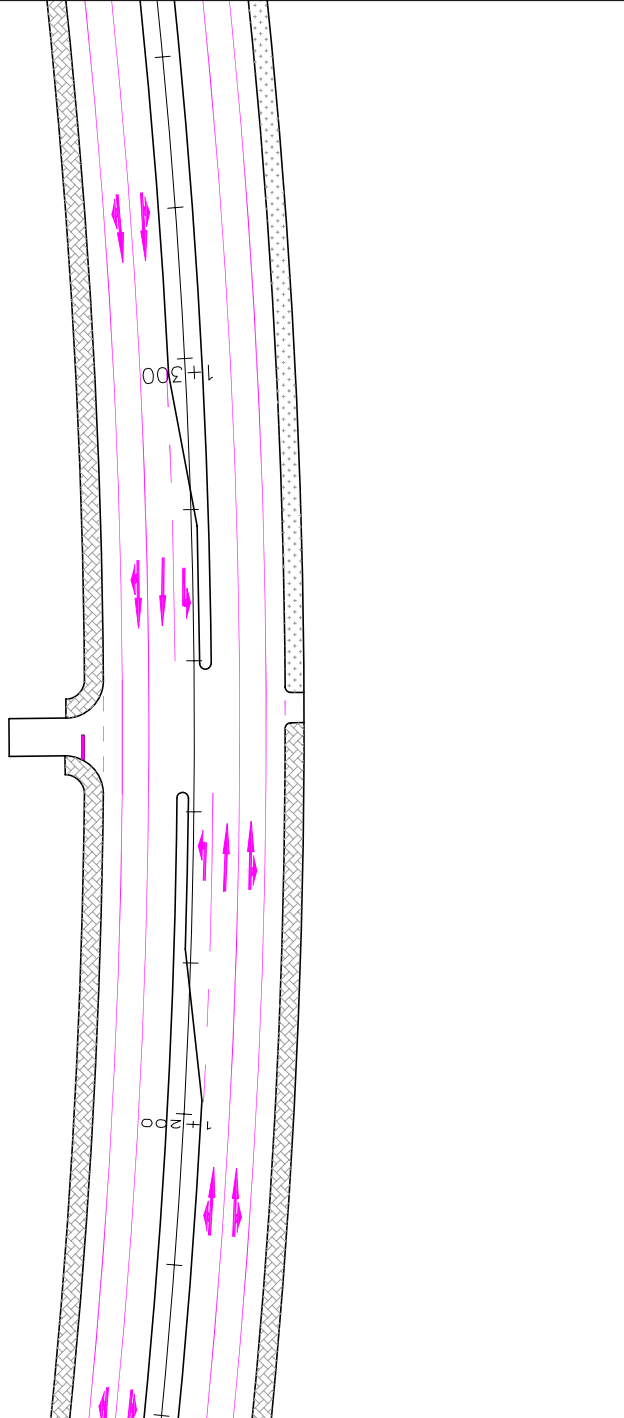
JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL

TITLE: TRAFFIC LIGHT & MARKING LAYOUT AT INTERSECTIONS (1/2)

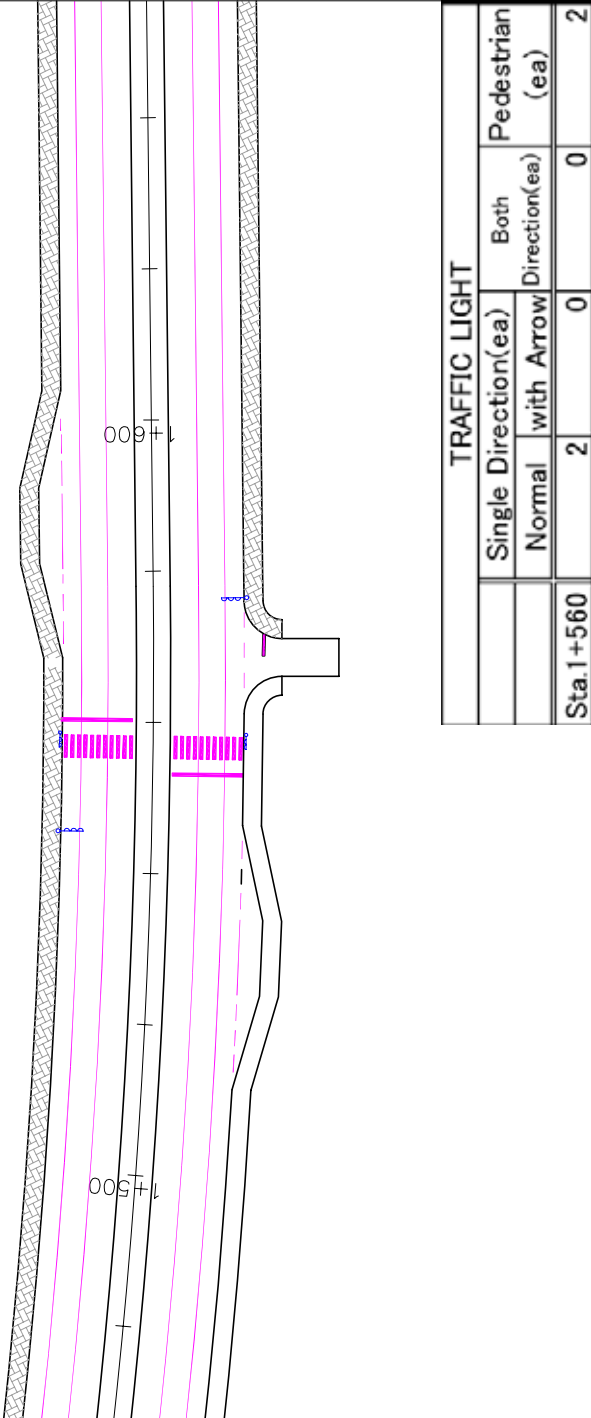
SCALE 1:1000

Drawing No. Sheet No. M - 1

Sta. 1+250

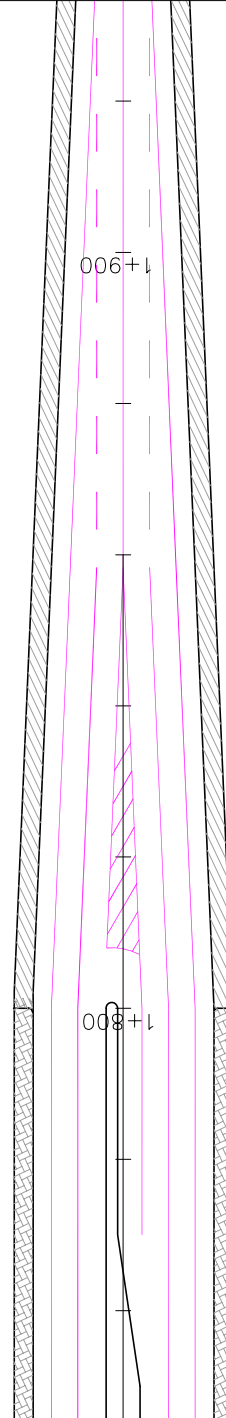


Sta. 1+560

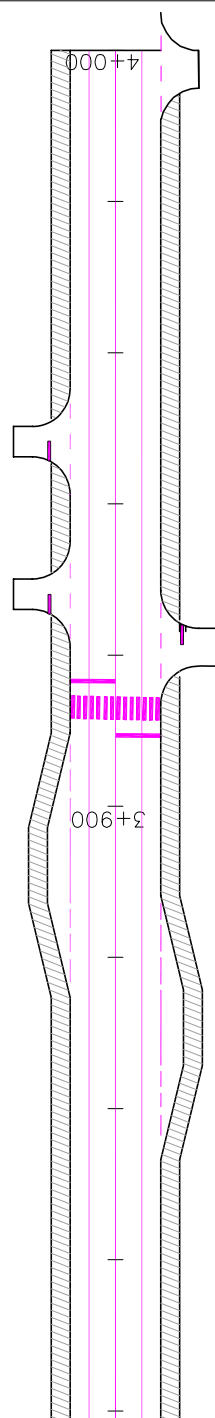


TRAFFIC LIGHT			
Single Direction(ea)	Both Direction(ea)		Pedestrian (ea)
	Normal	with Arrow	
2	0	0	2
Sta. 1+560			

Sta. 1+800



Sta. 3+920



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)

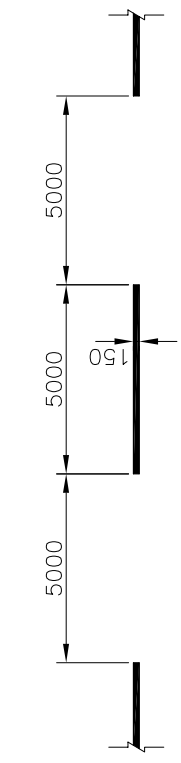
PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL

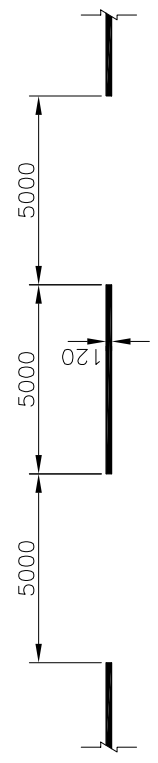
TITLE : TRAFFIC LIGHT & MARKING LAYOUT AT INTERSECTIONS (2/2)

SCALE 1:1000

Drawing No. Sheet No. M - 2



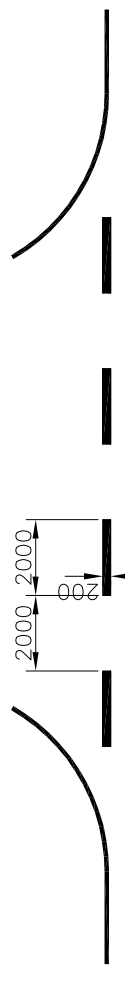
CENTERLINE



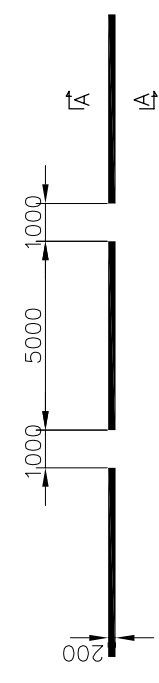
LANE MARK



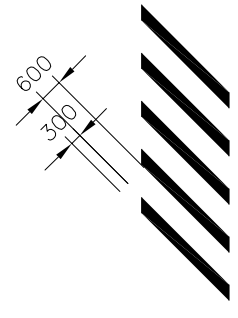
EDGE LINE
(Boundary of Vehicle and Motro-bike)



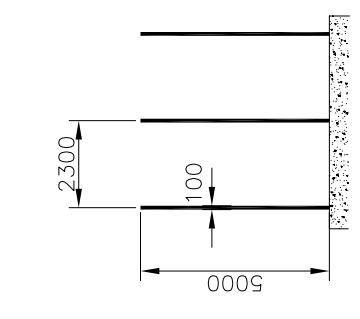
BROKEN LINE



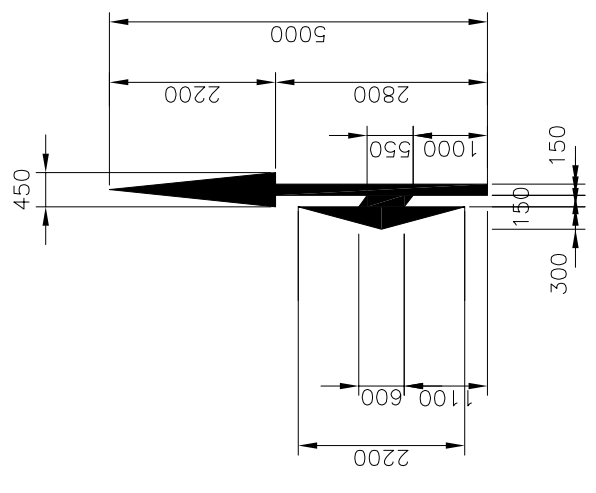
DIVIDER FOR 2-LANE SECTION
(BOUNDARY BETWEEN MOTER-BIKE LANE AND SIDEWALK)



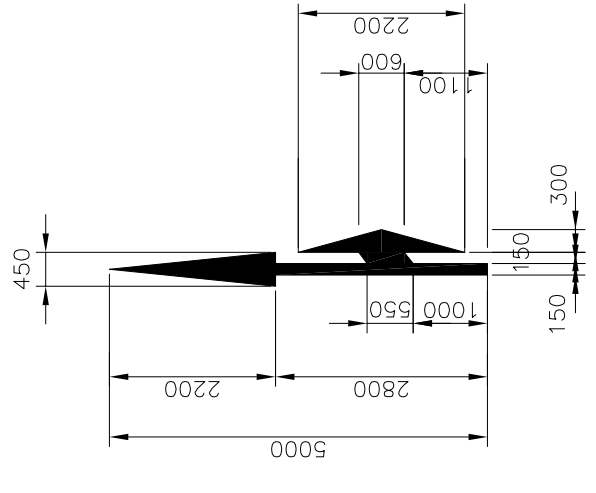
ZEBRA MARK



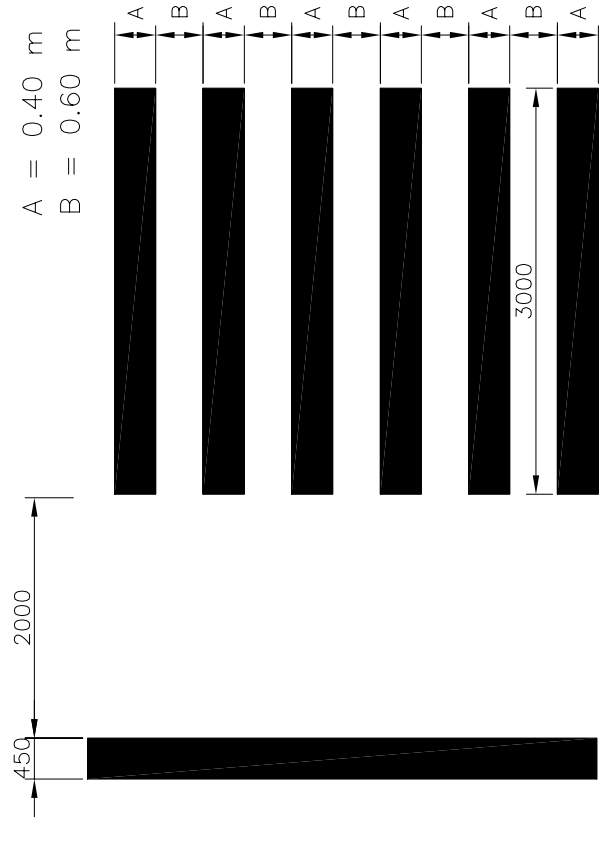
PARKING GUIDELINE



ARROOW MARKS



STOP LINE



CROSSWALK

MINISTRY OF
PUBLIC WORKS AND TRANSPORT
(MPWT)

PREPARATORY STUDY ON THE PROJECT
FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1
(PHNOM PENH-NEAK LOEUNG SECTION)
IN THE KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

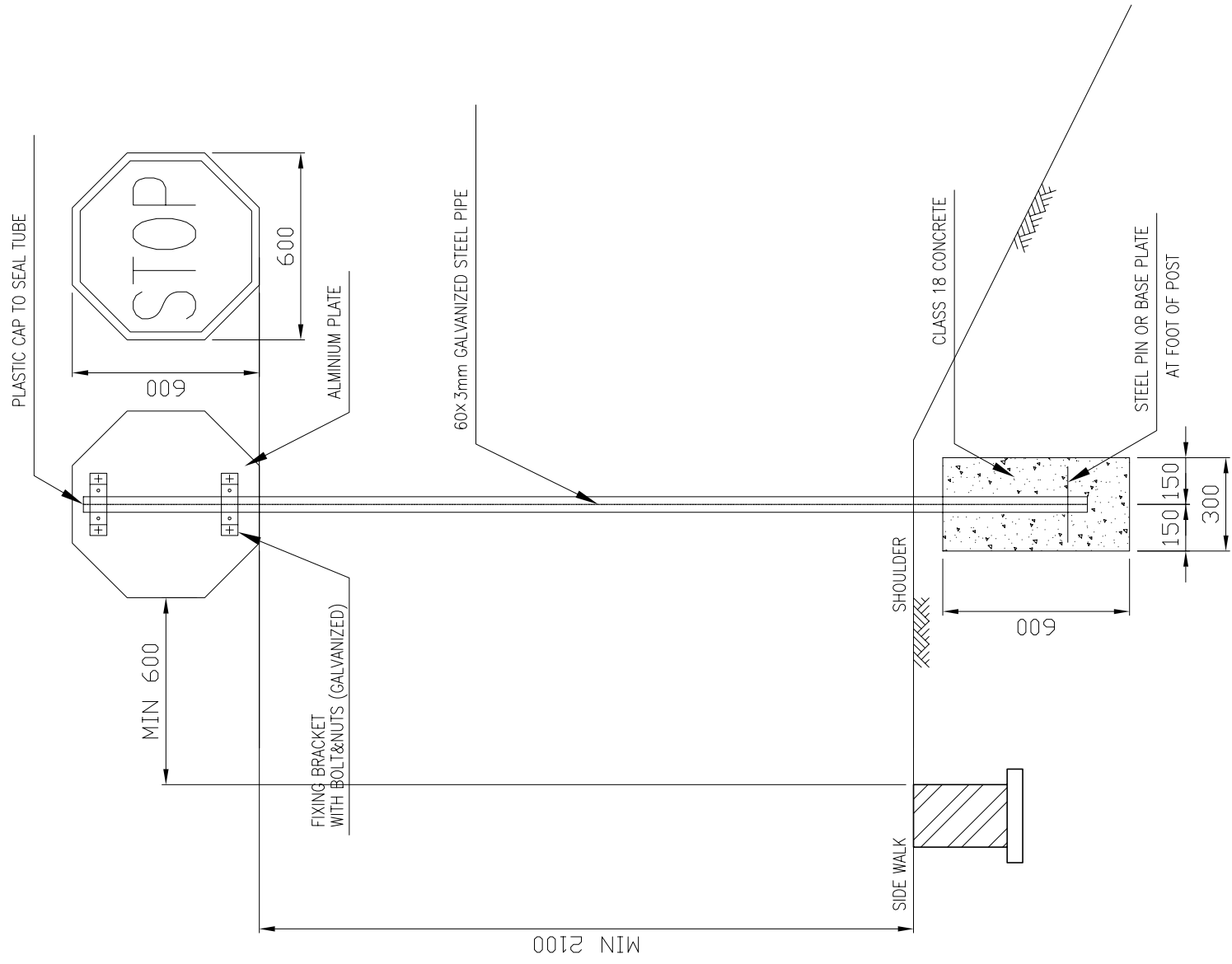
TITLE :
ROAD MARKING DETAIL

SCALE
1:100

Drawing No.
Sheet No.
M - 3

ROAD SIGN INSTALLATION SCHEDULE

TYPE OF ROAD SIGN	LOCATION OF ROAD SIGN							
	0+000-L	0+000-R	0+200-L	0+200-R	0+400-L	0+400-R	0+600-L	0+600-R
40 km/h Max	0+400-R	0+600-L	0+200-R	0+800-L	0+400-L	0+800-R	0+600-L	0+800-R
	1+000-L	1+000-R	1+200-L	1+200-R	1+400-L	1+400-R	1+200-L	1+200-R
	1+400-R	1+400-L	1+400-R	1+800-L	1+800-L	1+800-R	1+800-L	1+800-R
	2+000-L	2+000-R	2+200-L	2+200-R	2+400-L	2+400-R	2+400-L	2+400-R
60 km/h Max	2+400-R	2+400-L	2+400-R	2+800-L	2+800-L	2+800-R	2+800-L	2+800-R
	3+000-L	3+000-R	3+200-L	3+200-R	3+400-L	3+400-R	3+200-L	3+200-R
	3+400-R	3+400-L	3+400-R	3+800-L	3+800-L	3+800-R	3+800-L	3+800-R
	4+000-L	4+000-R	0+170-L	0+170-R	0+170-L	0+170-R	0+245-L	0+245-R
No Left Turn	0+040-L	0+370-R						
No Right Turn	0+080-L							
Stop	0+040-L	0+170-L	0+170-R	0+245-L	0+400-L	0+400-R	0+245-L	0+245-R
	0+370-R	0+800-R	1+250-L	1+570-R	1+400-L	1+400-R	1+250-L	2+300-L
	3+335-L	3+610-L	3+920-R	3+930-L	3+335-L	3+610-L	3+920-R	3+950-L
	3+995-R							
No Entry	0+040-L	0+085-R						
Hump Ahead	3+860-R	3+940-L						
Bus Stop Ahead	0+620-R	0+760-L	1+075-L	1+110-R	0+620-R	0+760-L	1+075-L	1+500-R
	1+620-L	2+290-L	2+300-R	3+270-R	1+620-L	2+290-L	2+300-R	3+400-L
Intersection Ahead	0+740-R	0+860-L	1+200-R	1+300-L	0+740-R	0+860-L	1+200-R	1+540-R
	2+330-L	3+380-L	3+365-L	3+800-L	2+330-L	3+380-L	3+365-L	3+970-R
Crosswalk Ahead	3+970-L							
Road Width Narrower	1+500-R	1+600-L	3+900-R	3+920-L	1+500-R	1+600-L	3+900-R	
Road Width Wider	1+720-R				1+720-R			
	1+960-L				1+960-L			



ROAD SIGN S=1:20

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)

PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL

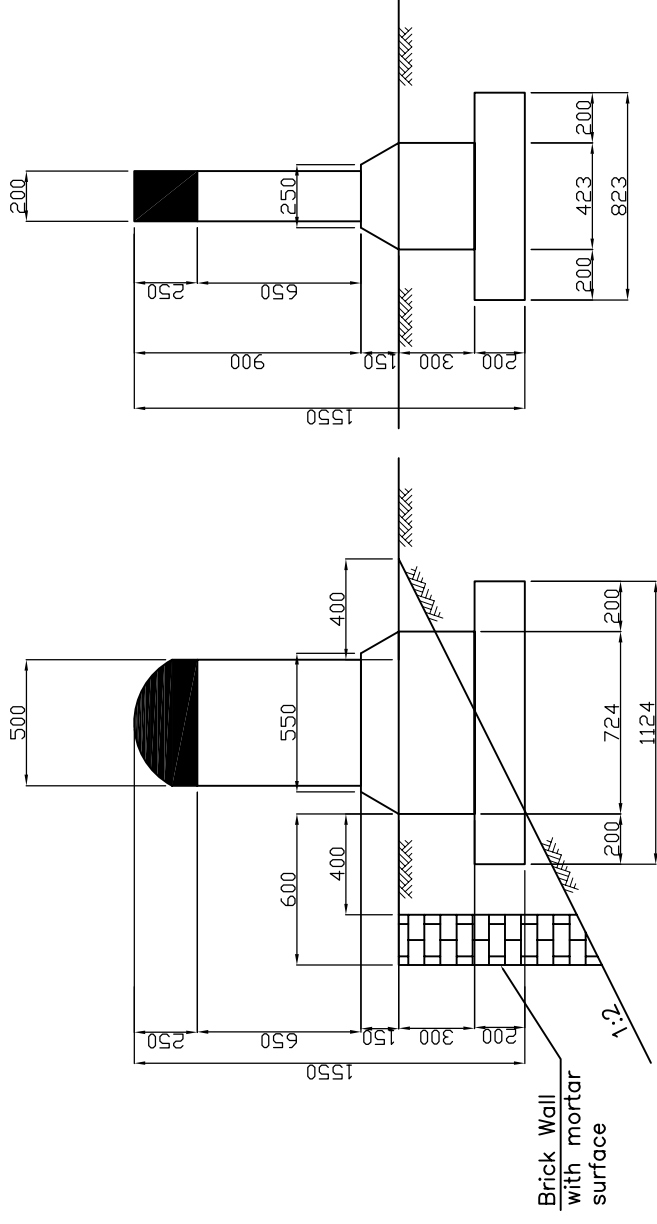
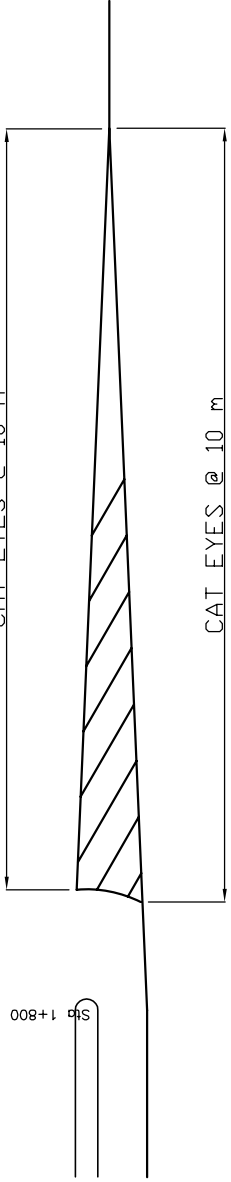
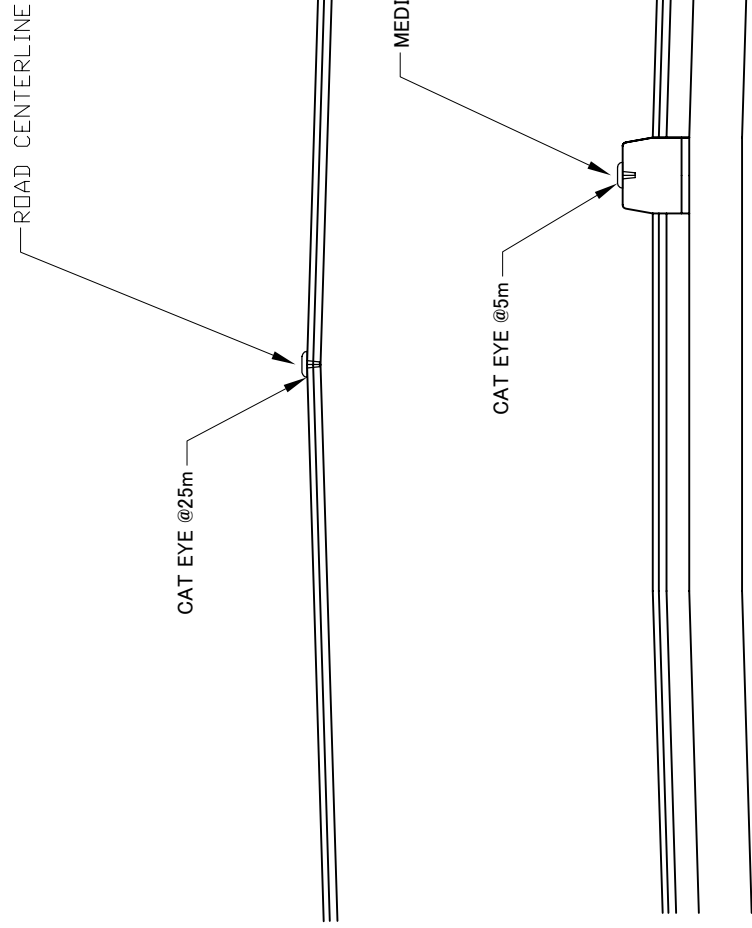
TITLE : ROAD SIGN DETAIL

SCALE 1:20

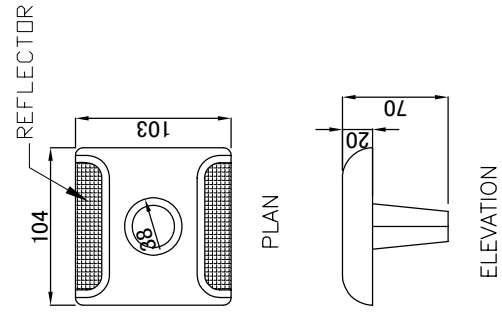
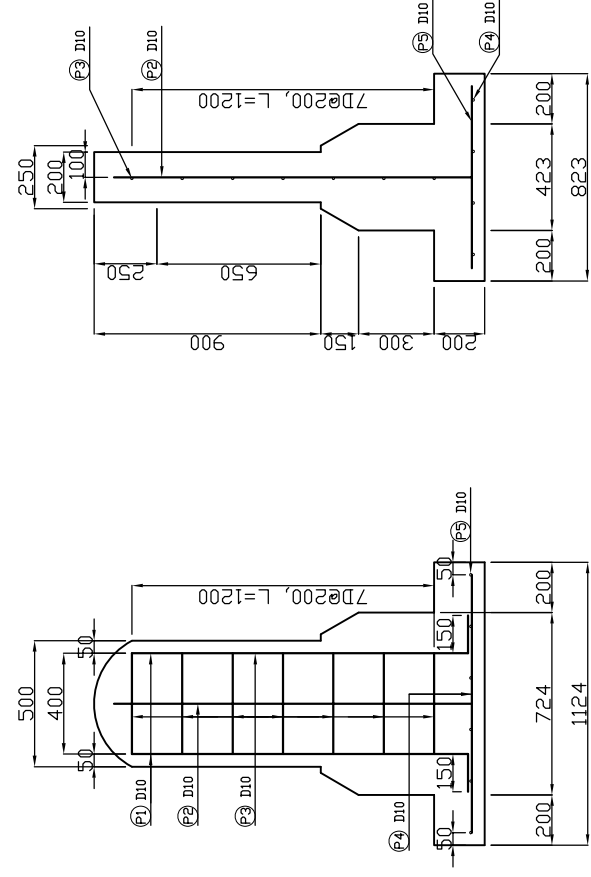
Drawing No.

Sheet No.

M - 4

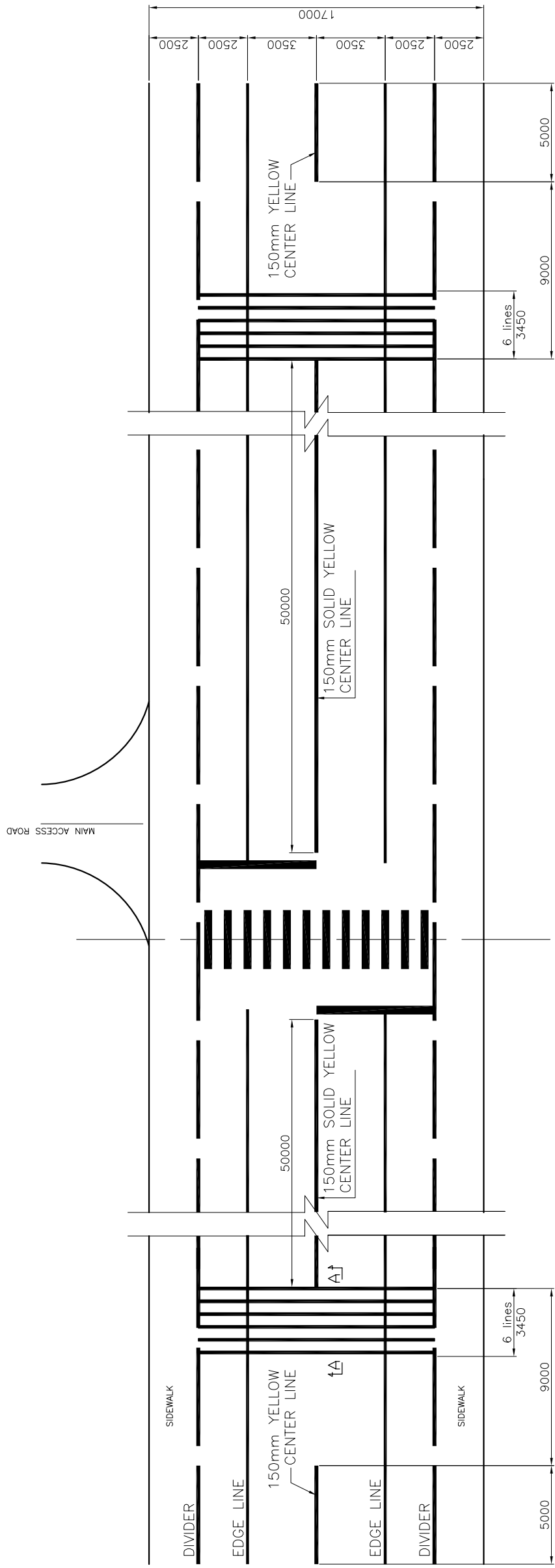


KILOMETER POST S=1:30
(To be installed at every 1km interval)

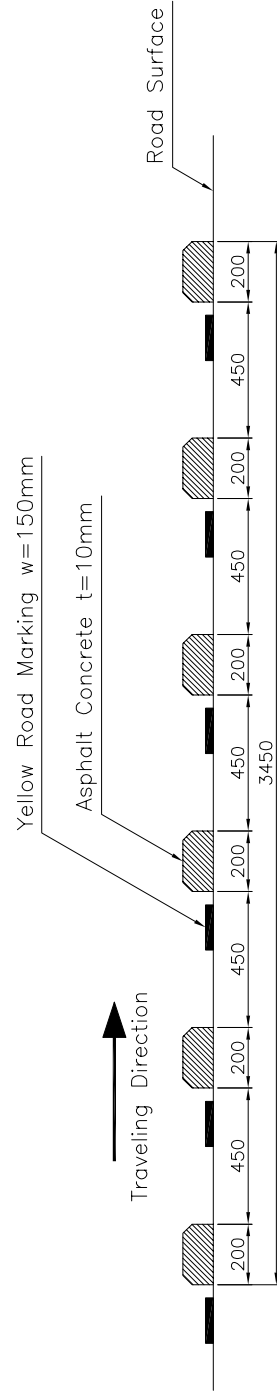


CAT EYE DETAIL S=1:5

MARK	DIA-METER	LENGTH (mm)	NO.	WEIGHT/m (kg/m)	WEIGHT/ONE (kg)	REMARKS
P1	D10	1502	2	0.616	0.925	1.850
2	"	1595	1	"	0.983	0.983
3	"	400	7	"	0.246	1.722
4	"	723	4	"	0.445	1.780
5	"	1025	6	"	0.631	3.786
					10.121	kg



RUMBLE STRAIPS FOR SCHOOL (2 LANE TYPE) S=1/250



Section A-A for 6 Lines S=1/25

MINISTRY OF
PUBLIC WORKS AND TRANSPORT
(MPWT)

IMPLEMENTATION REVIEW STUDY ON THE PROJECT
FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1
(PHNOM PENH-NEAK LOEUNG SECTION)
IN THE KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

TITLE :
SAFETY FACILITIES
(RUMBLE STRIPS)

SCALE
As Shown

Drawing No.
Sheet No.
M - 6

Appendix 7 Technical Data

7.1 Calculation of Discharge of Road Drainage

1. Calculation of Discharge from Catchment Area

No.	Catchments Area			Return Period	Reinfall mm/hr	Discharge Coefficient C	Discharge Q cu.m/sec
	With m	Length m	Area ha				
Pipe							
0+000 – 0+120 (Outlet)	40	500	2.00	2	71.1	0.90	0.356
0+120 (Cross Pipe)	20	500	1.00	2	71.1	0.90	0.178
0+120 – 0+500 (L=R)	20	500	1.00	2	71.1	0.90	0.178
0+500 – 1+097 (L=R)	15	597	0.90	2	71.1	0.90	0.159
1+097 – 1+340 (L=R)	15	243	0.36	2	71.1	0.90	0.065
1+097 (Cross Pipe)	15	840	1.26	2	71.1	0.90	0.224
1+097 (Outlet)	30	840	2.52	2	71.1	0.90	0.448
1+340 – 1+570 (L=R)	15	230	0.35	2	71.1	0.90	0.061
1+570 – 1+800 (L=R)	15	230	0.35	2	71.1	0.90	0.061
1+570 (Cross Pipe)	15	460	0.69	2	71.1	0.90	0.123
1+570 (Outlet)	30	460	1.38	2	71.1	0.90	0.245
Side Ditch							
1+800 – 1+950 (Left & Right)	9.2	150	0.14	2	71.1	0.90	0.0245
1+950 – 2+060 (Left & Right)	9.2	110	0.10	2	71.1	0.90	0.0180
1+950 (Cross Pipe)	9.2	260	0.24	2	71.1	0.90	0.0425
2+060 – 2+260 (Left & Right)	9.2	200	0.18	2	71.1	0.90	0.0327
2+260 – 2+420 (Left & Right)	9.2	160	0.15	2	71.1	0.90	0.0262
2+420 – 2+580 (Left & Right)	9.2	160	0.15	2	71.1	0.90	0.0262
2+580 – 2+740 (Left & Right)	9.2	160	0.15	2	71.1	0.90	0.0262
1+950 (Cross Pipe)	9.2	320	0.29	2	71.1	0.90	0.0523
2+740 – 2+960 (Left)	18.4	220	0.40	2	71.1	0.90	0.0720
2+960 – 3+090 (Left)	18.4	120	0.22	2	71.1	0.90	0.0392
3+090 – 3+175 (Right)	18.4	85	0.16	2	71.1	0.90	0.0278
3+175 – 3+340 (Right)	18.4	165	0.30	2	71.1	0.90	0.0540
3+340 – 3+500 (Right)	18.4	160	0.29	2	71.1	0.90	0.0523
3+500 – 3+580 (Right)	18.4	80	0.15	2	71.1	0.90	0.0262
3+580 – 3+670 (Right)	18.4	90	0.17	2	71.1	0.90	0.0294
3+670 – 3+800 (Right)	18.4	130	0.24	2	71.1	0.90	0.0425
3+800 – 4+000 (Right & Left)	9.2	200	0.18	2	71.1	0.90	0.0327
4+000 (Cross Pipe)	9.2	200	0.18	2	71.1	0.90	0.0327

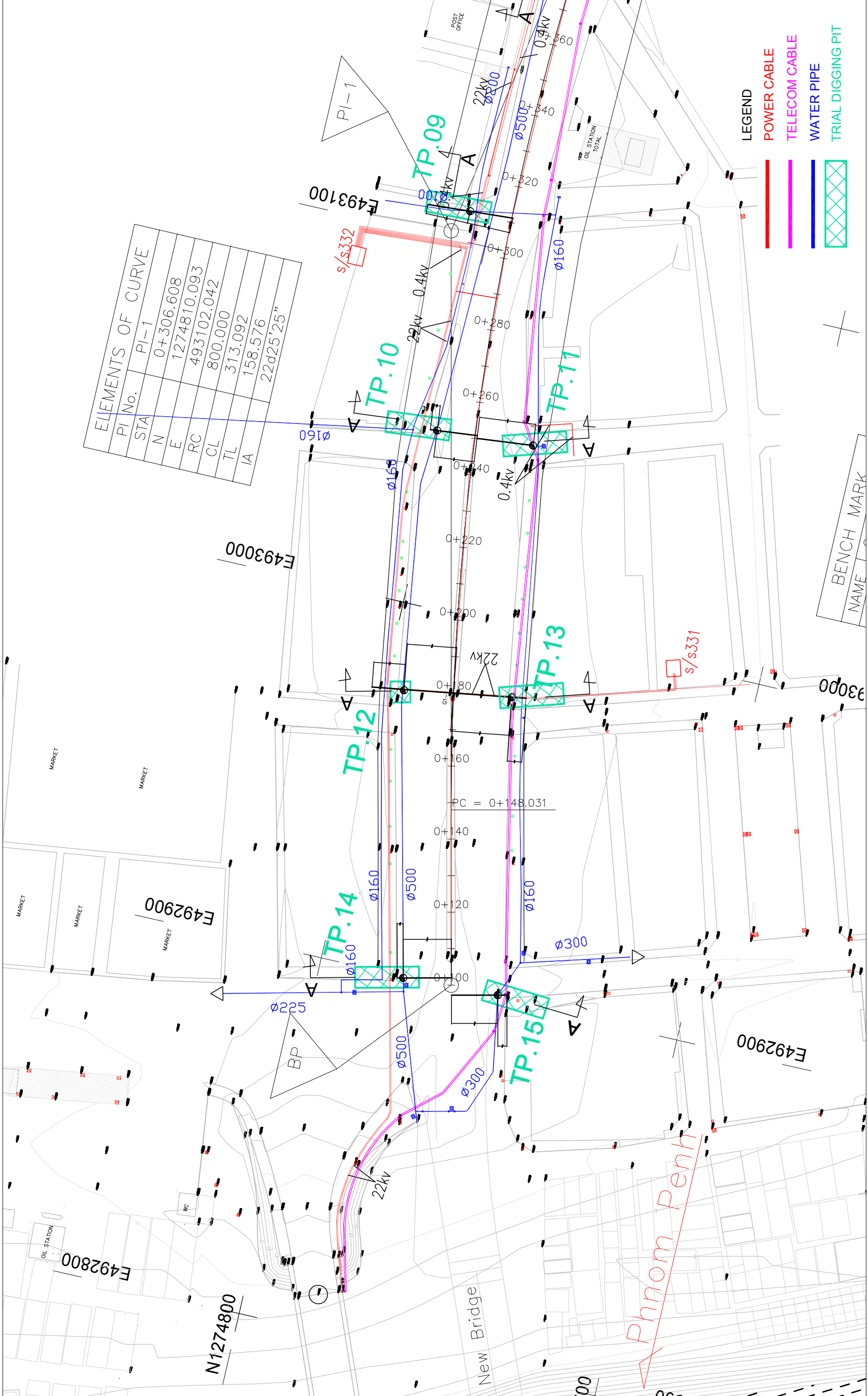
2. Calculation of Discharge by Pipe

No.	Pipe Dia. ϕ (m)	Roughness n	Discharge Q(m ³ /sec)	Gradient i(%/100)	Velocity V(m/sec)	W. Depth (m)	Sec. Area (m ²)	R (m)
0+000 – 0+120 (Outlet)	0.76	0.013	0.356	0.0050	1.734	0.350	0.204	0.180
0+120 (Cross Pipe)	0.61	0.013	0.178	0.0050	1.455	0.264	0.121	0.138
0+120 – 0+500 (L=R)	0.61	0.013	0.178	0.0020	1.031	0.345	0.170	0.164
0+500 – 1+097 (L=R)	0.61	0.013	0.159	0.0020	1.002	0.320	0.155	0.157
1+097 – 1+340 (L=R)	0.61	0.013	0.065	0.0030	0.925	0.180	0.072	0.103
1+097 (Cross Pipe)	0.61	0.013	0.224	0.0050	1.542	0.300	0.143	0.151
1+097 (Outlet)	0.76	0.013	0.448	0.0100	2.386	0.330	0.189	0.173
1+340 – 1+570 (L=R)	0.61	0.013	0.061	0.0030	0.896	0.170	0.067	0.098
1+570 – 1+800 (L=R)	0.61	0.013	0.061	0.0030	0.896	0.170	0.067	0.098
1+570 (Cross Pipe)	0.61	0.013	0.123	0.0050	1.329	0.220	0.095	0.121
1+570 (Outlet)	0.61	0.013	0.245	0.0200	2.659	0.220	0.095	0.121
1+950 (Cross Pipe)	0.61	0.013	0.043	0.0050	0.991	0.130	0.046	0.078
1+950 (Cross Pipe)	0.61	0.013	0.052	0.0050	1.035	0.140	0.051	0.083
4+000 (Cross Pipe)	0.61	0.013	0.033	0.0050	0.898	0.110	0.036	0.067

3. Calculation of Discharge by Ditch

No.	Ditch Width B(m)	Wall Slope (1:m)	Roughness n	Discharge Q(m ³ /sec)	Gradient i(%/100)	Velocity V(m/sec)	W. Depth (m)	Sec. Area (m ²)	R (m)
1+800 - 1+950 (Left & Right)	0.40	0	0.015	0.025	0.003	0.600	0.100	0.040	0.067
1+950 - 2+060 (Left & Right)	0.40	0	0.015	0.018	0.003	0.542	0.080	0.032	0.057
2+060 - 2+260 (Left & Right)	0.40	0	0.015	0.033	0.003	0.649	0.120	0.048	0.075
2+260 - 2+420 (Left & Right)	0.40	0	0.015	0.026	0.003	0.626	0.110	0.044	0.071
2+420 - 2+580 (Left & Right)	0.40	0	0.015	0.026	0.003	0.626	0.110	0.044	0.071
2+580 - 2+740 (Left & Right)	0.40	0	0.015	0.026	0.003	0.626	0.110	0.044	0.071
2+740 - 2+960 (Left)	0.40	0	0.015	0.072	0.003	0.811	0.220	0.088	0.105
2+960 - 3+090 (Left)	0.40	0	0.015	0.039	0.003	0.691	0.140	0.056	0.082
3+090 - 3+175 (Right)	0.40	0	0.015	0.028	0.003	0.626	0.110	0.044	0.071
3+175 - 3+340 (Right)	0.40	0	0.015	0.054	0.003	0.759	0.180	0.072	0.095
3+340 - 3+500 (Right)	0.40	0	0.015	0.052	0.003	0.759	0.180	0.072	0.095
3+500 - 3+580 (Right)	0.40	0	0.015	0.026	0.003	0.626	0.110	0.044	0.071
3+580 - 3+670 (Right)	0.40	0	0.015	0.029	0.003	0.649	0.120	0.048	0.075
3+670 - 3+800 (Right)	0.40	0	0.015	0.043	0.003	0.710	0.150	0.060	0.086
3+800 - 4+000 (Right & Left)	0.40	0	0.015	0.033	0.003	0.649	0.120	0.048	0.075

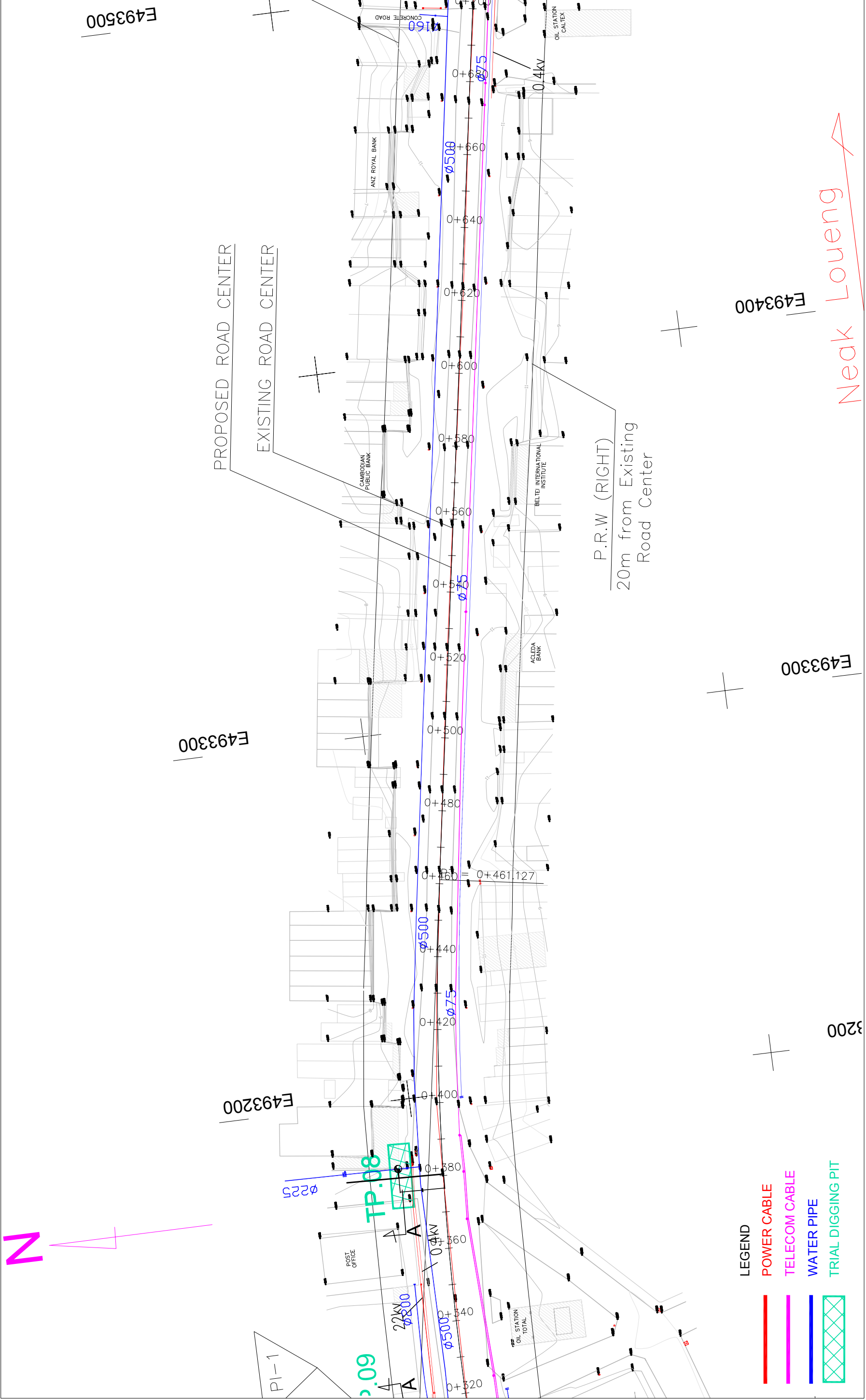
7.2 Plan of Public Utilities



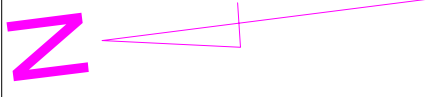
LEGEND

- POWER CABLE (Red line)
- TELECOM CABLE (Magenta line)
- WATER PIPE (Blue line)
- TRIAL DIGGING PIT (Green hatched box)

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			PLAN OF PUBLIC UTILITIES (1/12) (ASSUMED LOCATION)	1:1000	Sheet No.
					PU - 01



- LEGEND**
- POWER CABLE
 - TELECOM CABLE
 - WATER PIPE
 - TRIAL DIGGING PIT



PROPOSED ROAD CENTER
EXISTING ROAD CENTER

P.R.W (RIGHT)
20m from Existing
Road Center

Neak Loueng

E493300

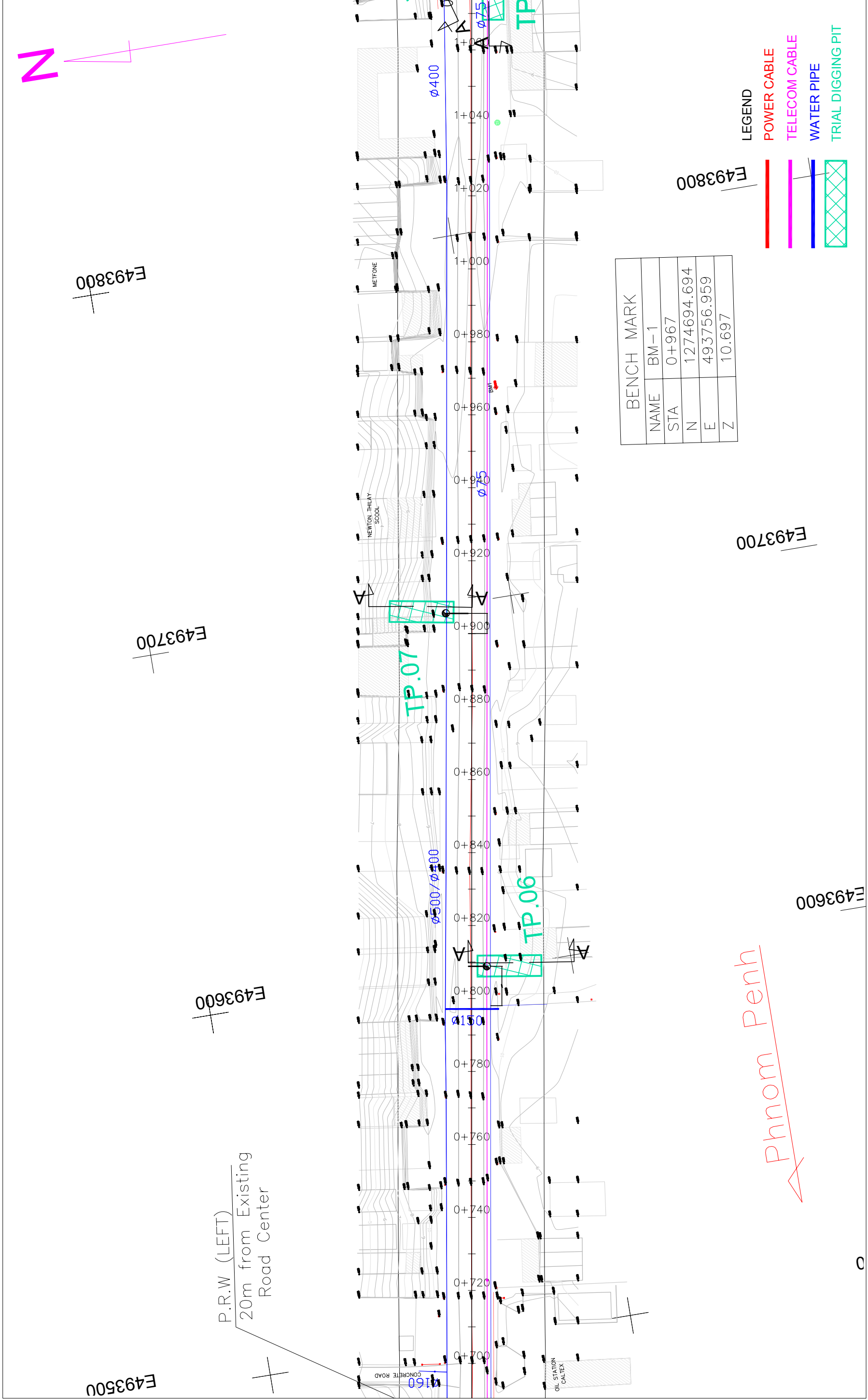
E493200

E493400

E493300

E493500

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			PLAN OF PUBLIC UTILITIES (2/12) (ASSUMED LOCATION)	1:1000	Sheet No. PU - 02



E493800

E493700

E493600

E493500

P.R.W (LEFT)
20m from Existing
Road Center

BENCH MARK	
NAME	BM-1
STA	0+967
N	1274694.694
E	493756.959
Z	10.697

E493800

E493700

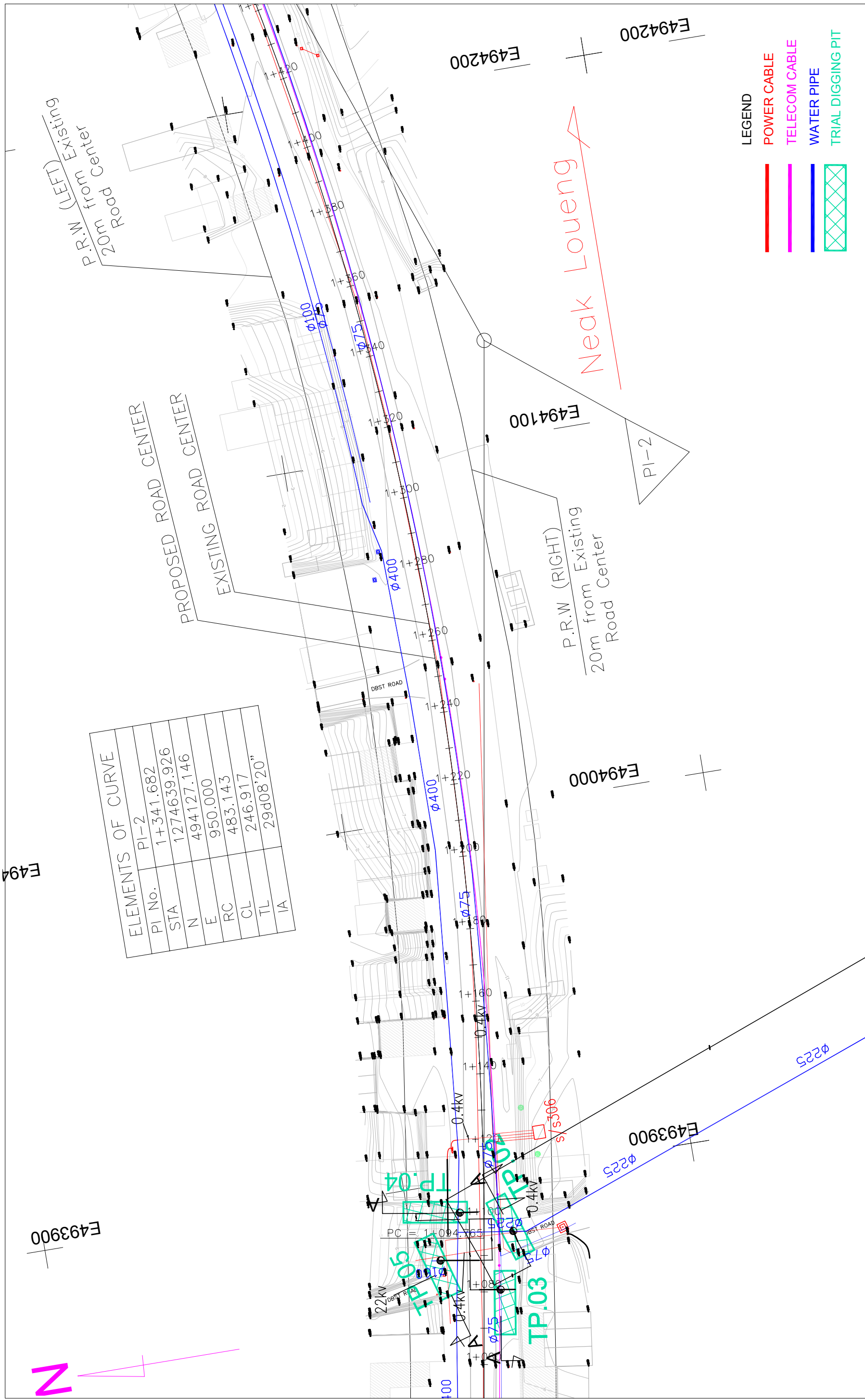
E493600

Phnom Penh

LEGEND

- POWER CABLE
- TELECOM CABLE
- WATER PIPE
- TRIAL DIGGING PIT

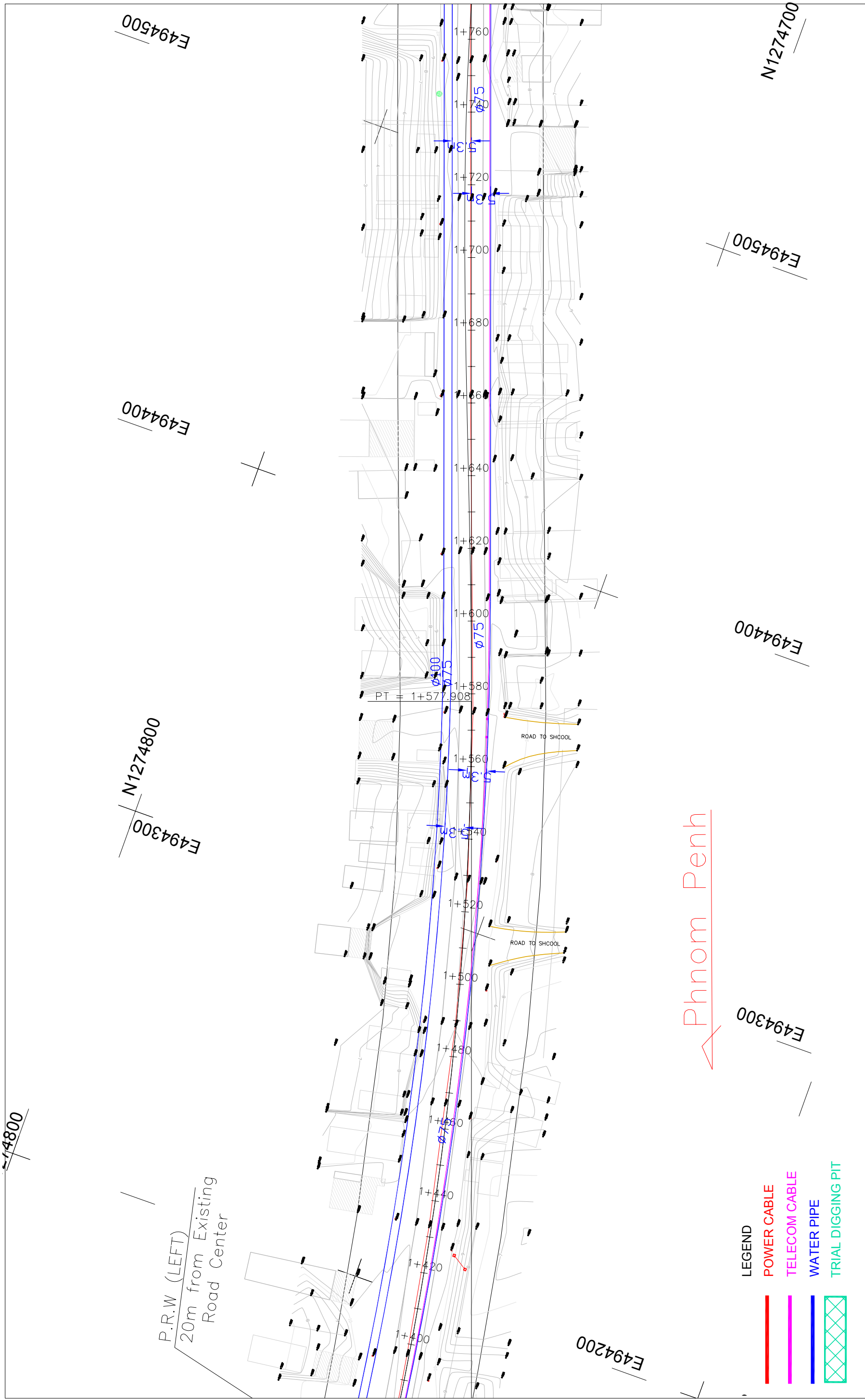
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE 1:1000	Drawing No.
			PLAN OF PUBLIC UTILITIES (3/12) (ASSUMED LOCATION)		Sheet No. PU - 03



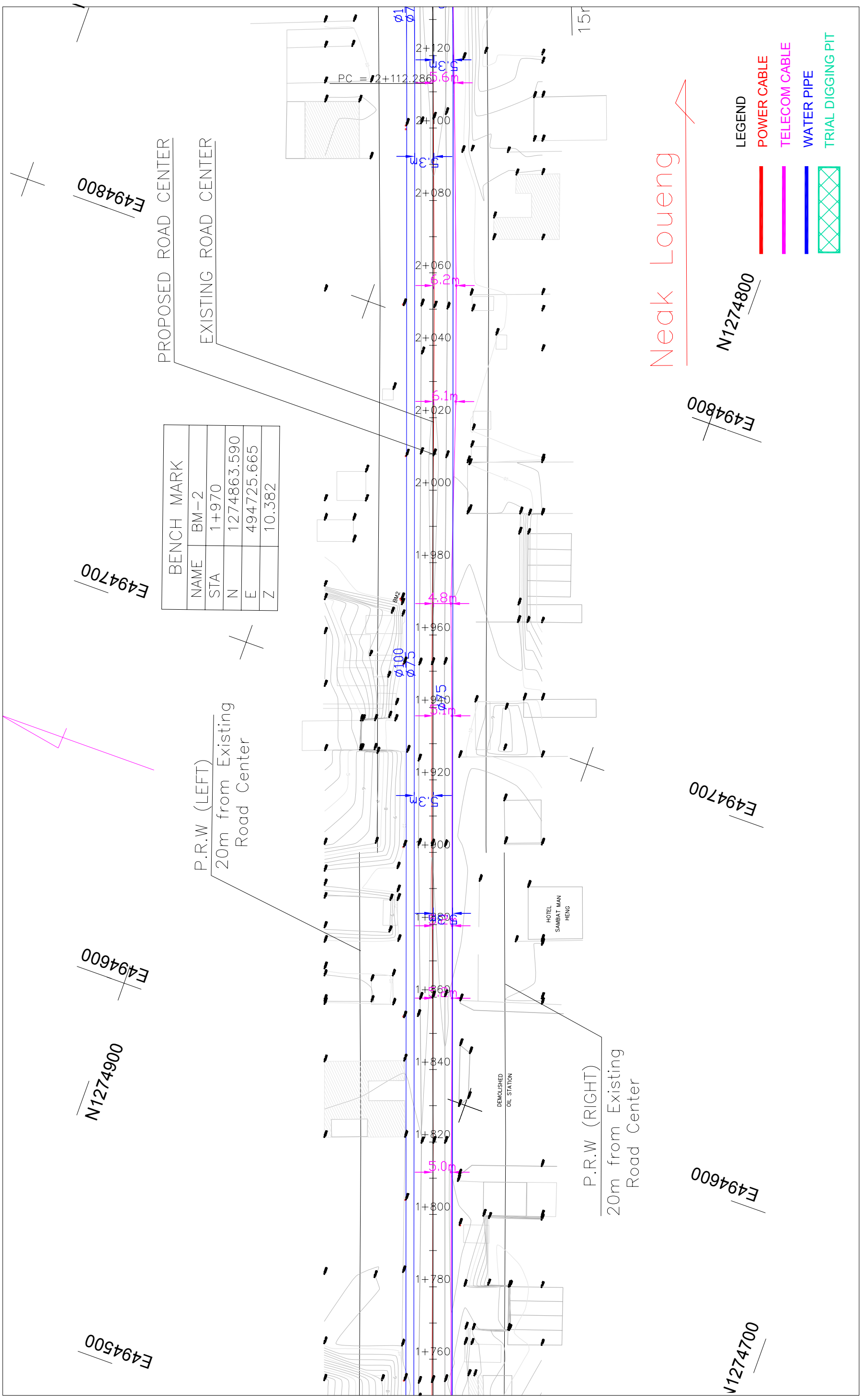
ELEMENTS OF CURVE	
PI No.	PI-2
STA	1+341.682
N	1274639.926
E	494127.146
RC	950.000
CL	483.143
TL	246.917
IA	29d08'20"

- LEGEND
- POWER CABLE
 - TELECOM CABLE
 - WATER PIPE
 - TRIAL DIGGING PIT

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			PLAN OF PUBLIC UTILITIES (4/12) (ASSUMED LOCATION)	1:1000	Sheet No. PU - 04



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			PLAN OF PUBLIC UTILITIES (5/12) (ASSUMED LOCATION)	1:1000	Sheet No. PU - 05



BENCH MARK	
NAME	BM-2
STA	1+970
N	1274863.590
E	494725.665
Z	10.382

- LEGEND
- POWER CABLE
 - TELECOM CABLE
 - WATER PIPE
 - TRIAL DIGGING PIT

PROPOSED ROAD CENTER
EXISTING ROAD CENTER

P.R.W (LEFT)
20m from Existing
Road Center

P.R.W (RIGHT)
20m from Existing
Road Center

Neak Loueng

N1274900
E494600

E494700

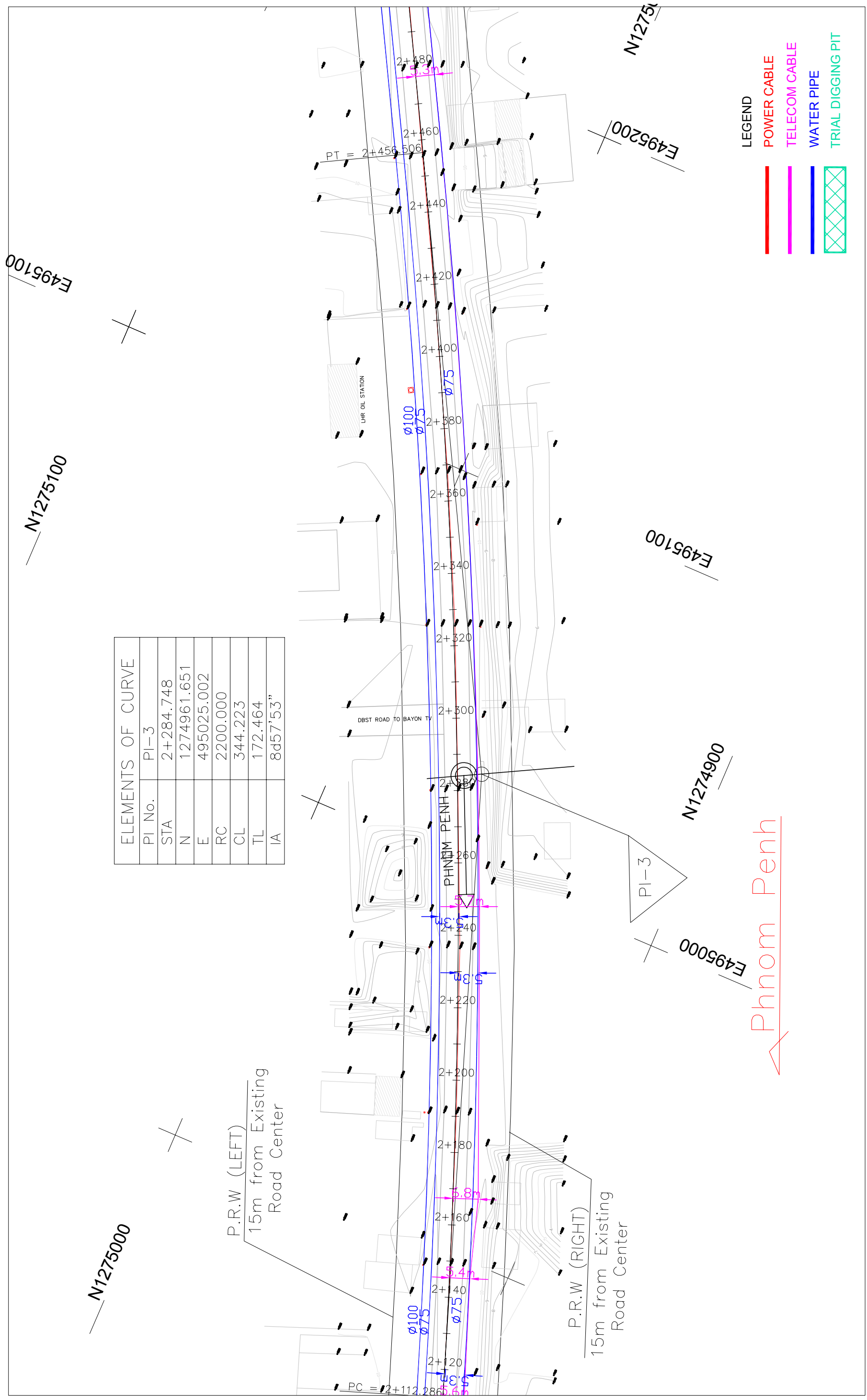
E494500

N1274700

N1274800

E494800

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			PLAN OF PUBLIC UTILITIES (6/12) (ASSUMED LOCATION)	1:1000	Sheet No. PU - 06

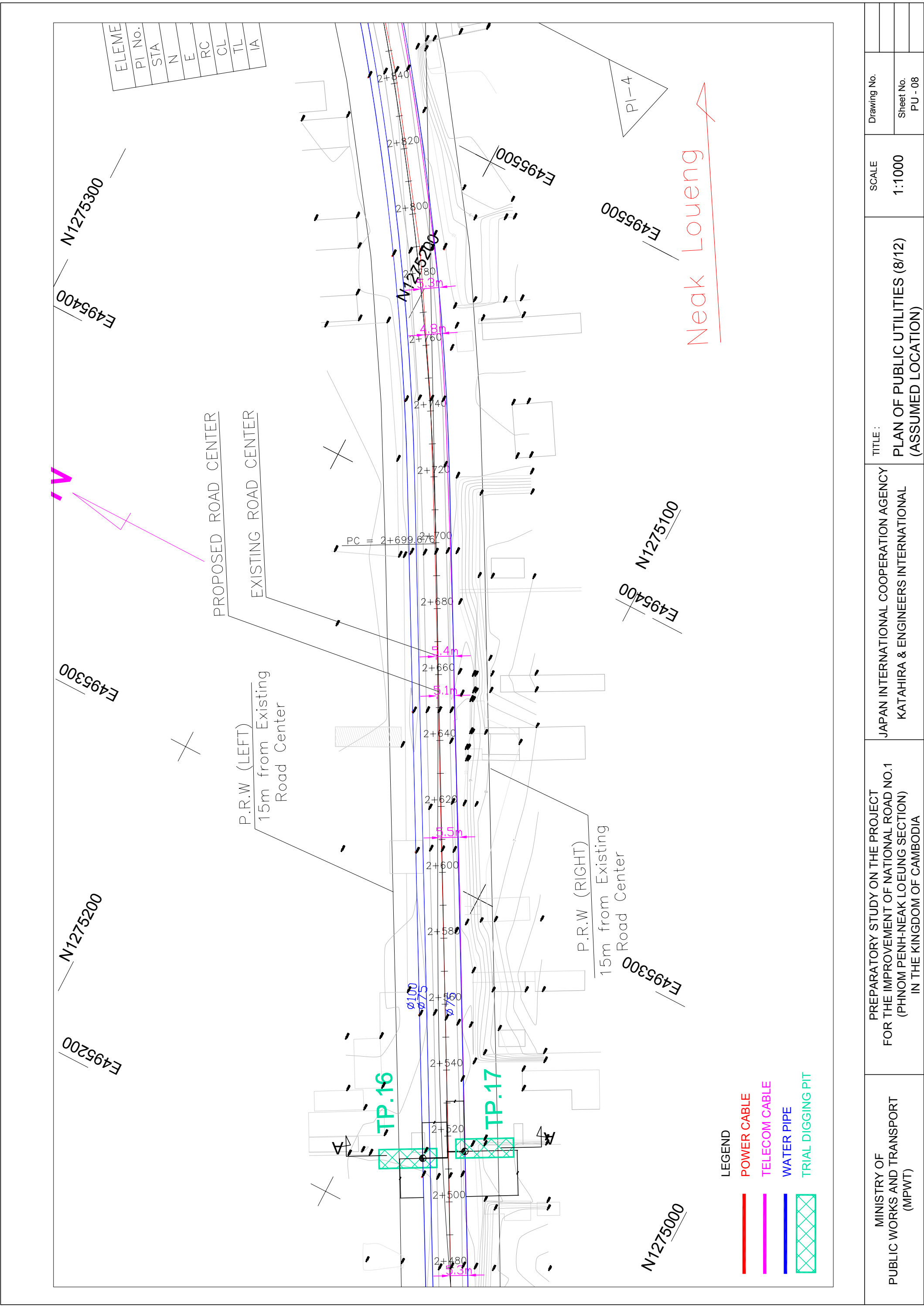


ELEMENTS OF CURVE	
PI No.	PI-3
STA	2+284.748
N	1274961.651
E	495025.002
RC	2200.000
CL	344.223
TL	172.464
IA	8d57'53"

LEGEND

- POWER CABLE
- TELECOM CABLE
- WATER PIPE
- X TRIAL DIGGING PIT

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : PLAN OF PUBLIC UTILITIES (7/12) (ASSUMED LOCATION)	SCALE 1:1000	Drawing No.
					Sheet No. PU - 07



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			PLAN OF PUBLIC UTILITIES (8/12) (ASSUMED LOCATION)	1:1000	Sheet No. PU - 08

15300

E495500

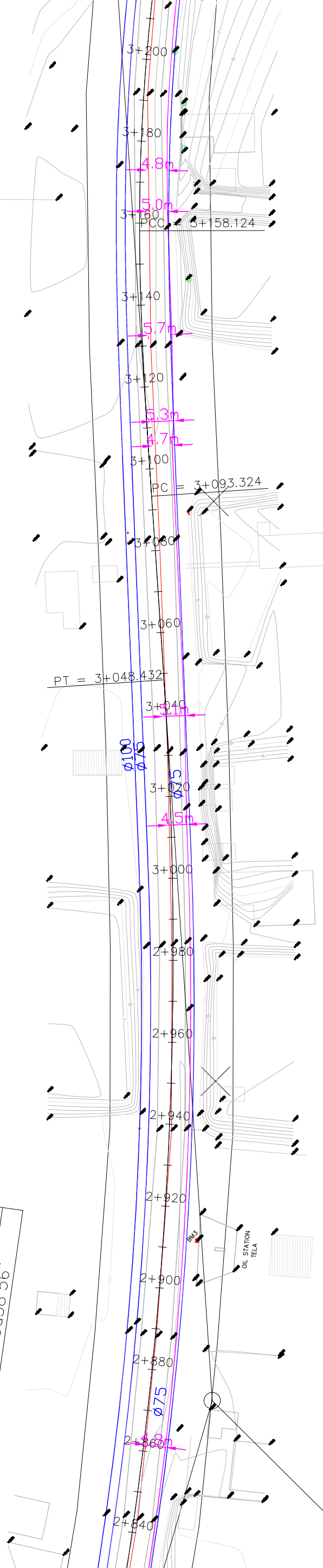
N1275400

E495600

N1275500

E495700

ELEMENTS OF CURVE	
PI No.	PI-4
STA	2+875.843
N	1275245.653
E	495544.202
RC	1000.000
CL	348.756
TL	176.167
IA	19d58'56"



BENCH MARK	
NAME	BM-3
STA	2+912
N	1275275.778
E	495569.260
Z	10.732

Phnom Penh

LEGEND	
	POWER CABLE
	TELECOM CABLE
	WATER PIPE
	TRIAL DIGGING PIT

N1275200

E495600

N1275300

E495700

E495800

N1275400

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)

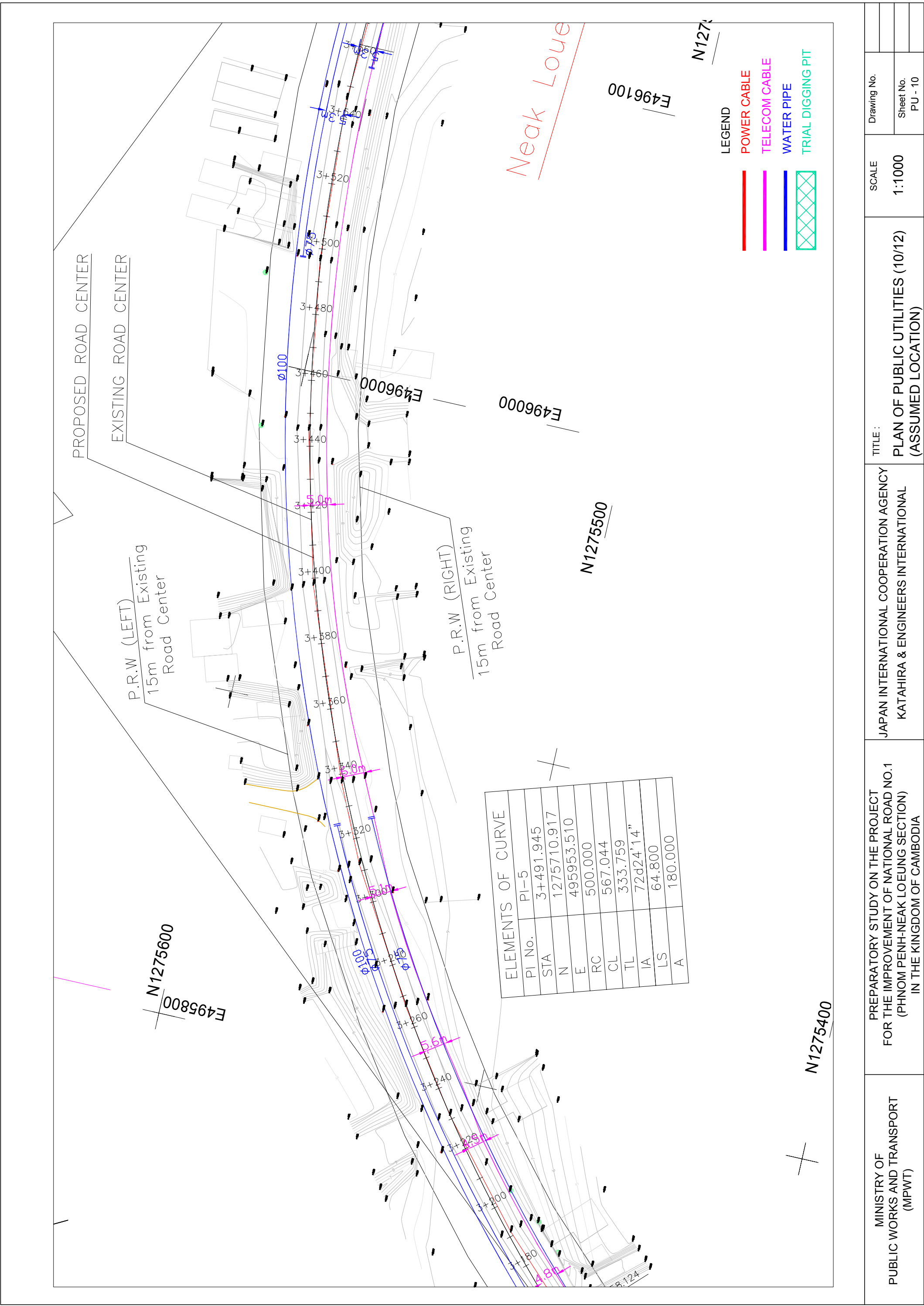
PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA

JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL

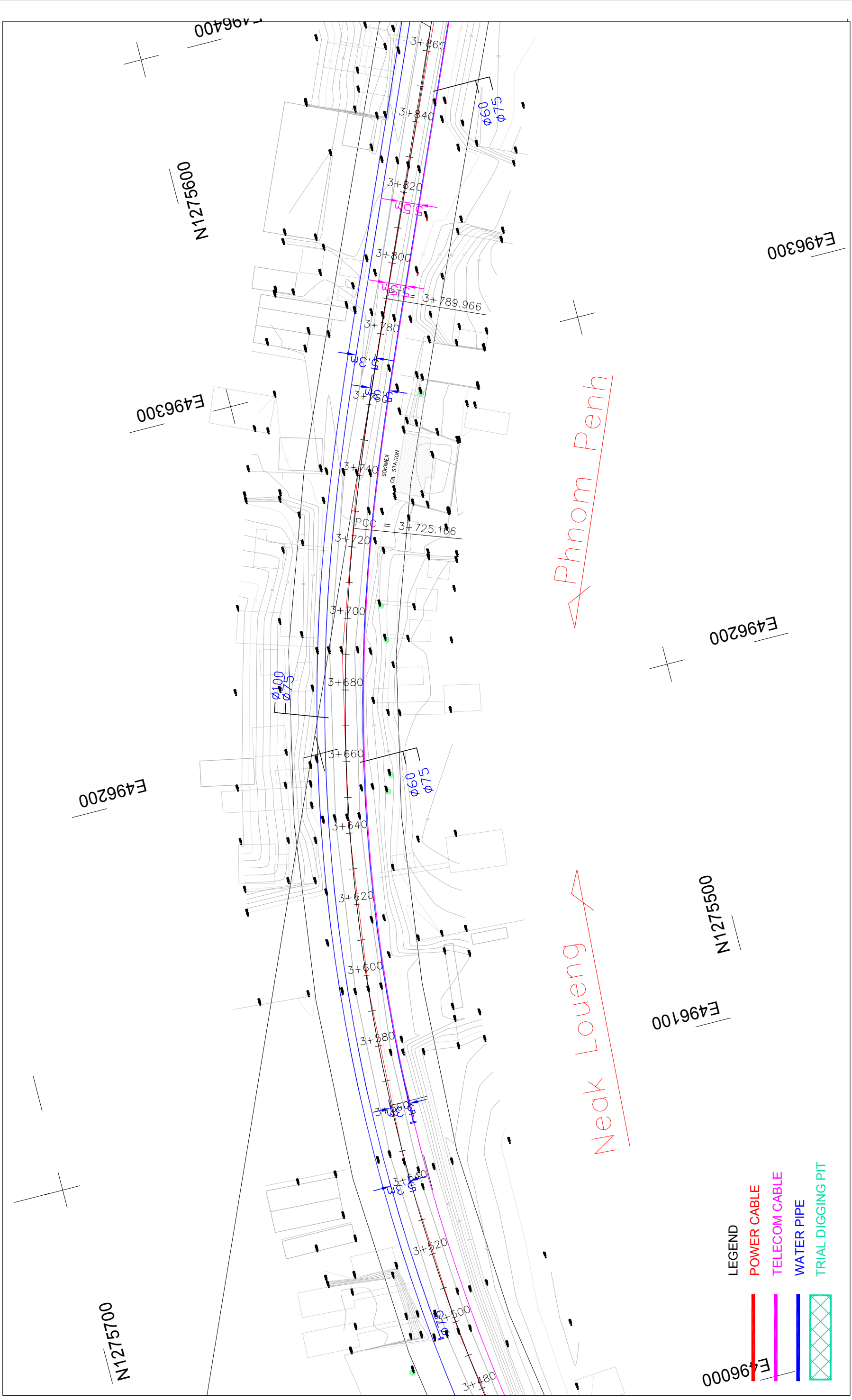
TITLE : PLAN OF PUBLIC UTILITIES (9/12) (ASSUMED LOCATION)

SCALE 1:1000

Drawing No. Sheet No. PU - 09



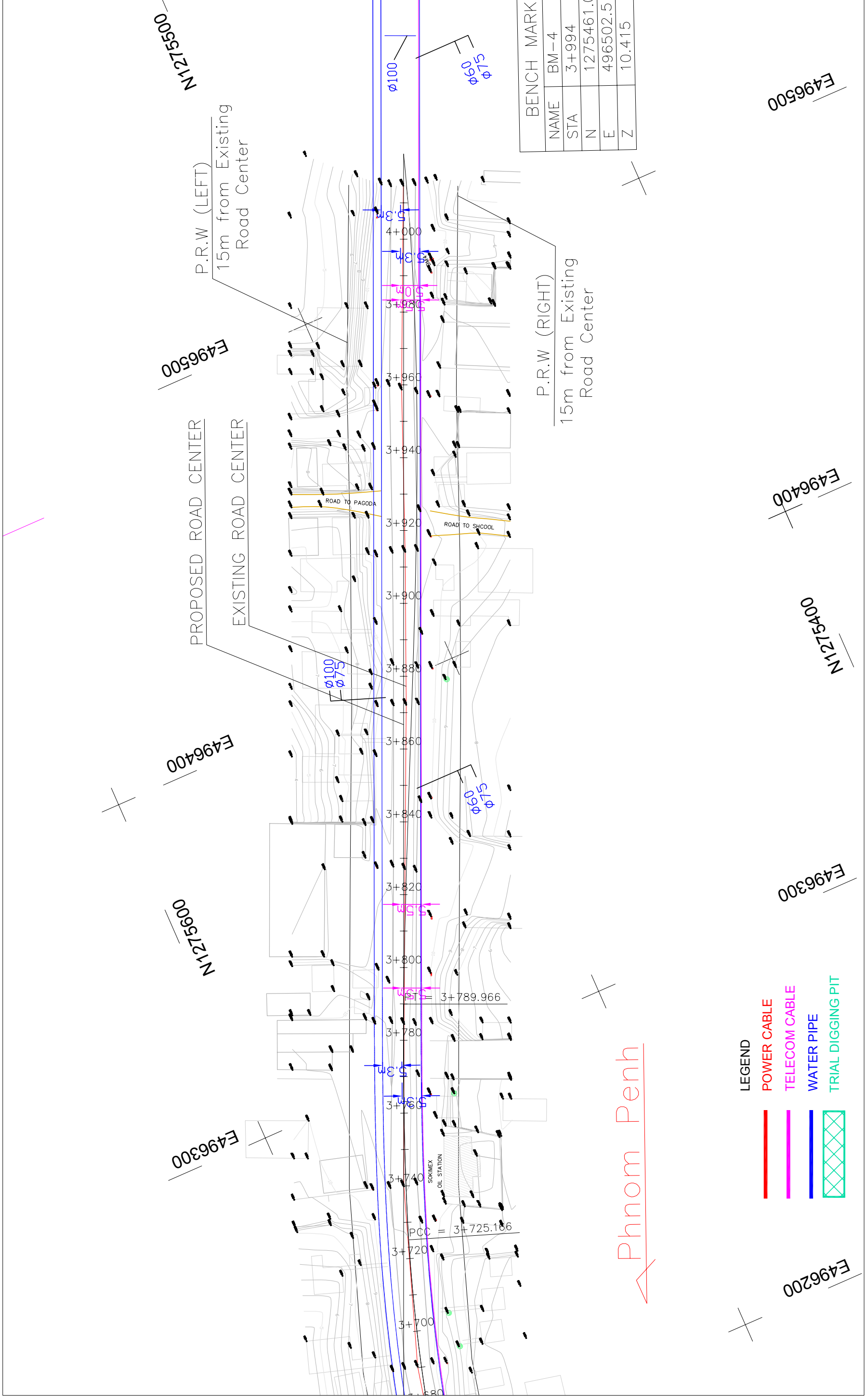
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			PLAN OF PUBLIC UTILITIES (10/12) (ASSUMED LOCATION)	1:1000	Sheet No. PU - 10



LEGEND

	POWER CABLE
	TELECOM CABLE
	WATER PIPE
	TRIAL DIGGING PIT

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE 1:1000	Drawing No.
			PLAN OF PUBLIC UTILITIES (11/12) (ASSUMED LOCATION)		



BENCH MARK	
NAME	BM-4
STA	3+994
N	1275461.0
E	496502.5
Z	10.415

Phnom Penh

LEGEND	
	POWER CABLE
	TELECOM CABLE
	WATER PIPE
	TRIAL DIGGING PIT

PROPOSED ROAD CENTER
EXISTING ROAD CENTER
P.R.W (LEFT)
15m from Existing Road Center
P.R.W (RIGHT)
15m from Existing Road Center

ROAD TO PAGODA
ROAD TO SCHOOL

SOMMEX OIL STATION
PCC = 3+725.186
PT = 3+789.966

MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	PREPARATORY STUDY ON THE PROJECT FOR THE IMPROVEMENT OF NATIONAL ROAD NO.1 (PHNOM PENH-NEAK LOEUNG SECTION) IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			PLAN OF PUBLIC UTILITIES (12/12) (ASSUMED LOCATION)	1:1000	Sheet No. PU - 12

7.3 Plan of Niroteh Production Facilities – Phase 1 Project

